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ARTICLES

Prolegomenon to a History of Paleoanthropology: The Study of Human Origins as a Scientific Enterprise. Part 1. Antiquity to the Eighteenth Century

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Interest in the history of paleoanthropology and the other disciplines related to human origins studies has grown considerably over the last several decades. Some very informative historical surveys have been written by prominent scientists reflecting on the major developments in their fields. Some well-known early examples include Glyn Daniel's *The Idea of Prehistory* (1962) and *The Origins and Growth of Archaeology* (1967), which focus primarily on the history of archaeology, Kenneth Oakley's "The problem of man's antiquity: an historical survey" published in the *Bulletin of the British Museum* (*Natural History*) [Geology] (1964), and L. S. B. Leakey's *Unveiling Man's Origins; Ten Decades of Thought about Human Evolution* (1969), with the latter two focusing on the contributions of geology, paleontology, and biology to the problem of human evolution.

These and other early works provided both an impetus and a foundation for later historical studies, but over the last two decades a profound transformation has taken place as historians of science have begun to integrate the history of paleoanthropology and prehistoric archeology into the history of science more generally. By situating the history of paleoanthropology within the context of developments in the other natural sciences, and more broadly within the emergence of science as a Western intellectual institution, scholars have come to recognize the complex and sometimes unexpected scientific, philosophical, and social roots of anthropological theories and discoveries. In this article I cannot hope to relate the details of this history; instead I mean to show how our broad understanding of the history of paleoanthropology has changed as a result of recent work in the history, philosophy, and sociology of science by outlining the major trends of that history as it has been reinterpreted. I will then refer the reader to recent scholarly sources that can be read to fill in the details of this complex history.

Research into the history of paleoanthropology has been justified in numerous ways. However, it has also been asked how useful it really is for practicing scientists to know the history of their discipline.[1] This article proceeds from the view that a knowledge of how present and past theories were formulated, how and why significant discoveries were made, and why scientists accepted or rejected certain ideas has more than merely pedagogical value. Contemporary theories and debates are almost always the product of innumerable previously held theories, beliefs, and assumptions, all of which were shaped by ever-changing social and intellectual conditions and a steady stream of new discoveries, all of which had to be interpreted by the means available at the time. Modern paleoanthropology is a complex amalgam of all these factors. Hence, it is only through a more complete investigation of their interactions that we will be able to understand how modern research on human origins has emerged as a scientific discipline.

This article cannot present a detailed history of paleoanthropology, nor is that its intent. Rather, it seeks to trace the broad steps by which speculations about, and the study of human origins became a scientific endeavor. It will be necessary to take a long chronological view of this process because some of its most critical conceptual and methodological developments occurred very early. While it may be argued that the modern science of paleoanthropology has its origin in the nineteenth century, the birth of a rational and naturalistic inquiry into human origins began much earlier. Indeed, the first steps toward a truly scientific inquiry into our origin and earliest history began with the first Greek philosophers. The principles, theories, and debates they established not only form the foundation on which modern paleoanthropology is based, but remain at the core of all contemporary theories and research. If we are to understand modern paleoanthropology as a scientific pursuit and as a body of scientific knowledge, we must begin with the Greeks and see how their innovations were

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Box 1. A Note on Chronological Terms and Periodization

Several terms are used throughout this paper to refer to particular historical periods. Since these terms are not entirely transparent or unproblematic, it may be helpful to specify how they are used. Antiquity refers here to the ancient Greek and Roman civilizations, which one can arbitrarily consider to begin at least from the time of Homer in the ninth century BCE and to extend to the collapse of the Roman Empire and ancient pagan culture. While the latter was a gradual process and cannot be said to have occurred in any particular year, I take as my markers for the end of Antiquity the sacking of Rome in the fifth century CE and the closing of the pagan philosophical schools in 529. The Medieval period, also called the Middle Ages, ensued, encompassing the period of the ascendancy of Christianity in Europe. By a remarkable coincidence, in the same year that the pagan schools were closed (529) the Benedictine monastery of Monte Cassino was founded in Italy. This stands as a symbolic beginning of Christian political and intellectual hegemony. Just as Antiquity does not come to a neat end, the Medieval period does not abruptly end. However, one can argue that in Italy by the fifteenth century, and in other parts of Europe by the middle of the sixteenth century, the Medieval world was coming to a close. The Renaissance (a word that means rebirth), refers here to the rebirth of interest in ancient Greco-Roman art, literature, and culture. This period was well under way by the sixteenth century and continued through until the end of the seventeenth century. Note also that I have chosen to replace the traditional BC (before Christ)/AD (anno domini) system with the more current designations, BCE (before the common era)/CE (common era).

adopted and developed in subsequent centuries.

