

## From Biology to Biography

*William Hurlbut*

*After science has done its best, the mystery is as great as ever.*

—John Burroughs

Nearly sixty years ago the eminent geneticist Theodosius Dobzhansky noted that “nothing in biology makes sense except in the light of evolution.” Today, it is becoming increasingly evident that what is true of biology in general is also true of the science of human life. With the sequencing of the human genome and recent advances in our understanding of developmental biology, we are gaining a greater appreciation of the unbroken lineage and intricate interrelation of the whole of living nature. Yet as evolutionary theory has become the unifying principle of interpretation of the organic world, it has raised difficult questions about the source and significance of human life, questions that challenge our traditional concepts of the human person. Together with a recognition of our ancient heritage of minute molecules and intricate cellular mechanisms has come an understanding that our capacities of mind are likewise grounded in our evolutionary past. What began in the early twentieth century as an assertion that human nature is driven by “unconscious forces” and “vestigial impulses” has now been transcended by the deeper pessimism of evolutionary psychology. This new vision of human origins, advanced within academic circles and promulgated as scientific truth through the popular press, is rapidly reshaping our human self-concept. Yet a more careful consideration of the evolutionary record may lead to far different conclusions concerning the foundations of human nature and the possibilities and prospects of the human person.

### Beyond Evolutionary Psychology

In its fullest expression, evolutionary psychology is a theory about the origins of the human mind. It assumes that all human behavior, like that of animals, is directed toward competitive advantage in the evolutionary struggle of life. Just as evolution has shaped our anatomy and physiology for optimal performance, natural selection has shaped our behavior. The crucial filter for preservation is not mere survival but “inclusive fitness”: success in getting our genes into the

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next generation and beyond. Evolutionary psychology claims that a wide array of adaptive psychological mechanisms have been preserved, ranging from specifics of social interaction to inclinations in mate choice. These adaptations extend beyond the realm of survival and reproduction into the most subtle manifestations of aesthetic preference, religious practice, and moral judgment.

As a statement about human nature, evolutionary psychology challenges our most fundamental concepts of freedom, morality, and spiritual purpose. The individual is subsumed within a larger impersonal process of genetic proliferation; reproduction is the “sole goal for which human beings are designed, everything else is a means to that end.” This concept reaches its most extreme expression in Richard Dawkins’ idea of the “Selfish Gene,” where an organism is simply a “robot vehicle,” the gene’s way of making another gene. Genes are our true masters and human beings are at best unwitting accomplices or, indeed, victims in a process without purpose. Although such ideas are an exaggerated form of determinism, their practical effect is, like moral relativism, the justification of any type of behavior. Behavior that seems altruistic is only slightly veiled genetic self-interest—whether “kinship selection” (helping your genetic relatives) or “reciprocal altruism” (hoping to get something in return). As the author Robert Wright starkly puts it: “the question may be whether, after the new Darwinism takes root, the word moral can be anything but a joke.”

The extensions of evolutionary theory expressed in these perspectives represent an extreme form of naturalism. The practical effect of this approach is to reduce all human behaviors to value-neutral adaptations and to deny the personal significance of mind and moral culture. Categories of good and evil are seen as functional fictions generated for social cohesion, and human freedom is considered an illusion useful to justify the legislation and enforcement of responsible behavior. Motivations are opaque to any introspective or intellectual inquiry, and reason is recognized as a tool of adaptation, not a rational calculator or moral guide. Individual crimes, though socially unacceptable, are from the perspective of evolutionary goals fully understandable; so are broader social crimes like genocide or eugenics. All of life is seen as a dynamic of power and self-promotion, a ruthless competition without mercy or moral meaning. Nietzsche had warned us: “To be natural is to dare to be as immoral as nature is.”

Although proponents of evolutionary psychology often disclaim the deeper implications of their ideas and call on us to rise above the process of our origins, their theory leaves little room for either the freedom or the motivation to do so. The fundamental problem is a philosophical one. Evolutionary psychology provides some interesting insights into human behavior. But its starting point is a narrow set of assumptions; and these assumptions are not derived from empirical evidence but represent philosophical views presented in the guise of science. What began as a methodological tool has become a metaphysical pessimism.

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This pessimism prejudices the very approach of our scientific inquiry and suppresses the self-evident testimony of the phenomenon of life. It assumes that nature has no intentional design, no direction or purpose, and no intrinsic meaning to its process. It describes wholes in terms of parts, the higher in terms of the lower, and matter and mechanism as somehow more “real” than the mind that investigates them. In the end, it obscures the most startling fact of evolution: the mystery of human emergence and the manifestation within matter of freedom, consciousness, and moral awareness.

Yet, if we step back and seek a richer reading of the evolutionary record, we can draw on some useful insights from evolutionary psychology while reaching for a fuller significance to Dobzhansky’s statement: “nothing in biology makes sense except in the light of evolution.” Beginning with the widest cosmic perspective and proceeding through a series of more focused lenses, it is possible to draw at least the outlines of a unified vision of the science of human life. From phylogeny (evolutionary origins) through ontogeny (organismal development), we can trace the historical process that culminates in the unique and unrepeatable existence of every human life.

Such an approach returns us to a recognition of our biological roots. It takes seriously the actual conditions of human existence—as embodied beings, evolved in form and function, and embedded within the ecology of nature. It allows a conceptual continuity from the most fundamental physical realities to the fullness of individual identity, from biology to biography, the emergence of the human person.

