From Genesis to Genetics

The Case of Evolution and Creationism

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When Worlds Collide

In July 1996 a nearly complete human skeleton was found by two college students on the bank of the Columbia River near the town of Kennewick, Washington. Human remains so encountered are always of concern—"Who was it?" and "Who did it?"—so the students called the police. In an effort to answer those two questions the police turned the bones over to the local coroner. Burial grounds of Native Americans are sometimes encountered in that part of the Northwest, and the Native American Graves Protection and Reparation Act, passed in 1990, required that any such remains be returned for burial to the tribe to which they belonged. The bones appeared to be of great age, and so it was assumed that the skeleton must be one of a Native American, since settlers of European origin reached the West Coast only a few centuries ago. But closer study suggested otherwise.

To solve the puzzle, the bones were examined by an anthropologist, James Chatters, a specialist in skeletal remains of human beings. Such professionals can determine sex, size, age, cause of death, and racial type with considerable accuracy. Examination showed the skeleton to be that of a 50-year-old male of medium build, his teeth well worn and a stone arrowhead imbedded in his hip bone. Radiometric methods determined that the man died about nine thousand years ago—

long before human beings of European origin first arrived in the New World, according to conventional historical accounts. Yet the skeleton had Caucasoid features. Chatters took the bones to another anthropologist for an opinion, without giving a hint of his analysis, and was told that the skeleton was of a Caucasian male. Even when Chatters revealed the age of the bones, the second anthropologist stuck to her original identification. A third anthropologist familiar with the skeletal features of modern tribes of Native Americans concluded that the skeleton could not be assigned to any one of them.

Finding the nearly nine-thousand-year-old skeleton of a Caucasoid male in any part of the New World is puzzling in the extreme. Traditionally, anthropologists have thought that the first human beings to inhabit the Western Hemisphere crossed from Siberia to Alaska about 15,000 years ago. Some now believe that the event occurred much earlier, but in any case these immigrants from Siberia were of the Mongolian racial type, as are Native Americans—not Caucasoids. Anthropologists know that a few nameless fishermen from Western Europe came to the eastern shores of the New World before Columbus's arrival in 1492, as did the Vikings, but Caucasians did not come in large numbers until early in the sixteenth century.

So who was the Caucasoid Kennewick Man who arrived thousands of years before the Vikings, Columbus, Cortez, and Pizarro? Needless to say, this is a most exciting and important question, not only for anthropologists and historians but for many nonprofessionals as well. There have even been some speculations that Caucasoid people may have been the original inhabitants of the New World. Thus, for scientists and others interested in such historical questions, further studies on Kennewick Man are overwhelmingly important.

For a while it looked as though these investigations would never take place. In an effort to comply with the federal Native American Graves Protection and Reparation Act, the Army Corps of Engineers assumed control of the bones, placed them in a vault, and refused to allow any further examination of them by scientists. The Umatilla

tribe, who live near the site of discovery, asked to have the bones returned to them, in which case the skeleton would be secretly buried and never be available for study. A group of anthropologists went to court to stop the Corps from complying with the tribe's request. The anthropologists claimed that the Umatillas were not in that part of the Northwest when Kennewick Man lived; hence, he could not be one of their ancestors. And of course his Caucasoid skeletal features led to the same conclusion. Thus, the available scientific evidence is that Kennewick Man was not a Umatillan or any other Native American.

In response to that hypothesis, a leader of the tribe, Armand Minthorn, stated this position:

> Our elders have taught us that once a body goes into the ground, it is meant to stay there until the end of time. . . . If this individual is truly over 9,000 years old, that only substantiates our belief that he is Native American. From our oral histories, we know that our people have been part of this land since the beginning of time. We do not believe that our people migrated here from another continent, as the scientists do. . . . Scientists believe that because the individual's head measurements do not match ours, he is not Native American. Our elders have told us that Indian people did not always look the way we look today. Some scientists say that if this individual is not studied further, we, as Indians, will be destroying evidence of our history. We already know our history. It is passed on to us through our elders and through our religious practices. (Preston 1997, 74)

As of early 2001, the matter remains unsettled. Nevertheless the two perspectives—the anthropologists' and the Native Americans'—provide a classic example of two polar points of view that I will analyze throughout this book. One point of view rests on the questions and methods of science. The other rests on cultural beliefs that have been passed down from generation to generation. One side seeks a solution to a problem of intense interest to scientists and historians; the other side does not recognize that there is a problem that needs a solution.