There are also certain inherent dangers that an article of this nature may encounter. By tracing the major trends, discoveries, and the contributors to a science over such a long time it is easy to portray the history of science as a continuous linear progression of theories and discoveries. This is, of course, far from the truth. The history of human-origins research is full of false starts, erroneous theories, and complex interactions of competing theories and individuals, all of which played important roles in the history of paleoanthropology. While it is impracticable to discuss these details in an article of this scope, it is important to recognize that there is hidden complexity in the history presented. It is through the scholarly literature cited herein that the reader will be led to works that provide more complete analysis and more nuanced and sophisticated investigation of specific periods or problems in the history of research on human origins.

ANCIENT SCIENCE AND THE FIRST THEORIES OF HUMAN ORIGINS

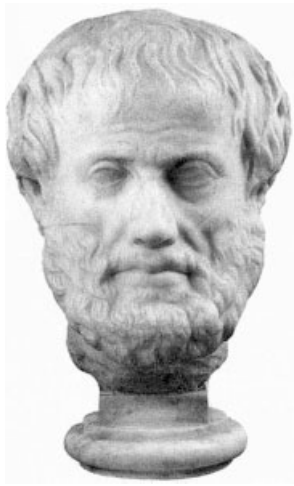
Science, the application of human reason to achieve an understanding of nature, began with the ancient Greeks. For this reason alone, modern scientists investigating human origins are deeply indebted to those early philosophers. But the debt goes far deeper than that because many of modern paleoanthropology's core assumptions about the origin and nature of human beings were first proposed by ancient Greek philosophers. Their ideas about human origins are not merely historical curiosities, remote precursors unconnected to modern ideas. They form the foundation for a scientific quest to explain, rationally and naturalistically, the origin and cultural development of the first humans. Those speculations established the framework for most subsequent inquiry into human prehistory in an unbroken intellectual tradition extending from antiquity to the present. Our task is to describe these first tentative theories about human origins and to explore how they were expanded upon and altered over the course of succeeding centuries, adapting to new discoveries and philosophical attitudes, until we reach their latest manifestation in modern paleoanthropology and its related disciplines.

A scientific investigation of human origins is possible only if one accepts several basic propositions that were first expressed by Greek natural philosophers (Box 2) in the sixth century BCE. Among these was the idea of a nature governed by natural laws that could be discovered through inquiry and rational thought. More directly related to our present subject was the proposition that humans are part of nature and subject to natural laws, which meant that humans could be studied scientifically. Intimately bound to these propositions was the conviction that natural phenomena should be explained through natural causes and natural agents, and that supernatural causes should be removed from scientific explanations of nature.[2] This nexus of beliefs formed the foundation of Greek science and the basis for a scientific investigation into human origins.

Following these general principles, early Greek philosophers attempted to discover the means by which the first humans had come into existence and what those early humans had been like. They began from the crucial assumption, still retained in contemporary studies of human origins, that human beings had an origin in time. Although there were those, such as Aristotle and his followers, who suggested that the world and the human race were eternal, so that there was no question of human origins, the vast majority of scientists since antiquity have subscribed to the former view. Equally critical was their conviction that the first humans had arisen through natural, not supernatural, means. Only through the belief in a

Box 2. Greek Natural Philosophers

The Greek natural philosophers were a group of thinkers who specifically applied the principles of Greek philosophy, with its emphasis on rationalism and naturalism, to the study of nature. Thales of Miletos (ca. 640–ca. 547 BCE), Anaximander of Miletos (ca. 610–ca. 546 BCE), and Parmenides of Elea (ca. 510–? BCE) discussed the nature of matter and change. Empedocles of Akragas (flourished 450 BCE) proposed the idea of the four elements (earth, water, air, and fire), while Democritus of Abdera (ca. 460–ca. 370 BCE) was among the first to formulate an atomic theory of matter. Plato (429–347 BCE) and Aristotle (384–322 BCE) were instrumental in formalizing and expanding on the work of their predecessors, laying the foundation for later research (Fig. 1). Historians of science consider these thinkers to be the founders of the idea and practice of science.



Sculpture of Aristotle.

natural origin, combined with the belief that scientific reasoning could discover the laws of nature, was there any hope of attaining a scientific explanation of human origins. It is from this simple set of principles that Greek natural philosophers set out to scientifically explore human prehistory.