### **Between Infinities**

Three hundred and fifty years ago the French mathematician and philosopher Blaise Pascal noted that human existence is located between infinities. Today, with the tools of our advancing science, we are gaining a greater appreciation of the meaning of this statement, as we come to understand the highly specific natural conditions that shaped the emergence of the human person.

Consider how human life stands between the infinitely large and the infinitely small, the vast realms of cosmic space and the tiniest subatomic particles. Each of us is fashioned in the silence of the womb from the most minute molecules—atomic assemblies one millionth of a hair’s width forming proteins and polymers, cells and tissues, organs and organ systems, in a fantastic symphony of process. And all this is played out on the small stage of the earth within a universe so vast that the number of stars actually exceeds the number of grains of sand on all the beaches of the world.

Consider also how we are placed between the infinities of time, the very fast and very slow. The frenzied dance of atoms that collide a billion times a second. Enzymes that convert substrate at a million a minute. Nerve networks and

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synapses of such speed that they integrate a hundred trillion neuronal connections in a fantastic behind the scenes choreography that makes possible the thought and movement of “real time”—life at the level of human perception. And yet our journey through the rhythm of the days and the cycles of the seasons is also made possible by the enormous stretches of cosmic time—processes so gradual as to appear as a changeless backdrop for the unfolding of human history. The ancient earth prepared through thousands of years of geologic upheaval. The steady revolution around a slowly aging sun, which itself circles once in 300 million years around the center of our galaxy, which spirals through billions of years in the outrush of the expanding universe.

Human existence—located between infinities. What is clear through the study of biology is that within this cosmic frame, within this order of time and space and material being, we have been formed and fashioned by the forces of the earth. And this is the root meaning of the word *human*—derived from the Latin for “earth” or “soil”: we are “creatures of the earth.”

### The Origins of Freedom

When we look back at the evolutionary process that formed us, we are at once struck by both its continuity and creativity. At every level, the unfolding of life’s diverse forms and functions reveals new and previously unseen dimensions of nature, and so revises our understanding of the nature of nature. Yet amid this extraordinary profusion of biological possibilities, we can discern a trajectory of ascent toward qualities and capabilities that culminate in the emergence of personal existence—the emergence of freedom, mind, and moral awareness.

Although evolutionary accounts often stress the contingency of development, it is more likely that the earliest phases of life were highly determined by specific conditions and constraints. Only certain combinations of chemicals with particular properties could form the structural and functional elements necessary for the continuity of life. These few, highly constrained, specific molecular elements in turn became the foundation on which all further complexity had to develop in coordinated and complementary integration. Looking back over nearly four billion years of evolution, it is astonishing to realize that these early life forms set the platform for an increasing flexibility and freedom within the phenomenon of life.

At its primary level, freedom within nature is prefigured as a widening range of possibilities. The most basic way this capacity for freedom expresses itself biologically is at the level of *mutation*. These variations within the coding sequence of DNA create a diversity of potentially adaptive phenotypes that are essentially biological experiments. This strategy works very well in rapidly reproducing organisms. A single bacterium, which has a limited ability to adjust to a changing environment, can produce tens of thousands of varied offspring within a few

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hours. This allows an adaptive radiation of new forms in response to circumstances of adversity. Such a capability does not just ensure stability and continuity; it creates an exploratory edge that extends the realm of life into a greater range of environmental conditions.

While early life forms adapted through mutation and reproduction, more complex systems soon evolved that allowed *individual organisms* to adjust to changing environmental conditions. At the most basic level, this “freedom” originated with an increasing range of vital powers of awareness and action. With the earliest emergence of brains more than 500 million years ago, the limited capacities of selective perception and locomotion in simple organisms were transcended by new programs of integrated organismal response, innate reflex arcs of nerves and muscles triggered by external stimuli. These in turn allowed the extension of life into more varied and challenging environments. Whereas the oceans had provided a more or less stable chemical context and constant temperature, the ascent to dry land required more complex regulation of body water and temperature, but in the process opened a vast new range of opportunities for the extension of life. It also led to the refinement of integrated motor and endocrine systems—a transformation that formed the biological basis of the emotions.

The emergence of affective life aided survival but also pointed beyond it. Emotions had their evolutionary origins in the physiological processes of body regulation: the postural and visceral changes that place the organism in a condition of readiness of response. Emotion means, literally, “to move away.” But within this rising scale of feeling and self-awareness, sensory perception and action became more complex; the organism developed a more integrated “inner” sense of subjective feelings and appetites. The philosopher of biology Hans Jonas considers this the essence of animal life: “[The animal] emancipates itself from its immersion in blind organic function and takes over an office of its own: its functions are the emotions. Animal being is thus essentially passionate being.” The unconscious process of plant life becomes the inner awareness and purposeful desire of animal life.

This legacy of our animal ancestors is preserved in human beings while transcended by voluntary intentional actions, guided by new powers of associative memory, analytic reason, and conscious aspiration. These capacities further extend the trajectory of freedom within the phenomenon of life. What began in the earliest life forms as chance mutation played out against the constraints of chemical properties has, through the course of evolution, progressed to adaptive indeterminacy and integrated purposeful being.

This entire evolutionary process of creative extension, stretching forth to ever increasing degrees of freedom, reflects the interplay of possibilities and potencies within living matter. Freedom emerges in response to the opportuni-

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ties of nature, reflecting an ever more complex complementarity between organisms and environment. Although chance may generate the multitude of mutations and recombinations tossed up to the filter of natural selection, their preservation is not random or arbitrary. This is the insight expressed by Leon Kass when he writes:

Ought we to be surprised, should we regard it as an accident, that, in a visible, odorous, and sounding world, the powers of sight, or smell, or hearing, once they appeared should have been preserved, magnified, perfected? Likewise with intellect. However accidentally intellect first appeared, is it surprising that it should have been preserved in a world of cause and effect, past and future, means and ends, all of which can be brought into consciousness and used to advantage in a being endowed with memory, a sense of time, self-awareness, and the ability to order means to ends in securing the future?