This dispute over the future of Kennewick Man represents a clash between two immiscible patterns of thought. Another example (reported in the *New York Times* on August 29, 1997) comes from Afghanistan, where the Taliban, a Muslim sect, have gained control of much of the nation and are enforcing conformity to the Sharia, sacred Islamic law. According to this code, thieves must be punished by having their hands and feet cut off; couples caught in adulterous acts must be stoned to death; and if women do not cover themselves from head to foot, the young Taliban enforcers deal them a severe flogging. The young zealots have even beaten women for wearing white socks or plastic sandals.

The head of the General Department for the Preservation of Virtue and Prevention of Vice, Alhaj Maulavi Qalamuddin, explains the Taliban point of view: "Some women want to show their feet and ankles. They are immoral women. They want to give a hint to the opposite sex." This must be controlled to "prevent impure thoughts in men"; "if we consider sex to be as dangerous as a loaded Kalashnikov rifle, it is because it is the source of all immorality." The rules of the Sharia relating to women are harsh in other respects, by late-twentieth-century standards in the West. Women are prohibited from working or obtaining an education or even receiving medical treatment, and after puberty they are almost entirely secluded in their homes.

Such behavior toward women is not acceptable in most nations today, including most nations where Islam is the predominant religion. In this type of conflict modern values concerning human rights, gender equality, and civil liberties clash with religious doctrines that have been handed down for thousands of years. Such doctrines are accepted as "true" by the culture that inherits them and are highly resistant to change. In most instances, there is no way to adjudicate a conflict between these two systems of belief with evidence acceptable to each side.

Many—probably most—of the problems between nations, as well as the problems among the people of a single nation, stem from taking

different points of view toward the same problem. Anthropologists using the methods and data of science propose one course of action for dealing with Kennewick Man, whereas the Native Americans relying on their received traditions propose another. Granted, only the scientists offer the possibility of reaching a decision about the identity of the remains based on confirmable data rather than on faith, but pursuing this course requires that both sides accept the validity of the anthropologists' assumptions, methods, and evidence; such acceptance by the Umatilla tribe seems unlikely. Consequently, in keeping with American jurisprudence, a federal judge will decide which point of view will prevail. By contrast, science has nothing useful to say when—as in the case of the Afghan women—the clash is between human rights and divine law. That conflict is between two different belief systems, each accepted as a matter of faith or principle, with one being far more restrictive on the lives of women than the other.

CREATIONISM VERSUS EVOLUTION

The immiscible patterns of thought that concern us in this book are those of creationists and evolutionists. Christian fundamentalists accept without question that divine creation is the explanation for the diversity of life we see today—the many different species of plants, animals, fungi, and microorganisms that flourish around the globe. Their position is based on their reading of Genesis, with its familiar story of the creation week—six days during which God created all of nature. On the first day God created heaven and earth and light and darkness; on the second He made the firmament and divided the waters; on the third day He separated land from the seas and created the land plants; on the fourth day He created the sun, moon, and other celestial bodies; on the fifth day animals in the sea and birds in the air came into being; on the sixth day the land animals appeared, and God also created, in his own image, two human beings. Until recently the accepted date for creation, based on a tally of the generations ("begats") listed in the

King James version of the Bible, was 4004 B.C. Creationists assume that all creatures living today are the same as when they were created. That is, there has been no evolution.

