BERKSHIRE *Essentials*

Big HISTORY

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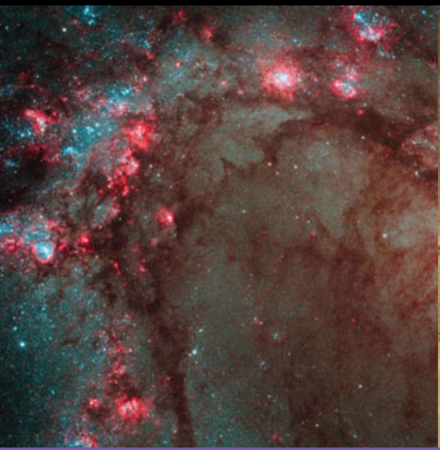

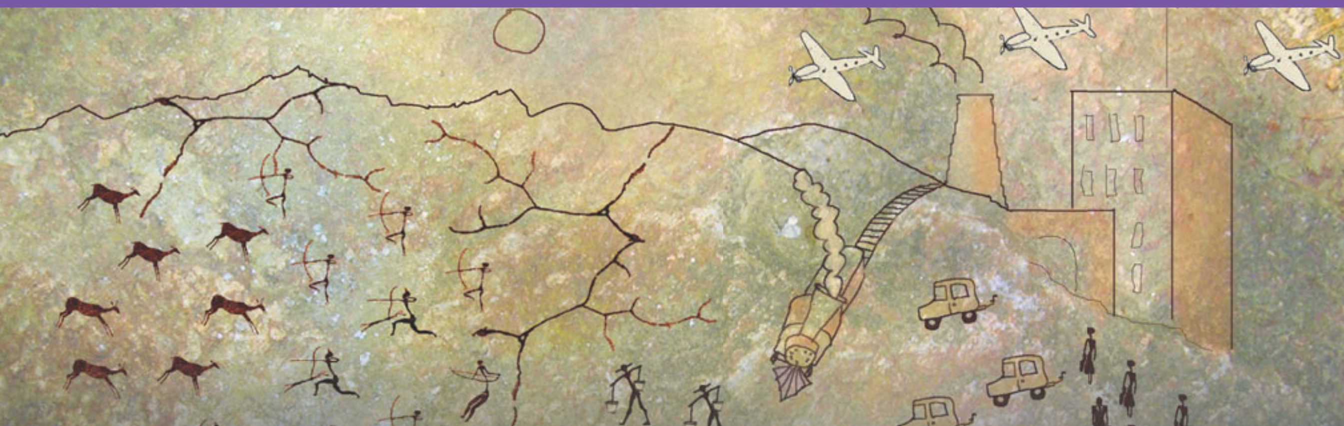

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Editors: William H. McNeill, Jerry H. Bentley, David Christian, Ralph C. Croizier, J. R. McNeill, Heidi Roupp, and Judith P. Zinsser

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David Christian,

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Heidi Roupp, and Judith P. Zinsser