This increasing freedom and self-awareness within the individual organism is extended by the extraordinary adaptive benefit of the *creative imagination*. Here mutations of matter are transcended by permutations of mind, by the self-generated production of possibilities independent of the constraints of immediate reality. The symbolic mind is capable of detaching image from object; recombining images in new ways; envisioning scenarios and sequences detached from time and space; and anticipating their implications and outcomes. This is yet another powerful form of freedom in which the organism can imagine possibilities and try them out (in a kind of dress rehearsal) without the expense of time and risk of resources in the process.

The human capacity for imagination, however, goes far beyond adaptive anticipation; imagination is not mere memory or imitation, but envisioned creation. Forming mental images, maintaining them in the mind, and achieving their realization signify intention, planning and implementation of ideals. The first recorded moment of true creativity occurred in our pre-human ancestors one-and-a-half million years ago. There, in the fossil record, the simple chipped tools representing a million years of hominid history are suddenly transcended by an artifact that bespeaks a cognitive leap: the production of the hand axe. As paleontologist Ian Tattersal explains: "These symmetrical implements, shaped from large stone cores, were the first to conform to a 'mental template' that existed in the toolmaker's mind." This is perhaps the first intentional innovation: the bringing into being of an imagined ideal. What began as the visualization of an axe within a stone would become, in another million and a half years, the capacity to generate the images and ideals of a complex technological and moral culture.

This imagining and realizing of ideals is the fullest manifestation of human freedom. Whereas most creatures exist in an unbroken immediacy of life, humans are able to draw both the past and the future into the present: from learning stored as *memory* and through the creative *imagination*. The immediacy

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of animal existence becomes the mediated flexibility of human consciousness. Together with the ceaseless drive to organize the unexplained (the “cognitive imperative”), the capacities to calculate, extrapolate and recombine are used to reconfigure that which is into that which could be.

While most creatures are pushed by biological and ecological circumstances, we are pulled into the future by our images of fullest flourishing. From the human capacity for imagination and the drive to pursue the possible comes something unprecedented in the history of nature: the freedom of aspiration toward an envisioned ideal. The human ascent to the coherent image of a moral ideal is the fullest extension and culmination of the most fundamental force in living nature. As Leon Kass writes, “Desire, not DNA, is the deepest principle of life.”

The story of life began within the constraints of chemistry; it has ascended to the open possibility of forming and seeking ideals. Whereas the earliest life forms adapted by mutation and reproduction, human beings are the culmination of an evolutionary trend with exactly the opposite strategy of survival. A multitude of short-lived organisms gives way to a distinct and defined human *self*: a long-lived, highly complex, and integrated individual being, one that adapts not by intergenerational genetic mutation but by the freedom and flexibility to think and act.

### The Emerging Self

The extraordinary phylogenetic (evolutionary) process that has given rise to this “creature of possibility” is reflected in the coordinated generation and development of the individual person. At conception, the union of sperm and egg initiates what is perhaps the most complex chemical reaction in the known universe. This single cell bears within itself the cumulative life-generating power of an unbroken lineage of nearly four billion years of evolutionary refinement. From the microscopic beginnings of the fertilized egg, a series of cell divisions sets the fundamental infrastructure and coordinated chronology of developing embryonic life. Each new cell is a constellation of almost unimaginable molecular intricacy and consolidated complexity: proteins, polymers, and minute organelles; lipid bilayers that form compartmentalized substructures and semi-permeable membranes; enzymes that channel and control cascades of chemical reactions; miniature molecular motors of transport, transcription, replication, and repair. Such highly specific cellular mechanisms maintain the balance and regulation, the self-sustaining stability of the cell’s internal environment, while allowing a responsive flexibility to external influences and interactions.

These intricate *intracellular* mechanisms are complemented by an ancient heritage of molecules of *intercellular* communication and coordination, echoes of the evolutionary origins of multicellularity and cell specialization. By the fourth day of development, diffusible molecular signals initiate the process of differentiation that produces the primary parts and patterns of early embryogenesis.

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Within a small set of pluripotent cells (embryonic stem cells), these intercellular communications induce the differential gene expressions that produce the specialized cell lineages. These diverging cell lines ultimately culminate in the more than 220 fundamental tissue types that constitute the 100 trillion cells of the fully developed adult. Many of the genes that control the specifics of cell differentiation or the regulatory dynamics of early development are highly conserved across the entire history of life; the specific proteins and proportions they produce are crucial to the development of the embryo, and mutations or perturbations that interfere with this basic process are generally lethal. (Indeed, it is estimated that as many as 60 to 80 percent of human conceptions may end in death during early development.)

The same phylogenetic process that has conserved these essential genes and regulatory patterns has also evolved for ontogenetic (organismal) flexibility and adaptability. This responsive adaptability is already evident within the womb, where maternal factors in the placental circulation influence development by affecting regulation of gene expression, setting hormonal levels, and conditioning later physiological responses. This maternal influence may in fact account for some of the similarities between twins. It is very likely that twins grown in separate wombs or at different times in the same womb would be far less similar than natural twins who share both their genes and their gestational environment.