The first problem was how to explain the physical origin of the first humans. Greek natural philosophers understood that this question was directly related to the problem of cosmogony (theories of the origin of the cosmos). The ordered structure of the world and the coming into being of the stars, the earth, and the first living things were all thought to be the result of a systematic natural process. The same natural principles that explained the formation of the earth and the generation of the first plants and animals were also thought to be responsible for the generation of the first humans. Spontaneous generation was the mechanism invoked to explain how the first living things, including human beings, originated. Anaximander (ca. 610–ca. 546 BCE) was among the first to suggest, in the sixth century BCE, that under the right conditions moist earth could spontaneously produce living organisms.[3] Empedokles (flourished 450 BCE) and Anaxagoras (ca. 500–428 BCE) each offered somewhat modified versions of this idea. Aristotle (384–322 BCE),[4] later expanded the concept of spontaneous generation into a fully developed theory, but the notion that the first animals and humans had been produced by some type of spontaneous generation remained the basis for subsequent scientific accounts of human origins in antiquity.

The idea that humans and animals had originated through the same natural process had implications for the nature of the first humans. According to Archelaus, a student of Anaxagoras in Athens in the fifth century BCE, early humans lived in the same manner as animals and were, essentially, bestial.[5] Democritus (ca. 460–ca. 370 BCE) described even more clearly his vision of brutish early humans living their lives in solitude without any of the accoutrements of civilization. Indeed, beginning with Archelaus and Democritus, a conception of human prehistory began to emerge in which early bestial humans were seen as gradually differentiating themselves from the other animals and slowly beginning to acquire the knowledge and skills that would eventually lead to civilization. By the end of the first century BCE, successive generations of Greek and then Roman philosophers had expanded on this foundation to produce a detailed image of human prehistory.[6]

The historian Diodorus Siculus (first century BCE)[7] and the Epicurean philosopher Lucretius (97–54 BCE)[8] both relate a history in which the first animals and humans were generated spontaneously from the soil. These early humans were savage and brutish, eating wild fruits and nuts and seeking shelter in caves. Significantly, they possessed no language and no technology, and lived solitary lives. Confronting a harsh environment and wild animals, these early humans eventually learned to make weapons from stone, to build crude shelters, and to harness the power of fire. Out of necessity and for mutual defense against dangerous animals, individuals eventually began to gather into groups and the first societies arose. Through trial and error, language was invented and then the other arts, such as metallurgy and agriculture. The final culmination of this progressive cultural development for most Greco-Roman philosophers was the founding of cities and the formulation of laws.

It is important to recognize that Diodorus and Lucretius are only two authors among many who discussed human prehistory and that the preceding account is merely a general summary. Many writers discussed the problem of human origins and one must analyze all those opinions in all their detail and within the context of each author's philosophical system.

But when one studies the broad array of texts from antiquity that discuss human prehistory, some general patterns are discernible. A great many philosophers and intellectuals in the classical world had come, by the beginning of the Christian era, to accept that humans had a natural origin and that the first humans, though bestial and lacking culture or technology, possessed some characteristic that led them to successive acquisition of the cultural and technical skills that gradually produced civilization.

Inherent in all these philosophical accounts of human prehistory is the idea of progress. Beginning from humanity's initial bestial condition, Greco-Roman philosophers reasoned that the use of fire, the development of language, and the invention of practices such as metallurgy and agriculture must have occurred in successive stages and in a very particular order. Also inherent in all their schemes is the assumption that this period of human "prehistory" was very long and progress was slow. But this conception of human origins, built on the foundation of Greek natural philosophy, would be dramatically challenged as the political structure of the Roman empire began to collapse in the early centuries of the Christian era. The destruction of the Roman educational system and the social upheaval produced by barbarian invasion and political chaos, combined with the increasing dominance of Christianity, prepared the way for a radical reconceptualization of the origin and early history of humans.

BIBLICAL ANTHROPOLOGY AND THE IMPACT OF CHRISTIANITY IN THE MIDDLE AGES

The collapse of the Roman empire during the fifth century and the rise of Christianity in the Mediterranean had a profound impact on the history of European philosophy and science. As Roman educational institutions crumbled in the face of social upheaval, the study of philosophy waned. At the same time, Christian polemicists were attacking pagan knowledge and beginning to formulate an entirely new view of the world based on their reading of the Bible. Early Christian theologians were suspicious of Greco-Roman natural philosophy. Many rejected it entirely, preferring instead to take the account of creation provided in Genesis and other stories contained in the scriptures to be the only true source of knowledge about the world. But there were others who had been trained in philosophy who wanted to retain a limited role for Greco-Roman natural history within the context of Christianity.[9] Thus, in the early centuries of the Christian era a process of negotiation took place among the early Christian theologians that redefined the role of science in European culture while elevating the Bible as the preeminent source of truth.