The scientific version of these events is quite different. Tentative estimates place the origin of the universe in the neighborhood of 15 billion years ago. The sun—a second-generation star—and its orbiting planets formed about 4.5 billion years ago from the interstellar debris created by the explosion of massive first-generation stars. The Earth started out in a molten state but cooled enough to form a solid crust by about 3.8 billion years ago. The first evidence of life dates to about 3.5 billion years ago and consists of very simple cells without a nucleus (prokaryotes), much like bacteria living today. The oldest known cells with nuclei (eukaryotes) date to about 2.7 billion years ago. The earliest multicelled organisms discovered so far date to about 1.7 billion years ago. Fossils of the first members of the animal kingdom date to about 650 million years ago. At the beginning of the Cambrian period, about 570 million years ago, animal life became abundant and highly diversified; the fossil record from this period is much better known than that of earlier times. From that point until today, there has been an incredible evolution of life (both plants and animals), with different species appearing, flourishing, and then becoming extinct or evolving into still other species.

The evolutionists' and the creationists' accounts for the origins and diversity of life could hardly be more incompatible. Strict creationists base their account on faith—a belief that Genesis was divinely inspired and provides the only true explanation for the origins of the universe, living creatures, and the many variations in organisms that we observe today and find in the fossil record. The creationists' pattern of thought begins with the answer and then seeks to explain the world in terms of that answer. Scientists work in the opposite direction. They study the universe and its earthly inhabitants and on the basis of observations and experiments propose a rational account for the past and the present. Scientists as a group, including those who adhere to religious

beliefs, do not understand why any person familiar with the data would reject an explanation based on confirmable knowledge and accept instead a supernatural concept based on faith alone. Similarly, deeply committed fundamentalists wonder why anyone would reject the Word of God in favor of what a bunch of scientists has to say.

The long strands of human history have seen many conflicts between science and religion, and sadly, they have often turned violent and bloody. It is fascinating to consider how individuals come to hold such conflicting explanations for the same phenomena and why they hold them so tenaciously. We know that parents and society are remarkably efficient in transmitting patterns of thought and behavior to successive generations. This cultural inheritance sets up rules for behavior that help individuals get along within their group. It also provides each generation with an avenue for learning new things, and it creates order within the society. But beyond these practical advantages, a culture's unique belief systems may retain their enormous power from generation to generation in large part because they supply impressionable young people with answers to many questions they quite naturally ask, such as "Where did I come from?" "Who made me?" "Who will take care of me?" "Why do people die?" "What happens to me after I die?"

Such inquisitiveness seems to be part of our human inheritance. For hundreds of thousands of years, early human populations were illiterate and encapsulated in small tribes whose very survival was regularly endangered. Human beings lived a marginal existence like all other animals, dependent on the ability of the environment to sustain them and on their skills and knowledge of how to obtain food, water, and shelter. But within every society, some individuals must have exhibited a much stronger desire than their peers not just to survive from moment to moment but to understand themselves and the world around them. They asked questions and sought answers. According to anthropologists who have studied hunter-gatherer cultures, the explanations inquisitive tribe members come up with usually include

both natural and supernatural elements. Natural things and processes are those that can be observed: wind, rain, birth, death, animals, plants, fire, night, day, and the seasons. But for each of these observable entities, a supernatural element of some kind usually figures in the explanation as well. For example, although death is now accepted by most people in Western societies as due to natural causes such as disease, accidents, or the ravages of age, people in some parts of the world still believe that death results from the displeasure of a god or spirit or the effects of a curse such as the evil eye.

The tenacity with which people hold onto beliefs in the supernatural or paranormal has been the subject of much scientific investigation. The results are complex and unexpected. Two psychologists, Barry Singer and Victor A. Benassi (1981, 49–51), made an extensive study of occult beliefs in the United States and offer this summary:

> Far from being a "fad," preoccupation with the occult now forms a pervasive part of our culture. Garden-variety occultisms such as astrology and ESP [extrasensory perception] have swelled to historically unprecedented levels. . . . Belief in ESP, for instance, is consistently found to be moderate or strong in 80–90% of our population; . . . in one survey it ranked as our most popular supernatural belief, edging out belief in God in strength and prevalence.
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> Experiments which have attempted to encourage disconfirmation of occult or illusory beliefs by motivating subjects to think through their judgments more carefully . . . have uniformly revealed an astonishing resistance to change of such beliefs. . . . [Such] stubbornness of illusory and occult beliefs is typical rather than exceptional.