This flexibility during gestation foreshadows characteristics of crucial significance in the development of the individual throughout life: relational interdependence, responsive creativity, and the extraordinary human capacities for learning, integrative analysis, and comprehensive understanding of the world. These capabilities underlie individual identity, cultural cohesion and continuity, and the unique human capacities for moral and spiritual awareness. To understand these fascinating dimensions of human biology, it is instructive to reconsider the sources of human diversity and individual variability as well as our common foundations of fundamental biology. In so doing, we transcend the misunderstandings implied by the nature/nurture debates and arrive at a far more fascinating perspective on the relationship between evolutionary origins, organismal development, and the open possibilities of human existence.

### **Our Genetic Heritage**

Both our earliest developmental processes and our highest capacities for freedom of thought and action are dependent on a central core of highly specific shared biology. The externally evident physical differences between individuals belie a far greater similarity of fundamental genetics, anatomy, and physiology.

With the sequencing of the human genome we are gaining a greater appreciation of the genetic basis of human similarities and differences. A large number of our genes appear to be essentially invariant between individuals. Of those



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that differ, most produce only slight variations in structure or function that have either no functional significance (and for this reason have not been eliminated by natural selection) or confer some advantage in a specific environment. A common example of this is a variant of the hemoglobin gene: the sickle cell allele does not function as optimally as the normal hemoglobin allele, but confers some resistance to malaria.

Despite these well-known examples of one-to-one correspondence between genes and evident traits, situations where single genes directly determine phenotype are the exception rather than the rule. Most traits (including much of what we think of as human variation, such as overall beauty, intelligence, or longevity) reflect the cumulative and interactive effect of many genes. Most genes affect many traits, and most traits are affected by numerous genes. Our differences in color and morphology, so evident in geographically separated populations, are not the result of dramatic genetic mutations but rather different combinations or altered expressions of genes common to all human groups. Indeed, studies of human genetic variation (looking at their protein products) have undercut the idea of distinct “races” altogether. One study found that 93 percent of all human genetic variations were found in Africa alone, and 80 percent in a single tribe in southern Africa. This global similarity reflects our relatively recent common ancestry. In the great human diaspora during the last 50,000 years, human populations spread into a diversity of separate environments. Under the influence of different selective forces, and in relative reproductive isolation, certain combinations of genes were favored in the struggle for survival: for example, the tall thin bodies of the Nuer tribesmen disperse the equatorial heat, while the bodies of the shorter and stockier Inuit conserve heat against the arctic cold.

Notwithstanding these inherited differences, a far more significant source of human variation is the way genes express themselves differently in different environments. This sensitive adjustment of the quantity and chronology of gene expression allows an intricate interaction of the individual with his or her environment. This interaction of gene expression and environment is essential for full and proper physical and psychological maturation. It is evident in the role that normal weight-bearing and motion play on the proper development of the musculo-skeletal system. Likewise, it is evident throughout life in the callusing of skin in response to pressure or abrasion, the strengthening of muscles by the stress of exercise, and the tanning of the skin in response to exposure to ultraviolet light. Each of these examples involves distinct changes in the expression of specific genes, which result in altered levels of the proteins essential for specific body changes.

Built on a central core of essential biology, we are flexibly responsive at the interface with our environment. Our evolutionary heritage has been shaped in

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coordinated complementarity with the exigencies and opportunities of the world—not just its fixed forms, but its dynamics of change, not for strict genetic determinism, but for freedom and indeterminacy. Nowhere is this more evident than in neurological development and the emergence of mind.

### **The Unity of Mind-and-Body**

An estimated 30 to 50 percent of the human genome is specifically dedicated to neurological development. Considered the single most complicated physical structure in the universe, the human brain has an estimated hundred billion neurons with 100,000,000,000,000 interneuronal synaptic connections. The basic pattern of this complexity is established by genetic factors, though early sensory inputs, such as sound and taste within the womb, play a role in learning, and so probably in solidifying fundamental functional connections. This responsiveness of brain development in utero foreshadows the way the brain functions through life. Human beings possess remarkable capacities for adaptive learning, perception, and memory, which allow the fantastic extensions of identity and continuity that underlie both personal and social existence. The cerebral cortex, the six millimeter thick surface layer on the brain's convoluted outer surface, is a learning marvel, a veritable mirror of the world. Through a range of mechanisms—from basic neurogenesis to specific gene regulation to dynamic adjustments of interconnectivity—the cortex absorbs, analyzes, integrates, and encodes an ongoing revision of identity in interaction with the world.

Notwithstanding all the extraordinary capabilities attributed to it, the brain is not a distinct entity at all, but a term of conceptual convenience for the “central processing unit” of a neurological system inseparable from the whole of the body and its dynamic experience within the world. Despite the dreams of some artificial intelligence experts and transhumanists, a brain in a vat would almost certainly be incapable of even the most basic cognitive functions. It is here, in a deeper appreciation of the psychophysical unity of the human person, that we begin to see the full significance of our physical being and the evolutionary process that formed us. To understand the emergence of mind, it is essential to recognize its crucial significance in matters of the body. As neuroscientist Antonio Damasio has pointed out: “The mind had to be first about the body, or it could not have been.” Whatever abstractions and capacities of thought we may have, they are grounded and built upon our bodily being and its dynamic of experience.

The origins of the mind within the history of life may be understood as an extension of the most fundamental principles of biology: continuity and creative change. Life is at once survival and proliferation, the continuity of stability and the constructive creativity of adaptive change. These capacities reach their fullest expression in the human neurological system, but they are prefigured even at the most basic cellular level.