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This had a deep and enduring impact on the study of human origins. With the ascendance of Christianity, the Greco-Roman conception of a natural origin of humans and a lengthy period of savage prehistory was repudiated and replaced by a very different view of human origins. Indeed, the very idea that one could rationally reconstruct human prehistory was called into question, as were the assumptions about human nature that had been the basis of the Greeks' speculations. Medieval Christian philosophers (Box 4) found a complete account of human origins clearly stated in Genesis. It was this account that formed the foundation for essentially all medieval and Renaissance discussions of the subject. Genesis provided a competing and considerably more agreeable picture of early human history (Box 3). And yet, even though they possessed what was believed to be a divinely revealed account of human origins, there were some medieval philosophers who asked questions and entertained ideas that could only be explored through the application of pagan philosophy. Thus, Greco-Roman ideas about human prehistory periodically reappear in medieval discussions of the first humans.

When one surveys the medieval historical and philosophical texts that discuss the origin and early history of human beings, the dramatic break with the Greek philosophical tradition becomes apparent. Early Christian philosophers began by rejecting the natural origin of humans, asserting that the first man had been created directly by God. In the third century Lactantius (ca. 240–ca. 320) wrote a lengthy critique of spontaneous generation and of the philosophies that supported this idea.[10] Augustine (354–430) provided reasoned arguments to explain why the scriptural account of human origins was superior to those found in pagan philosophies.[11] The belief that God had created the first man and woman and that all humans had descended from this first pair led almost all medieval thinkers to be monogenists. Thus, although there were many different races, it was clear that they all had a common ancestry and that humans constitute a single species.[12] The mechanism most commonly invoked to explain the origin of the human races was the dispersion of the descendants of Noah after the catastrophe of the Deluge. As different popu-

lations migrated to diverse regions of the globe, differences in climate and environmental conditions caused these peoples to change physically and culturally.

The "biblical anthropology" constructed during the Middle Ages differed from Greco-Roman conceptions of human prehistory in other critical ways. Most medieval philosophers argued that the first human had been created with an innate knowledge of language, a rational mind, and capacities that set mankind above the animals.[13] Even the diversity of human languages was considered to be the product of divine intervention, through the Tower of Babel incident, although writers from Augustine[14] in the fifth century to Dante (1265–1321)[15] acknowledged that more recent languages had probably been formed through more "natural" means. Augustine and Lactantius were also adamant that humans had never lived as isolated creatures and that society was innate to human nature. Thus, humans had never been driven by necessity to form societies.[16] But it was only after the Fall that humans had been forced to domesticate animals, practice agriculture, and invent the various technologies that gave rise to civilization. Although Genesis appeared to offer a reliable but vague account of the cultural and historical development of the earliest people, that did not mean that Greek ideas about human origins completely disappeared during the Middle Ages. One can occasionally find authors such as the poet Prudentius (d. 410) and the historian Eusebius of Caesarea (c.260–c. 340), who discuss the possibility that early humans were savage and without culture of any kind, only gradually becoming civilized.[17] But such descriptions are rare. The "biblical anthropology" that took shape in the early Christian era dominated discussions of human origins until the seventeenth century.

In almost all of its details, the conception of early humanity that prevailed during the Christian Middle Ages was opposed to the pagan philosophical depiction of savage primordial humans slowly advancing through trial and error toward civilization. But there was another feature of medieval thought that powerfully influenced European thought on human origins until the nineteenth century. The biblical account of human origins and early human history is antithetical to the very idea of prehistory simply because the Old Testament was thought to provide a complete history of humanity from the very beginning of the world to the historic period. Unlike the Greek natural philosophers, medieval philosophers did not believe there was a long period during which the first humans strove to acquire the accoutrements of civilization and for which we have no records, which meant that this period could be reconstructed only through philosophical speculation. Medieval philosophers were confident that they had a complete and reliable record of humanity's earliest history and cultural development.