By way of explaining the origin of beliefs in the paranormal, Singer and Benassi point out that if human beings do not understand the reason for a given event, they tend to invent one, and the kind of reason they invent will depend on the intellectual baggage they carry

with them. A simple, rational, natural explanation might be preferred, but if that cannot be developed, the need to explain remains and supernatural causes may be invoked. Thus, according to these investigators, one factor in the great increase of interest in the occult in the United States is inadequate science education in the schools. Over half of the students they tested did not know, for example, that the level of water in a partially filled glass remains parallel to the Earth's surface as the glass is tipped.

Singer and Benassi suggest that the "iffiness" of science is a second factor that weighs against the acceptance of scientific explanations over supernatural ones. Scientists tend to resist claiming that their statements are true by any absolute measure, stating only that they represent the best available explanation based on existing data. As Thomson (1997, 219) expresses it, the facts of science are "temporary way-stations on the long path to the refinement of knowledge." For many people, this tentativeness is a pale substitute for the finality and certainty of supernatural explanations.

A third factor that has increased interest in the occult is the media, which report stories about UFOs (unidentified flying objects), psychic healing, people who claim that the dead speak through them, and ghosts. Splendid examples of articles of this kind can usually be found in publications stacked at the checkout counters of supermarkets. The media rarely provide scientific analyses of these reports. Added to this "news from the other side" are highly entertaining motion pictures and television dramas that contain supernatural and superhuman feats. And of course even our own dreams can be quite extraordinary and entertaining, carrying us into compelling worlds where the constraints of waking reality no longer apply.

But Singer and Benassi found that the biggest factor by far in people's acceptance of the occult is organized religion. Most people profess a belief in some religion, and essentially all religions accept miracles as a given. This institutionalized belief in miracles, according to Singer

and Benassi, has a spillover effect into other realms of life and accounts in large part for people's acceptance of paranormal events ranging from visits by angels to alien abductions.

Just how rigid occult beliefs can be is documented in an interesting experiment done with students in a psychology course at Concordia University in Montreal (Gray 1984). The course was called "The Science and Pseudoscience of Paranormal Phenomena." Students were given a test at the beginning of the class to see whether they believed in ESP, ghosts, or miracles (see table 1). At the end of the semester they were asked the same questions to see what effect studying these phenomena would have on their beliefs. Then, to get an estimate of the stability of any change in beliefs, the students were asked the same questions a year later. Occult beliefs declined by the end of the course but usually by trivial percentages. After one year, belief in the paranormal had moved back to levels close to those before the course was taken. In some cases it was slightly higher. This one-semester course designed to reduce students' belief in the paranormal was not a success. Lawson and Weser (1990, 589) report similar findings in another study and note that "the less skilled reasoners were more likely to initially hold the nonscientific beliefs and were less likely to change those beliefs during instruction. It was also discovered that less skilled reasoners were less likely to be strongly committed to the scientific beliefs."

Should we conclude that a willingness to accept supernatural explanations over scientific ones has been hardwired into the human brain—that it is "human nature" to seek meaning beyond the confines of the natural world? Perhaps, but an alternative—and to my mind more probable—hypothesis is that one's patterns of thought and belief are the result of influences very early in life associated with family, church, friends, community, books, other media, and the schools. Children almost always develop the habits and beliefs of the family and culture to which they belong; indeed, the fidelity of cultural inheritance often seems as strong as the fidelity of genetic inheritance. Most children in the United States grow up in communities where they see

TABLE 1.
College Students' Belief in the Paranormal

Phenomenon	*Students Who Believed in the Phenomenon*		
	BEFORE THE COURSE	AFTER THE COURSE	A YEAR LATER
Extrasensory perception (ESP)	85	54	68
Unidentified flying object (UFO)	69	51	46
Astrology	55	43	61
Ghosts	43	34	45
Psychic healing	49	35	43
Miracles	43	46	54
Reincarnation/Life after death	69	55	57

many churches but encounter few or no institutions that extol the methods of science. Many television channels they watch feature evangelists expounding on miracles, heaven, and eternal damnation but show few scientists explaining science as a way of knowing. Most people are exposed to stories of creation from childhood, but few of them ever hear scientists' account of evolution.