Editors

Brett Bowden

Associate Editor

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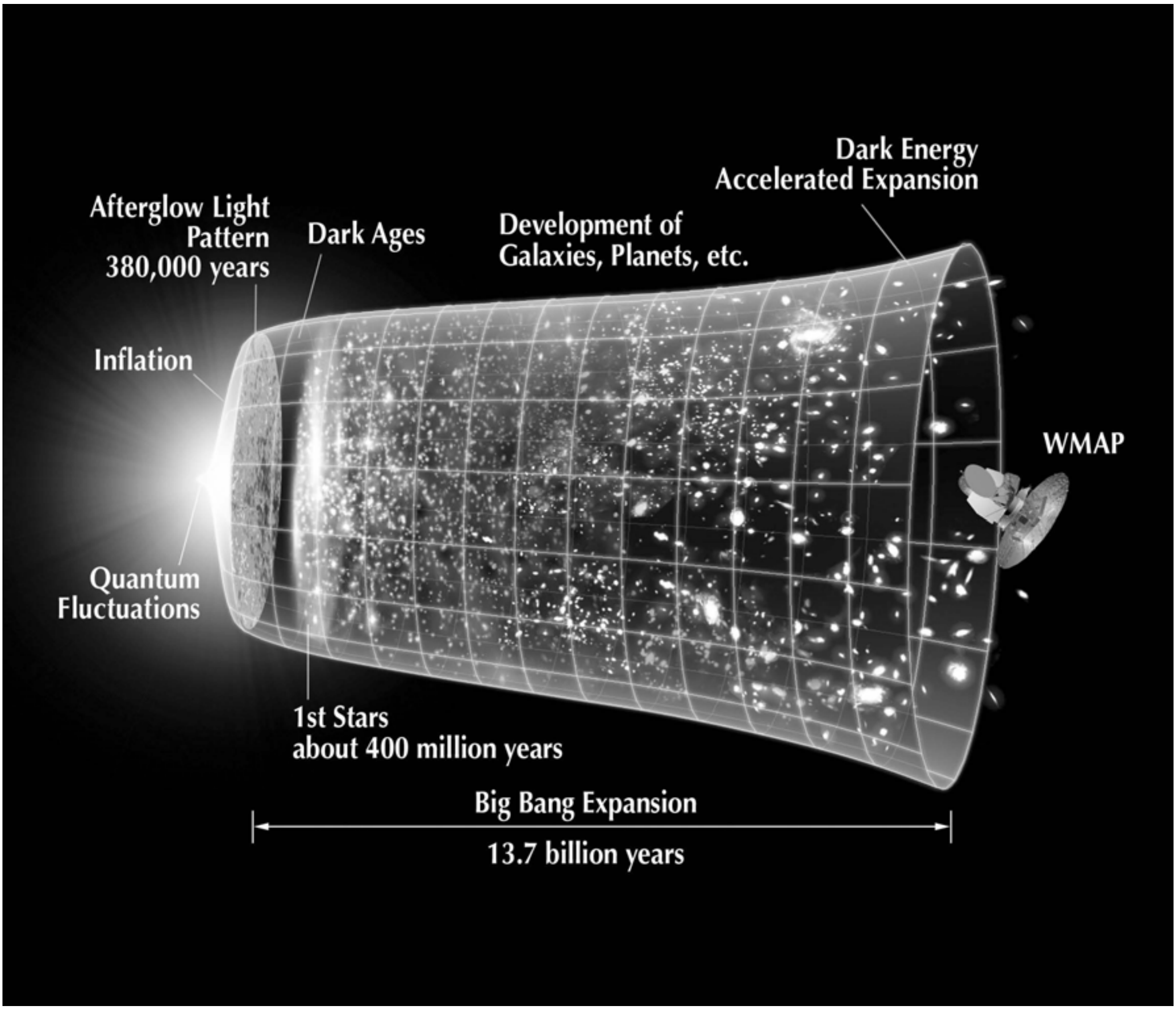

***Time Line of the Universe*—Scientists peering back to the oldest light in the universe have evidence to support the concept of inflation, which poses that the universe expanded many trillion times its size faster than a snap of the fingers at the outset of the big bang. The new finding was made with NASA's Wilkinson Microwave Anisotropy Probe (WMAP) and is based on three years of continuous observations of the cosmic microwave background, the afterglow light from the first moments of the universe.**

The expansion of the universe over most of its history has been relatively gradual. The notion that a rapid period "inflation" preceded the Big Bang expansion was first put forth 25 years ago. The new WMAP observations favor specific inflation scenarios over other long held ideas. Image and caption credit: NASA/WMAP Science Team