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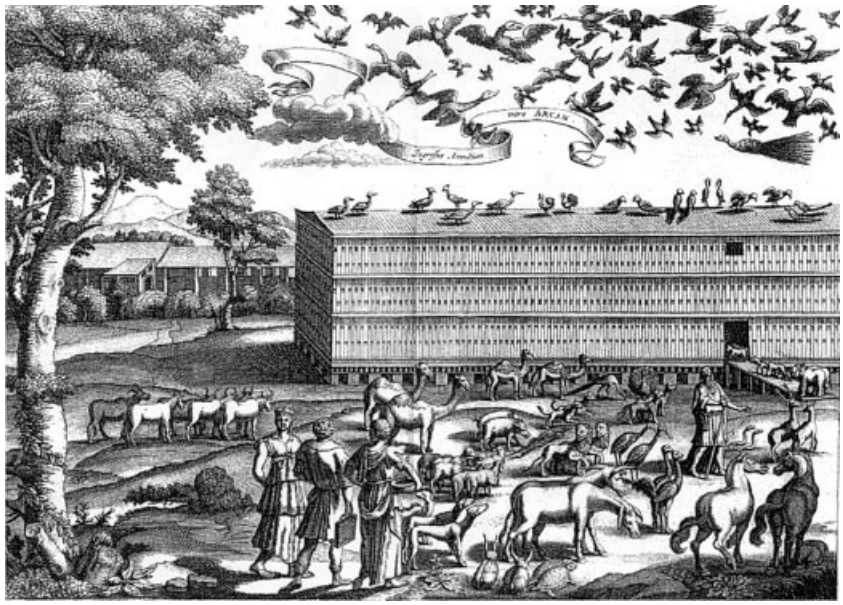
Moreover, it was almost universally agreed that the history of the world, as well as human history, was a short six thousand years.[18] According to Genesis, everything from the origin of the first people to the domestication of animals, the invention of agriculture and metallurgy, and the founding of the first city all took place within this relatively short period. Medieval philosophers rejected the long chronologies and murky ages of primordial human progress assumed by the Greeks. They were convinced that one could construct a universal history that would accommodate the histories of all peoples in the world into the overarching historical scheme presented in the Bible.[19,20]

Beginning in the twelfth century, a resurgence of interest in Greek philosophy and science occurred after the Christian reconquest of Muslim Spain (which began with the capture of Toledo in 1080). This led to the translation of many Arabic scientific texts into Latin. As science had declined in Europe after the collapse of the Roman empire, it thrived in the new Muslim empire that extended from Arabia across North Africa to Spain. The influx of philosophical ideas that resulted from the translation of this Arabic-Greek scientific literature, combined with the establishment of the first medieval European universities, prompted a flurry of scientific activity as medieval scholars such as Thomas Aquinas (1225–74), Boethius of Dacia, Siger de Brabant (ca. 1230–ca. 1283), and Robert Grosseteste (1175–1253) attempted to reconcile this new philosophical material with Christianity.[21] Once again we find philosophical speculation about the origin of the world, spontaneous generation, and the relationship between human beings and the natural world. Radical digressions from the orthodox Christian view of the world were rare, but scientific inquiry, including philosophical speculation into humanity's place in nature and how the natural world came into being, began to challenge accepted ideas and to offer philosophical alternatives. This process only accelerated as European culture moved out of the Middle Ages and into the Renaissance.

Box 3. Genesis Account of Creation

Judeo-Christian conceptions of human origins are rooted in the biblical account of creation. According to Genesis, God first creates the world, then plants and animals. Adam and Eve are created last, only after the earth has been prepared for them. In Eden they live off the fruits of the earth, but after the expulsion from Eden they must find ways to survive in a harsh world. The domestication of animals and agriculture are developed quickly (Abel is a shepherd and Cain tills the soil). Nor does it take long for Cain to build the first city. Metallurgy is invented several generations later, by Tubal-Cain. But it is significant that most of the major steps toward civilization are made within just a few generations after the creation of the first pair of humans. When the Deluge is sent to destroy all humanity, with the exception of Noah and his family, an important historical and anthropological consequence is that Noah's three sons (Japhet, Shem, Ham) must repopulate the world (Fig. 1). Their descendants migrate throughout the globe and are linked by a common language until the Tower of Babel incident when God, through a supernatural act, creates a plurality of languages.



Noah's ark. From Athanasius Kircher, Arcane (1675).