NATURAL VERSUS SUPERNATURAL EXPLANATIONS IN WESTERN CULTURE

Natural and supernatural explanations for the way the world works have ebbed and flowed throughout human history, and both are still with us today. It is tempting to imagine a slow progress through time toward rational thought and naturalistic explanations and away from superstition, cults, and magic, but this is not the case. Shortly after World War II, the remarkable advance of science and technology elevated respect for the procedures and discoveries of science. But by the late 1960s, many people had become disenchanted with scientific perspectives and skeptical of the ability of scientists to do more good than harm.

Conversely, attempts to exclude the supernatural from explanations of natural events have been an important part of Western civilization from its beginning. As far back as the sixth century B.C., a few Greek philosophers who lived in Ionia on the coast of what is now western Turkey attempted to understand natural processes in terms of natural causes, a firmly rooted characteristic of science to this day. Only fragments remain of what they wrote, and most of the information we have about them comes from the surviving manuscripts of Greek authors who lived several centuries later. But from what scholars can tell, those Ionian thinkers were the earliest scientifically minded philosophers in the West.

The philosophy and science of the classical world of Greece and later of Rome continued this tradition. Aristotle in the fourth century B.C. codified the science of his time; and although later observations showed him to be incorrect in many instances, he sought natural explanations for natural phenomena. Throughout the centuries when Rome ruled the Mediterranean world, Western civilization saw a slow improvement in living conditions, technology, and general knowledge, all based to a great extent on a scientific approach to problem-solving. Those trends began to reverse themselves, however, in the fourth century A.D., with the passing of the great Roman emperors. By 476, after a long decline, the Roman Empire in the West fell and its political center moved east to Constantinople (modern Istanbul). The emperor Constantine was a Christian, and the Christian Church became increasingly powerful throughout the Middle East and the Mediterranean. The West had entered the Age of Faith. During the millennium from the fall of Rome to the fall of Constantinople in 1453, intellectual activity centered on the Church and was devoted to Christian practice and doctrine. Individuals who might have been the scientists, political leaders, artists, teachers, and philosophers in a more secular society were almost all occupied in the service of the Church. The literacy and education of the time were centered in the monasteries. Science

and technology progressed little, and much of what had been generally known in classical times was forgotten.

The story was quite different farther east, in China, India, and Arabia, where learning flourished during this period. Islamic scholars made great contributions to mathematics and astronomy—a legacy still with us in the Arabic names of the major stars and in Arabic numerals. Eastern medicine was also superior to that in the West. Arabic scholars were greatly interested in what Aristotle, Plato, Galen, and other Greeks had written, and they translated the Greek manuscripts available to them into their own language. Later these works were translated from Arabic to Latin and so became available to scholars in the West. The quality of these classical works was so superior to any secular writings of the time that they eventually joined the Bible as the basic texts of the medieval period.

As writings of Greek and Roman scientists became available, some Christian scholars saw the need to adjust them to Christian beliefs. That great doctor of the Church Saint Thomas Aquinas (1225–1274) tried, for example, to adjudicate between the Averroists, who, following Aristotle, held that faith and reason were two absolutely distinct ways of thinking, and the Augustinians, who, following Saint Augustine (354–430 A.D.), believed that faith always precedes reason. Aquinas suggested a compromise: the truths of faith complement the truths of reason. This puzzling solution had advantages: in the short term, it protected the Averroists from being classed as heretics, with possibly grisly consequences; and in the long term, it saved Aristotle's work from banishment and kept the cause of reason alive in the Age of Faith.

By around 1400 A.D., another change in the intellectual climate began to be felt, leading to the period historians have traditionally called the Renaissance. This "rebirth" started in Italy in the late fourteenth century and then spread throughout Western Europe. Slowly but inexorably, humanistic themes replaced religious subjects in literature

and the arts. Henry the VIII in England and Martin Luther and John Calvin on the Continent lessened the iron grip that the Catholic Church had exercised over those seeking new knowledge. Science and secular philosophy became acceptable pursuits once again. The year 1543 saw the greatest breakthrough in the cause of science, as three important intellectual works were published: the writings of the Greek physicist and mathematician of the third century B.C., Archimedes, which provided a basis for the later work of Galileo and Newton; Andreas Vesalius's text on human anatomy; and *De Revolutionibus Orbium Coelestrium* by Nicolaus Copernicus, a Polish astronomer and clergyman.