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Early in the evolutionary process, single cell organisms controlled their stability and adaptive responsiveness through a protective outer membrane containing ion channels that allowed regulated changes in intracellular chemical concentrations. With the emergence of multicellular life, specialized tissues and organs allowed the division of labor and complex control necessary to maintain and regulate a sustained and stable self. This includes respiration to maintain levels of oxygen; renal filtration to regulate chemical balance; and the metabolic control of a constant body temperature. These adaptations are crucial for the continuity of physical identity; they come under neurological control through a system of body representations within the brain. Together with peripheral sensory awareness of body surface and proprioceptive perception of body position and balance, this inner awareness of bodily state is the basis for the human person's sense of self. This web of self-awareness, like a map suspended in mental space, provides a constantly updated image of our state of being, against which any perturbation or alteration can be compared. Damasio explains that the body, as represented in the brain, constitutes "the indispensable frame of reference for the neural processes that we experience as the mind; that our very organism, rather than some absolute external reality, is used as the ground reference for the constructions we make of the world around us, and for the constructions of the ever-present sense of subjectivity that is part and parcel of our experience." Precision and clarity in consciousness, and the coordination and application of memory across time and circumstance, are only possible because of the defined borders and the remarkably invariant reference of the "self" anchored in the body. Indeed, the body serves as a stable standard against which change can be measured.

The mind, then, is not an abstract neurological function but an activity of the whole body. We know the world not as a separate reality, but with reference to ourselves. When we "see" an object, for example, we are interpreting information from the retina: light waves reflected by the object alter the physical structure of our retinal cells, which in turn activate impressions in the brain. At the higher levels of perception, the effect is analogous but vastly more complex; it extends the same basic biological principles of dynamic responsiveness of the body to impressions of the world. For such a system to function, the organism must pick out the important information by selective perception, evaluate it both qualitatively and quantitatively, and make the appropriate adaptive response or revision of self. Our capacity for adaptive transformation through learning and memory—prefigured, at a basic level, in simple and direct single-cell mechanisms of response—forms the biological basis for both the continuity of personal identity and for interpersonal cultural transmission. The accurate apprehension and self-transformation allowed by the stable ground of the body make possible the genuine acquisition of information. The detection and interpretation of an outside stimulus culminates in the in-forming of our physical body: its con-

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formation to a wider consciousness of the nature of the world and the self within the world.

The awareness and learning of the responsive self are not, however, the objective knowing of a dispassionate observer. The mind has been selectively shaped for perception and interpretation in accordance with its service to survival and the goals of life. As Damasio argues, “our minds would not be the way they are if it were not for the interplay of body and brain during evolution.” He explains how the evolved body states and responses encoded as emotions carry implicit biological values and, together with the instruments of logic, are essential in rationality, allowing us to reason “in consonance with a sense of personal future, social connection and moral principle.” There is no pure perception or reason, only the purposive personal existence within the dynamics of life. We do not exist in the world as passive receptacles, indifferent to the implications of information. Even to the simplest sensory awareness we bring the entire weight of selective attention, contextual interpretation, and the images and ideals that guide our deepest goals. Just as we are shaped by perception, we also shape our perception, stretching forth as active agents, probing the world with our questions in a quest for its unifying principles and coherent order. This places the human person within a larger frame. It beckons beyond biology to questions of the spiritual significance of life. And it raises the fundamental question: what kind of knowing is made possible by this inseparable psychophysical unity of the human person?

### **The Language of the Body**

In *Philosophy in the Flesh*, George Lakoff and Mark Johnson explore the meaning of this “embodied mind” for its implications in individual consciousness and social communication. They argue that reason is not literal but metaphorical, that the very structures of our categories and concepts come from the nature of our bodily experience—the world as we know it by living in it. Time, for example, is understood by its representation through the experience of movement in space. These primary, bodily based concepts then serve as metaphors for abstract concepts, such as the “force” of a reasoned argument or the “attraction” of love. There is no mind separate from and independent of the body and no “pure reason” apart from bodily experience.

Consider, for example, the different metaphors built on vision and olfaction. Although most of our sense-based metaphors are visual, there are certain concepts—diffuse, vague, but emotionally real—which we could not convey without reference to odor. These do not just represent useful analogies, but actual felt realities, conceptualized and communicated through a common grounding in bodily experience. Moreover, there is evidence that we employ the very regions of our brain associated with the sensations of taste in the cognitive processes of our moral awareness. This unconscious association is reflected in some of the

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words we use for moral description, such as when we speak of “distasteful” or “disgusting” behavior. This way of grounding our experiences in the nature of our bodily being allows the shared exchange of social communication. As Lakoff and Johnson explain: “The mind is not merely embodied, but embodied in such a way that our conceptual systems draw largely upon the commonalities of our bodies and the environment we live in. The result is that much of a person’s conceptual system is either universal or widespread across languages and culture. Our conceptual systems are not totally relative and not merely a matter of historical contingency.”

These shared conceptual systems, built on our ancient heritage of evolutionarily selected emotional responses and perceptual biases, serve as the foundation for further shared features of human cognition. Anthropologists have noted similarities across cultures in certain mental constructions, aesthetic preferences, and learned behaviors. The psychologist Martin Seligman has called these cognitive developmental tendencies “prepared learning.” He includes a wide range of responses from an innate aversion to snakes to the way we structure grammar and syntax. These behaviors are not directly coded by genes, as experience plays a role in their expression, but they are a kind of bias in cognitive development “prepared” by the fundamental structures of the mind.