TOWARD A SCIENCE OF HUMAN ORIGINS: THE RENAISSANCE AND THE SCIENTIFIC REVOLUTION

The study of human origins underwent a remarkable transformation in the sixteenth and seventeenth centuries, due in large part to intellectual developments arising out of Renaissance scholarship and the Scientific Revolution (Box 5). It is useful to note that neither of these movements was a homogeneous or clearly delineated entity. Nevertheless, it is possible to identify broad intellectual trends that can be conveniently grouped under the rubric of these historical categories.[22] Renaissance scholars dramatically changed the problem of human origins through their avid quest to recover the lost philosophical works, as well as artistic and literary works of the ancient Greeks and Romans. The Greek scientific theories of human prehistory that had been discarded by early Christian philosophers and that had mostly been lost and ignored throughout the Middle Ages once again became available. As new editions of Greco-Roman scientific texts were published and translated, the notion of primordial bestial humans slowly rising to civilization now directly confronted the view of early human history that had been constructed during the Middle Ages. In the more secular culture prevalent among Renaissance intellectuals, these ancient philosophical speculations about human origins spurred new inquiries and a willingness to in-

Box 4. Medieval Christian Philosophers

With the rise of Christianity in the Roman Empire and the conversion of educated pagans to the new religion, a new group of philosophers emerged, trained in Greco-Roman philosophy but also imbued with the teachings of the Old and New Testaments. These Christian philosophers helped to shape early Christian theology, but they also developed a distinctly Christian form of philosophy that blended ideas from Greco-Roman philosophy and Christian theology. Basil of Caesarea (329/330–379) wrote an important treatise on the biblical account of the six days of creation; Augustine (354–430), bishop of Hippo, in Egypt, introduced ideas from Plato and Neoplatonism into Christianity; Lactantius (ca. 240–ca. 320) was a professor of rhetoric in Nicomedia; Thomas Aquinas (1225–74) was a Dominican friar who strove to reconcile the philosophy of Aristotle with Christian theology.

Box 5. The Renaissance and Scientific Revolution

In Renaissance painting and sculpture, Italians such as Ghiberti (1378?–1455), Botticelli (1445–1510), and Michelangelo (1475–1564) drew inspiration from ancient works of art, just as Petrarch (1304–74) did in literature. Scholars such as Poggio Bracciolini (1380–1459) also scoured Italian monastic libraries searching for manuscripts of ancient Greek and Roman philosophical texts that had been preserved but ignored during the Middle Ages. Byzantine scholars fleeing from Constantinople (modern Istanbul) to Italy in the fifteenth century (as a result of the Turkish invasion) brought numerous ancient Greek texts that had not been preserved in Europe. The combination of these events with other developments in Europe helped to produce a dramatic period of productivity in science called the Scientific Revolution. Nicolaus Copernicus (1473–1543), Johannes Kepler (1571–1630), and Galileo (1564–1642) transformed astronomy; Andreas Vesalius (1514–64) revived the study of anatomy; and interest in botany, zoology, and geology was renewed by Otto Brunfels (1488/9–1534) and Konrad Gesner (1516–65). One can reasonably argue that the Scientific Revolution reached its culmination with the new physics of Isaac Newton (1642–1727).

vestigate the subject from a nontheological perspective.

The recovery of Greek scientific texts in the fifteenth and sixteenth centuries also played an important role in promoting renewed interest in the study of nature, which led to the many remarkable discoveries and theories that constitute the Scientific Revolution. There will be much more to say about this later. But Renaissance scholarship did make one other important contribution to the study of human prehistory. Along with an interest in ancient texts, Renaissance scholars were also interested in the monuments and antiquities of the ancient world. Beginning in Italy, scholars began to study the material remains of classical Rome and Greece in an attempt to extend their knowledge of those civilizations beyond what written texts could tell them.[23] A similar interest in Roman ruins arose in northern Europe, but in those areas researchers such as William Camden and Ole Worm also encountered crude stone monuments such as Stonehenge (Fig. 1), which seemed to offer insight into the aboriginal inhabitants of those regions. What emerged was a systematic study of megalithic monuments that had its origins in humanism but gradually became connected to a branch of science called natural history. This marks the beginning of the rise of a science of archeology that sought to know the distant past through the study of artifacts and antiquities.[24,25] The study of prehistoric monuments in the seventeenth century produced discoveries and raised questions about the earliest inhabitants of Europe, slowly undermining widely accepted beliefs about early human history.