Both Vesalius and Copernicus proposed ideas that flew in the face of beliefs the Catholic Church had upheld almost without question for a millennium. These beliefs were based on the writings of Galen (b. 129 B.C. in Greece) on human anatomy and of Ptolemy (fl. 127 A.D. in Alexandria) on astronomy. When Michael Servetus, a Spanish physician, theologian, and scholar, made observations suggesting that Galen was not always correct in his anatomical descriptions, the Church had Servetus arrested, investigated, and in 1553, burned at the stake with a copy of one of his offending publications hung around his neck. When Giordano Bruno, a Dominican monk, rejected the Church-approved system of Ptolemy in which the heavens circled the Earth and accepted the system of Copernicus in which the Earth circled the sun, he too was burned alive, in 1600. Being burned alive is one of the most painful ways to die and, hence, appropriate for those who challenged authority in those times.

Still, a revolution in science had burst on the scene with a vigor the Church could not stamp out. By the time the seventeenth century came to a close, William Harvey (1578–1657) had described the circulation of the blood, Sir Francis Bacon (1561–1626) had written great treatises on the nature of science, and three pioneer astronomers and physicists—Galileo Galilei (1564–1642), Johannes Kepler (1571–1630), and Sir Isaac Newton (1642–1727)—had laid the basis for heavenly cos-

mology and earthly physics. The work of these scientists of the sixteenth and seventeenth centuries was for the most part grounded on careful observations and experimentation rather than on preconceived notions of how the world ought to work. Galileo, Kepler, and Newton discovered that complex phenomena, such as the motions of celestial and earthbound bodies as well as gravitation, obeyed precise rules that could be expressed mathematically. This was the beginning of serious attempts to reduce all natural processes to scientific—and ultimately mathematical—statements. Conclusions were based increasingly on natural processes and less and less on metaphysical concepts.

Suddenly all problems relating to nature seemed to be approachable by the unfettered human mind, and a sense of freshness and freedom swept over Western intellectuals. In 1664 Henry Power, Dr. of Physick, described how it felt to be part of this great intellectual revolution: "This is an age wherein (me-thinks) Philosophy comes in with the Spring-tide. . . . Me-thinks I see how all the old Rubbish must be thrown away, and the rotten Buildings be overthrown, and carried away with so powerful an Inundation" (192). Heady stuff. And he was not burned at the stake, mainly because he was an Englishman, and the Anglican Church was far less powerful in Britain than the Catholic Church was on the Continent. Times were changing, as Henry Power realized.

Science was stimulated by other developments as well. Western Europeans were voyaging around the globe, encountering new cultures and discovering hundreds of new species of plants and animals. The Royal Society of London, founded in 1662, became a center for scholars of Western Europe who were seeking a deeper knowledge of the natural world. Its publications served as a vehicle for making scientific knowledge available to all who might be interested. Universities throughout Europe were increasing in number and quality, and there was a slow but deliberate change in attitude about what was appropriate intellectual activity.

RATIONAL VERSUS ROMANTIC THINKING

The triumph of rationalism in astronomy, mechanics, and anatomy spilled over into other human endeavors to such a degree that by the eighteenth century, Western civilization had entered a period known as the Age of Reason or the Enlightenment. The newly freed human mind no longer looked to the Bible or to the authority of ancient scholars for answers. Instead, it sought to study the natural and human worlds through the powers of logic and observation. Above all else, supernatural explanations were to be rejected. It became widely accepted among intellectuals that the universe operated according to natural laws, which could be discovered through scientific procedures and expressed mathematically. The knowledge gained could lead to great improvements in the human condition.