The evolved embodiment that provides a common ground for self-consciousness and conceptual categories also provides a basis for the desires and intentions that shape our shared system of values. With increasing organismal complexity, the central values of evolutionary success—survival and reproduction—are served by pleasurable intermediate activities that become valued ends in themselves. The most obvious of these is the pleasure associated with sexuality—where the biological goal of reproduction may be completely unintended (and, in at least one culture, unrecognized!). But if evolutionary biologists are right, this same principle extends to all corners of human activity, from children’s play to the aesthetic arts and religious practice. These and other dimensions of human life, observed widely across cultures, are activities in the service of species survival. Notwithstanding the great variety of cultures and diversity of personalities, there is a central core of basic biological need that forms a shared human community of desires and aspirations.

But these basic biological drives of human beings point beyond survival to a shared realm of more transcendent values. Our unique human form and its concomitant capacities and inclinations of mind make possible what Leon Kass describes as “a new world relation, one that admits of a knowing and accurate encounter with things, of genuine and articulate communion and meaningful action between living beings, and of conscious delight in the order and variety of the world’s many splended forms—in short, a world relation colored by a concern for the true, the good, and the beautiful.”

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## The Biology of Empathy

All of these shared foundations of human existence, our particular form of embodied being and the common challenges and opportunities of a similar environment in which our lives are embedded, provide the crucial underpinnings of human social life and its cultural and moral meaning. Human beings are intrinsically and irreducibly social. The very process by which we enter the world promotes human cooperation. Because of the large size of the human brain and changes in the pelvic bone structure associated with upright posture, childbirth is painful, difficult, and medically risky. (Even today, in certain pre-technological societies, the maternal mortality rate associated with childbirth is close to 20 percent.) According to anthropologist Karen Rosenberg, chimps hide at the time of birth, but humans seek assistance. Furthermore, human infants are born at an early stage of neurological development. Their long period of childhood dependency assures that social stimulation plays a formative role in the maturation of the mind. This intricate social interplay, especially between infant and mother, is built on a remarkable set of anatomic and physiologic adaptations that make possible the unique human capacity for *empathy*.

Empathy is the ability to identify with and understand the situations, motives, and feelings of another. It is so natural to us that we rarely ponder the mystery of its mechanism. Although in popular discourse empathy has taken on the somewhat sentimental notion of sympathy, from a scientific perspective it is a crucial ingredient in personal development and essential for the full range of social interactions. Our particular human form provides a common “language” of mental categories, emotional responses, and shared needs that are the basis for intelligible communication and genuine social community. In contradiction to Durkheim’s notion that we are “merely the indeterminate material that the social factor molds and transforms,” there can be no “social factor” without a stable human nature that provides the ground for mutual understanding.

The biological foundations of empathy, however, are far more than a simple system of signs to be expressed and observed. Rather, the communication made possible is a form of “intersubjectivity,” in which the observer actually participates in the feelings of the other. This extraordinary capacity is built on a combination of evolutionarily ancient emotional responses and more recent anatomical and neurological innovations unique to primates and highly refined in human beings.

Charles Darwin was fascinated by the question of the cross-cultural meaning of emotional expression. He wanted to know if facial expressions of emotion are universal or socially learned and thus vary between cultures like language. He inquired of missionaries and foreign travelers for their observations and opinions on this matter, and he tried to formulate evolutionary explanations in

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support of universality. The idea of universality fell out of favor for most of the twentieth century, as we digested the bewildering diversity of ethnographic studies, but has recently received support in the research of psychologist Paul Ekman. In a systematic study of more than a dozen cultures, including a preliterate culture in New Guinea, he found a nearly universal language of facial expression for the emotions of anger, sadness, disgust, enjoyment, and surprise. In addition, he noted consistent physiological changes in both the central nervous system and the autonomic nervous system (that controls functions such as blood pressure and heart rate) that accompanied specific emotional experiences.

The act of voluntarily performing those muscular actions that normally accompany a specific emotion generates involuntary changes in autonomic nervous system activity. For example, performing the muscle actions that express anger will cause an acceleration of the heart rate and a readiness for action. This demonstrates that emotions are integrated psychophysical states with both inward and outward expressions. Put differently: there are no subjective states without visceral and postural correlates, and there are no body actions without psychological correlates. It is this shared, bodily based quality of emotions, manifested and experienced in a similar way by all people, that makes possible the human experience of empathy. By perceiving and understanding the bodily movements of others, we come to understand something of their inner life.

The ability to draw on the outward manifestations of emotional expressions that reveal the inward subjective feelings of another was made possible by the evolution of the specialized human form. Along with upright posture came a reordering of the senses, with sight taking prominence, and with it the evolution of the highly flexible, furless canvas of self-presentation we call the *face*. Upwards through mammalian evolution there was a progressive refinement of the structures of the face that facilitate active and increasingly subtle communication. With more than 30 finely tuned muscles of facial expression and vocal control, human beings are capable of a wide array of communicative expressions of emotions and intentions. We have an astonishing capacity to recognize and remember faces. Neonates preferentially touch faces, and within days discriminate between their mother's face and that of a stranger. Within just nine minutes of birth infants turn their heads and eyes toward a normal image of a face, but not towards a scrambled mix of facial features. Furthermore, we are uniquely sensitive to the dynamic changes and emotional expressions of faces. The absence of pigment in the human sclera (the whites of the eyes) highlights the iris and thereby enhances the interpretation of eye movements. Special ensembles of cells in the brain respond only to faces, and some respond to specific facial expressions and direction of gaze. Within thirty-six hours (some researchers claim forty minutes) of birth, infants are able to discriminate among facial expressions, and reflect them in the facial movements of their own brows, eyes, and mouths.