The archeological study of prehistory that began in the sixteenth and seventeenth centuries had serious obstacles to overcome. The meaning of artifacts and monuments were not at all clear and the scientific methods required to interpret them were just developing. Moreover, in a world where historical knowledge was entirely constructed from the written records of the past, prehistoric artifacts stood as silent testimonials to an obscure antiquity. Significantly, just as prehistoric monuments were beginning to raise questions about the early inhabitants of Europe, other evidence was being collected that challenged the short biblical chronology of human history. As Europeans came to learn more about the civilizations of the Chinese, Indians, Aztecs, and Incas, they found that these peoples possessed records that purported to extend further into the past than the six thousand years recorded in the Bible. Most scholars rejected the authenticity of such records, but for those individuals who were willing to entertain the idea of a human history far longer than was commonly believed, these claims prompted much interest and discussion.[26]

Throughout the sixteenth and seventeenth centuries, the study of prehistoric monuments, contact with civilizations that claimed to have histories of many thousands of years, and the discovery of the New World inhabited by "savage" peoples of whom the Bible said nothing, all posed problems for the biblical anthropology formulated during the Middle Ages. But a particularly provocative challenge to the generally held view of early human history appeared in 1655 when the French

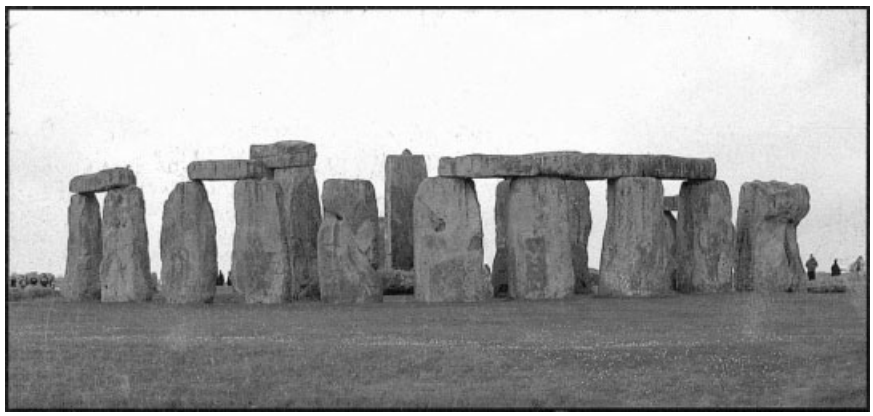


Figure 1. Stonehenge. Photo by John Fleagle.

scholar Isaac de la Peyrère (1594–1676) proposed a radical thesis that tried to make sense of some of these new discoveries while, at the same time, solving an apparent problem in biblical exegesis. In his book entitled *Praeadamitae,* la Peyrère argued that the world had been inhabited for many centuries before the creation of Adam. Whereas Adam had been the father of the Jewish people, these pre-Adamites were the ancestors of all other peoples in the world, including the newly discovered peoples of the New World. This explained how some pagan civilizations could have histories extending back before the Deluge or even before the creation of Adam; it also explained the origin of the "New World savages." For La Peyrère, Adam was the ancestor only of the Jews, and the Bible, rather than being a history of all humankind, was only a history of the Hebrews.[27,28] Needless to say, his thesis provoked considerable outrage, but it marked the beginning of a scholarly and scientific debate over how to interpret the evidence of early human history and whether or not it was possible to explain that evidence within the framework of a literal reading of Genesis. The pre-Adamite thesis suggested that there might be a great deal more human history to investigate than a traditional reading of the Bible indicated.

Challenges to the biblical view of the origin of the world and of the history of life on earth also arose as a result of new geological theories and the study of fossils. Several prominent scientists in the seventeenth century sought to explain the origin of the earth as a natural process governed by natural laws.[29] Theories of the formation of the earth proposed by Thomas Burnet (1635–1715),[30] William Whiston (1667–1752),[31] and G. W. Leibniz (1646–1716) were instrumental in establishing geology as a science, but portrayed the historical development of the planet in terms that could not always be reconciled with the traditional view of the earth as a relatively young and unchanging body. Moreover, the debate over the origin and meaning of fossils,[32] together with the evidence they provided that the earth must be extremely old and that its surface must have undergone significant change over the course of millennia, slowly began to revolutionize scientists' ideas about the formation of geologic strata and the history of life on earth.[33] They also raised serious questions relating to when and how the first humans appeared in the world. Developments in geology and paleontology during the Scientific Revolution were tremendously important for the formation of a scientific understanding of human origins because these sciences provided important evidence of the temporal development of the earth and life on earth. These sciences thus established the historical and physical context within which humans must first have appeared. In addition, these sciences offered a methodology for how one might scientifically investigate human origins. But it must be emphasized that no one had yet imagined that fossil human remains could exist. Although the biblical account of creation was sometimes directly challenged by new discoveries and theories, the scientists of this time were still a long way from a vision of primitive humans inhabiting the world for millions of years.