This is not to say that scholars of the Enlightenment uniformly rejected God or religion. Quite the contrary; they were usually pious Christians who believed that science was a useful tool for understanding God's work. According to the deistic worldview of the time, God could be known in two ways. One was to study "the Word," that is, the Bible, which was still accepted by the Church and nearly everybody else in the Judeo-Christian tradition as having emanated from God. The other was to study "the Work," that is, what He had wrought through creation. Scientists such as Galileo and Bacon were well aware of the many difficulties in interpreting what was said in the Bible, and they hoped that the "book" of nature might help to solve those puzzles. Interpreting nature, therefore, became a companion activity to the theologians interpreting the Bible. Together these pursuits would lead closer to truth—or so it was hoped.

Not surprisingly, the Age of Reason elicited a counter-reaction. The widespread attempt to "be scientific" in the eighteenth century was largely rejected by nineteenth-century intellectuals of the Romantic movement, who viewed the Enlightenment world as cold, heartless,

and confining to the human spirit. In all this rationality, they asked, where was a place for inspiration, imagination, emotion, spiritual aspirations, self-expression, individual creativity, mystery, revelation, and tradition? Copernicus and his followers had demoted Earth from the hub of creation to a minor planet orbiting a minor star. The great eighteenth-century classifier of plants and animals, Carolus Linnaeus, had demoted humankind from the center of creation to a member of the Primate order, where a man or woman became just another ape. The Romantics accused science of finding no noble purpose for human life, overlooking the fact that finding purpose or creating meaning is not a proper assignment for science.

Human thought is far too complex to be divided strictly into these two discrete patterns—rational and romantic. Nevertheless, the pattern fairly typical among intellectuals of the Enlightment of the eighteenth and nineteenth centuries still characterizes much of our thinking in the modern world. During that time the pendulum swung noticeably toward the rational, critical, empirical, mechanistic, material, impersonal, skeptical, and reductionist mode. According to this ideal, unbiased observations and experiments produced data that others could confirm, and supernatural beliefs unsusceptible to scientific procedures were to be rejected. The world was a fit object of critical study, and not only was great progress possible in understanding it, but the products of science would inevitably increase the well-being of humanity. This philosophy—one might even call it a mission statement—is one that most scientists accept today.

But in some areas of human life, such as love, friendship, religion, the arts, and literature, a romantic way of thinking takes precedence over rational thought. Again, allowing for much fuzziness, one might characterize this kind of thinking as romantic, creative, emotional, humanistic, spiritual, personal, mystical, and holistic. But in no major undertaking does one mode of thought or action suffice. The design of an automobile that actually works is heavily weighted toward the

operations of the rational mind; but if one hopes to sell the cars one manufactures, then style, beauty, and history must be given their due. The nurturing of a child requires both a romantic and a rational mindset. Love and individual attention in a warm and supportive family situation are essential, but so is scientific information about nutrition and medicine for maintaining the child's health.

It is important to note also that intellectual debates between rationalists and romantics in the eighteenth and nineteenth centuries involved a mere fraction of society in a small corner of the world. Most human beings during that time lived, acted, and believed as human beings always had, and as most human beings do today. Moreover, we must not make the mistake of assuming that these two general patterns of thought first crystallized during the Enlightenment and Romantic periods. The Greek philosophers in Ionia were surely enlightened and they were just as surely capable of thinking in the romantic mode as well. Today, as then, the two points of view are different and often incompatible, but the consequences of that incompatibility are rarely severe. The human population is not divided into two hostile camps; everyone uses both patterns of thought, depending on what is being thought about.

The scientists I know make use of the romantic mode in at least 90 percent of their nonprofessional activities. The people they marry; the food they eat; the art, music, and literature they create or appreciate; the religious practices they follow; the recreation they enjoy; the pets they choose; and the clothes they wear are not selected on the basis of cold, calculating, impersonal data. And we can be thankful for that. On the other hand, few scientists I know—or anyone else, for that matter—would step off the curb into fast-moving traffic and expect a personal God to intervene and prevent their change from three dimensions to two.

Because all human beings are capable of these divergent thought patterns, one rational and the other romantic, there are no easy solutions for what to do with the bones of Kennewick Man or how

to view the conditions of the women of Afghanistan under the control of the Taliban—or whether to teach creationism or evolution in the schools. There is no one acceptable answer to these social decisions, because different groups adhere, sometimes fiercely, to different answers.