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It appears that there is an innate ability to correlate the sensory information of a visually perceived expression with the muscle movement involved in imitating the expression. This idea has recently received support with the discovery of “mirror neurons” in monkeys (suggesting that similar cells might be present in humans). These cells fire not only when the individual *makes* certain hand motions, but also when he *observes* others making such motions. This remarkable discovery suggests a neurological basis for a correspondence between seeing an action and performing it, and for feeling in oneself the goals and intentions that attend the actions of another. Recent studies suggest that such mirror neurons also exist for other gestures, including facial movements and even audio-visual mirror neurons that relate the auditory, visual, and motor actions associated with a specific movement. Taken together with the studies cited earlier showing that voluntary performance of muscular actions of emotional expression generated concurrent involuntary autonomic nervous system states typical of that emotion, one can see the grounds for a genuine empathic resonance through facial communication. Observing another person’s facial expression subtly activates the same muscular movements and autonomic responses in the observer, which together constitute the physical grounding of an inwardly felt subjective state. We experience this, for example, when we see someone yawn or grimace in pain.

These studies suggest that innate, hard-wired connections between the sensory, motor, and visceral components of emotions make possible a single psychophysiological state shared between individuals. They suggest how we might leap beyond our solipsistic self into genuine society with others. As psychiatrist Leslie Brothers puts it: “Findings such as these suggest that an archaic kind of sociality, one which does not distinguish self from other, is woven into the primate brain.”

### **The First Conversation**

This remarkable human capacity for empathy between persons is grounded in our biological origins. From earliest infancy there is an interactive engagement between mother and child that sustains a shared conversation of reciprocating rhythm and unifying emotional resonance. Just as newborns have inborn neurologic dispositions (including perceptual discriminations) that direct their attention toward the sights and sounds of other human beings, adults have an instinctive range of baby-engaging actions and responses. Adults in all cultures, when talking to babies, raise the pitch of their voice, slow the rhythm, and make the melody more pronounced, more singsong. It seems that evolution has shaped parental behavior to complement babies’ auditory preferences. Babies, in turn, shift their gaze to the region around the eyes while listening to speech, and thereby gain an additional complementary source of emotional communication and a deeper penetration into the mind of the mother. As psychiatrist Daniel Sterns notes, “The distance between the eyes of a baby at the breast and the



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mother's eyes is about ten inches, exactly the distance for the sharpest focus and clearest vision for a young infant." The infant follows the flow of the mother's emotional expressions and their vital association with the process and patterns of events. "Her smile exerts its natural evocative powers in him and breathes a vitality into him. It makes him resonate with the animation she feels and shows. His joy rises. Her smile pulls it out of him." Likewise, the mother's exquisite responsiveness to what the baby does moment to moment builds in the infant a sense of connection and a growing awareness of his role in the dynamics of their engagement.

By age three and a half months, the baby can control his gaze and initiate face-to-face encounters, gaining a sense of himself as an agent or actor who can alter the dynamics of interaction. In a process that Sterns calls "attunement," there is a reciprocity of small, repeated exchanges, a kind of facial "duet" in which the mother responds, not with an imitation but with a reply that lets the baby know that she has understood his feelings. These small attunements give the infant the reassuring feeling of being emotionally connected, a message which mothers send about once a minute when they interact with their babies. This interaction, of joint initiation and mutual creation, is an improvisation with theme and variations—back and forth, a kind of conversation of feelings, an unspoken communion of mind. As psychologist Daniel Goleman writes: "Mutual gaze provides the structure for these interactions. Gazing back and forth, rather than talking back and forth, is the action." This provides the crucial lessons of pure social interaction, the ties of attachment and the nonverbal foundations upon which language will later be built. "Mutual gaze is, indeed, a world within a world. Looking into the eyes that are looking back into yours is like no other experience with another person. You seem to feel and follow vaguely the mental life of the other." This experience forms the foundations for the deepest engagements of love later in life. There is evidence that our very concept of the human person, of a distinct subjective locus of life—replete with intentions, hopes, fears—is formed in a uniquely human extension of the neurological substrate that processes facial and vocal expression.

This primary grounding of communication and trust, based on shared biology, bridged by empathy, and built by personal interaction, provides the foundations for language, moral awareness, and cultural community. The infant's mind awakens to the world and establishes a sense of self and others. As the philosopher Charles Taylor writes: "The genesis of the human mind is... not 'monological,' not something each accomplishes on his or her own, but dialogical." The basic congruency of feeling established between mother and infant is slowly extended into a broader conversation that reaches out in exploration and evaluation of new and unfamiliar experiences. In a process of "social referencing" that builds a common set of values, the infant will point or gaze at an object to establish joint attention

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and then observe the mother's reaction. The mother's spoken responses, which at first convey to the baby only feelings—the shared affective language of posture and prosody—begin to carry specific semantic content. A web of meaning is formed within this linguistic system of empathetically grounded symbolic gestures, the coded concepts on which all human cultures are constructed.

This capacity to use language is an extraordinary freedom, essentially unique to the human species. It is an extension of the basic principle of voluntary use of the muscles, freed from obligate automatic action. It is, in a sense, a prime example of the open indeterminacy of the human person, having no fixed or restricted response. With language we move beyond the imperatives of the present to the creative constructions of cultural meanings and values. We weave an interpretive story, rich with ideals and aspirations, a narrative by which we navigate the world. In a kind of “re-encouragement,” the child begins to structure his understanding of the world, the very pattern of his thoughts, by the echo of the words of others. In this frame the social significance of the self is placed within a pattern of moral meanings and transcendent truths. Slowly the child becomes connected to the society in which he is born, raised to a realm of beliefs and hopes inaccessible to an isolated individual.