. . . a particularly provocative challenge to the generally held view of early human history appeared in 1655 when the French scholar Isaac de la Peyrère (1594–1676) proposed a radical thesis that tried to make sense of some of these new discoveries while, at the same time, solving an apparent problem in biblical exegesis. In his book entitled *Praeadamitae,* la Peyrère argued that the world had been inhabited for many centuries before the creation of Adam.

Other discoveries made during the Renaissance were even more directly relevant to the question of human origins. The discovery of the New World and the hitherto unknown peoples living there came as a surprise to Europeans. The uncivilized and crude state of their existence, their lack of many basic technologies, and the fact that some groups possessed only implements made from stone or wood posed puzzling questions for Europeans, whose knowledge of early human history was based on the Bible and the historical records of the Greeks and Romans.[34] As we have already seen, the problem of how to explain the origin of New World peoples was one of the factors that led to the pre-Adamite thesis. But for those looking for ways to link the savages of the New World to the orthodox view that all humans must be descended from Noah, there still remained the problem of explaining the "brutish" life and crude technology of these peoples. Moreover, for those familiar with the ancient Greek theories of early brutish humans slowly rising toward civilization, the savages of the New World appeared to exemplify an intermediate stage of just such a progressive development of human culture.

While ethnographic information about the New World flowed into Europe, prompting much scholarly debate about what its implications were for the traditional view of human history, there was also an extremely important influx of cultural artifacts that found their way into museum collections all across Europe.[35,36] Household implements, clothing, religious idols, and weapons obtained from peoples in Peru, Mexico, the Caribbean, and North America were sent to European collectors. For many, these were curiosities; for others, they were important sources of information about the cultures of the New World. The arrows tipped with flint points, axes made from chipped stone, and other stone implements were of particular interest because the apparent lack of knowledge of metallurgy among some cultures was difficult to explain.

But a much more significant discovery was made by Michele Mercati (1541–93) late in the sixteenth century.

Mercati, an Italian naturalist who served as the curator of the Vatican botanical garden and its natural history collection, became curious about the origin of stone objects called ceraunia, which had long been collected by geologists and antiquaries in Europe. Ceraunia were thought to be produced when lightning struck the ground and were often considered to be just another type of fossil (although the organic nature of fossils was not yet recognized). Mercati, however, made the startling suggestion that ceraunia were stone weapons manufactured by early Europeans before they discovered how to produce metal implements.[37] This meant that the ceraunia in geological collections all over Europe were actually archeological artifacts from a remote period in European history. Moreover, the presence of stone arrowheads and axe-heads in Europe meant that at some time in the past the inhabitants of Europe must have been culturally and technologically similar to the savages of the New World.[38] This was not a palatable prospect, but the way was now open for archeologists to explore the earliest inhabitants of Europe through the study of material remains that could be compared to artifacts used by surviving "savage" peoples. The meaning and use of these material remains could be reconstructed through the use of ethnographic parallels.

The recognition that ceraunia were, in fact, cultural artifacts from Europe's remote past opened the way for the development of prehistoric archeology. But this began only late in the seventeenth century because Mercati's ideas were not published in his lifetime. The English historian William Dugdale (1605–86) briefly noted the discovery of a polished stone axe that he considered to be an implement used by the ancient Britons.[39] Thirty years later, Robert Plot (1640–96), an English naturalist and curator of the Ashmolean Museum at Oxford, argued that ceraunia were stone arrowheads and axes.[40] But it was not until the eighteenth century that the study of prehistoric stone artifacts truly began in earnest. Once it did begin, though, it became one of the most significant elements in the scientific study of human origins. This will be the point of departure for the second part of this article, which will trace the scientific study of human origins from the eighteenth century to the middle of the twentieth century.

The brief history provided here has, of necessity, excluded many important discoveries and ideas. None the less, it has identified crucial early developments, theories, and discoveries that were instrumental in the creation of both a scientific understanding of human origins and a scientific methodology for investigating prehistory. Critical early steps were taken by Greek and Roman philosophers. Attitudes and debates originating in the medieval period had an impact that has persisted until today. But is was the proliferation of new ideas and discoveries during the Scientific Revolution—the investigation of antiquities, the recovery of Greek scientific texts, the development of new geological theories, the discovery of the cultures of the New World, and the identification of prehistoric stone artifacts in Europe—that would all contribute in significant ways to the emergence of a modern science of human origins in the eighteenth, nineteenth, and twentieth centuries. This is the period that will be covered in the concluding portion of this paper.

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