The child psychologist Jerome Kagan describes how moral awareness develops together with this empathetically grounded sociality: “A moral motive and its attendant emotions are as obvious a product of biological evolution as digestion and respiration.” In an orderly developmental progression, a child begins to crystallize a sense of self and other, to recognize the differentiation of animate and inanimate beings, and to discover the inner mental world of private beliefs and intentions. With conscious personal identity comes awareness of the distinct identity of others. Indiscriminate emotional contagion, with its blurred boundaries of self, gives way to cognitive empathy, a willed and knowing stepping into the role of the other.

Within this profound resonance of mutual understanding, between the second and third year of life children develop an appreciation of the symbolic categories of good and bad, and learn to apply these moral categories to their own actions, thoughts, and feelings. The child's sensitivity about the propriety of his behavior relates to a larger concern with the right order and relationship of things. Discrepancies, such as broken toys and shirts missing buttons, trouble the child, and he begins a lifelong search for a coherent and harmonious explanation of the larger order of the world. With a growing understanding of the relationship between present actions and future outcomes, the child begins to develop a conflict between acting on present desires and recognizing their consequences to himself and others. Before the age of five, children have difficulty governing their actions, but by around six the capacity for self-control, and therefore an awareness of accountability, emerges. This in turn allows shame and

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guilt, but also the happy sense of virtue and consonant awareness of the goodness of self. Freedom becomes, increasingly, the central moral axis; guided by the emotional pull of empathetic communion, it leads to the poignant drama of the individual self in the quest for a sense of moral worthiness. This personal quest for ethical identity provides the fundamental platform for cooperative community, the continuity of culture, and the wider search for spiritual harmony with the deepest source and significance of life.

### **The Mystery of Biology**

We have moved from biology to biography, from the fundamental forces of matter to the distilled consciousness and moral awareness of the human person. Here, between Pascal's "infinities," the full mystery of this "creature of the earth" becomes evident. Brought forth from primary material substance, our specific form of embodiment prepares the grounding for both self-awareness and interdependence, for voluntary action and engagement with others. Our particular physical construction, this unique collocation of chemicals, provides the intelligible language of being that makes possible the shared meaning and moral awareness of human community. Built on a common core of organized development and organic growth, refined through four billion years of evolutionary adaptation, our unique human bodily being and dynamic of lived experience provides the essential condition, the indispensable medium of genuine communion, and the extensions of freedom and flourishing it implies.

Shaped and sculpted within the womb, even before birth we are attuned to the rhythms of our mothers' bodies. Born into the world with senses already alert to the signals of social significance, we are attuned to the interpersonal exchange of empathy. Grounded in a pre-linguistic conversation of intersubjective awareness, we are socialized within the particular symbolic language and cultural narrative of our community.

Looked at from the perspective of evolution, one can immediately recognize the advantage in the synergism and adaptive flexibility of a coherent community. Affiliation provides protective alliance, division of labor, and the accumulated cultural wisdom of human experience. Within such community, we explore our world in the counterpoint and corrective of a shared dialogue, seeking a comprehensive understanding of existence that reaches forth for the fullness and flourishing of life.

But one dilemma remains. Along with the biological possibility of cooperation and community, there is a dark side to empathy. Group life implies previously unimagined freedoms, but also the opportunity for exploitation. The canvas of mutual understanding made possible by the human capacity for empathy can also be used for cold deceit and calculated deception. Indeed, in the strivings of life, other human beings are both our companions and our competition. Is not all of

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nature a struggle for survival, a ruthless rivalry fashioned in the crucible of suffering and death? Indeed, evolutionary psychology maintains that ultimately all adaptations, including the empathic agencies of social life, must redound to the benefit of the individual through selective advantage in the proliferation of his genes. Such an imperative would hardly promote genuine acts of altruistic concern but rather the unimpeded extension of self-will.

The implications of this view of the human person cast an ominous shadow as we enter the deepening drama of the age of biomedical technology. Brought forth in an evolutionary trajectory of ever-increasing freedom, we have ascended to a comprehension and control of the natural world that places into our hands the very powers that have formed us. In the nearly five thousand generations of our species' journey on the earth, never has the exploratory edge of human existence been at once so open and yet so full of danger. Liberated from the basic struggles of survival, we are drawn forward by the seductive promise of technological self-transformation. These powers and possibilities suggest an ever-escalating extension of self-will driven forward by our appetites and ambitions toward an imagined ideal of perfect bodies and perfect minds.

Yet, within this rising scale of freedom and peril, between the dreams of technological perfection and the pessimism of aimless materialism, we sense a significance to human life that mysteriously transcends the imperatives of evolutionary process. Self-aware and sensitive to others we have awakened to a wider moral meaning. Torn between the pull of pride, the private lures and longings of our self-will, and the aspiration to truth and beauty, we become acutely aware of the central significance of both suffering and self-sacrifice. Conscious and comprehending, we are lifted to the level of love, beholding with wonder our place and possibility in the whole of life. We are a revolution within nature that revises our understanding of the nature of nature; we are matter come to mind and moral awareness. Amid increasing intuitions of a transcendent design and destiny overarching all of life, we ascend to an awareness of the spiritual unity of an ordered cosmos, where the material and the moral flow forth from a single creative source, consummated and completed through the evolutionary emergence of the human person. When science has done its best, the mystery is as great as ever.