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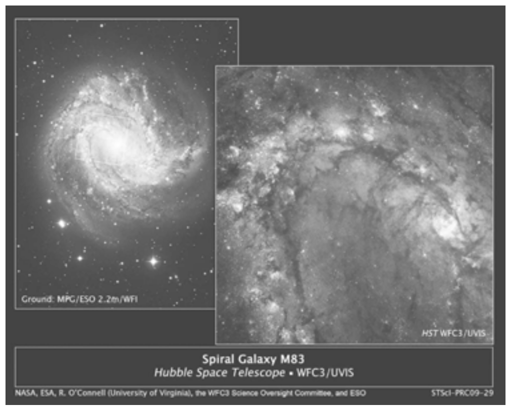
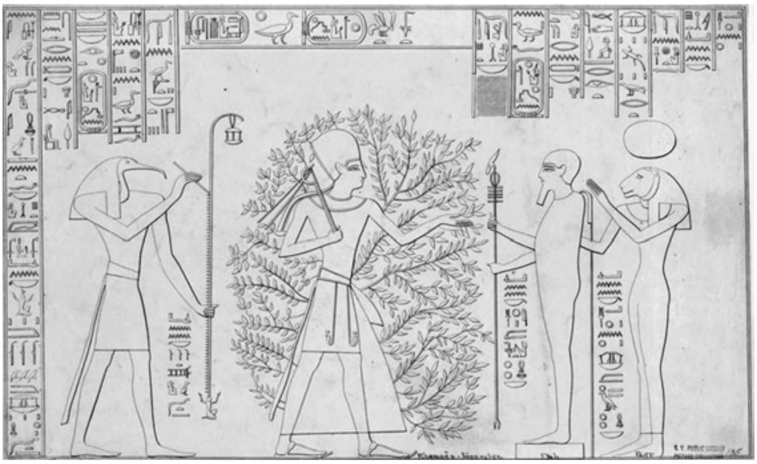
In 1991 the Anglo-American historian David Christian came up with the name "big history" to describe a field of study that places the history of humanity and the Earth in the largest of contexts—that of the universe. The earliest courses using this concept were taught in the United States in the late 1980s and have become increasingly appealing to students and teachers hungry for a more unified vision of the past. (Big history courses can now be found in the Netherlands, Australia, Russia, Egypt, India, and South Korea.) The big history approach is interdisciplinary, as Christian explains in his introduction to the volume, drawing on archaeology, paleoanthropology, astronomy, and biology to raise questions about the future of our species and its relationship with the biosphere.



Spiral Galaxy M83 as photographed by the Hubble Space Telescope. Looking at the formation of other galaxies helps us understand the creation of our own. National Aeronautics and Space Administration.

The selections chosen for this volume convey big history's span and scope, from cosmology, creation myths, and James Lovelock's "Gaia Theory" to ice ages, extinctions, migrations, and "Anthropocene," which tell us why many geologists today believe the world entered a new geological epoch at the beginning of the Industrial Revolution, when human activity unwittingly



***Ramses and the Tree of Life*, a nineteenth-century illustration, depicts an Egyptian mural painted circa 1330 BCE.** New York Public Library.

became the single most important force for change in the biosphere.

Wilfried van Damme's "Art—Paleolithic," another example of big history's interdisciplinary draw, explores how recent archaeological discoveries in Africa have prompted scholars in a growing number of fields to revive their interest in Paleolithic-era art—and thus to open up debate on fundamental world history questions that involve the origins of human art making; the physical, mental, social, and cultural conditions that made it possible; and the fact that creating art has endured and become increasingly integral to our existence. With a unique twist on the usual encyclopedic "fact sheet" and "species identification" approach to dendrology, the British botanist Oliver Rackham presents "Trees," an essay that addresses "human–tree interaction" through the ages—the cultural and spiritual significance of trees, from the sacred groves of ancient Greece to the formal plantings in modern Shinto shrines. He also discusses trees as sources of food or obstacles to agriculture, and trees as a wildlife habitat adversely affected by humans.

The historical record provides evidence that the simple formula "more people = more environmental disruption" doesn't always compute. Thus many scholars today challenge the theory of the British political economist Thomas Malthus (1766–1834), that the unchecked growth of human population would exhaust the world's food supply (see Mark Nathan Cohen's "Carrying Capacity." The article provides valuable context for understanding the issues raised by David Christian's "Population Growth" and J. R. McNeill's "Population and the Environment," two articles that chronicle the complex demographic trends shaped by technological advances, climate change, the spread of disease, and the actions of states.

We at Berkshire appreciate comments and questions from our readers. Please send suggestions for other Essential volumes you'd like to see in this world history–themed series. And do check our website for news about our other Essential volumes on China and environmental sustainability.

Karen Christensen
CEO and Publisher
Great Barrington, Massachusetts

Contents

Introduction: Big History

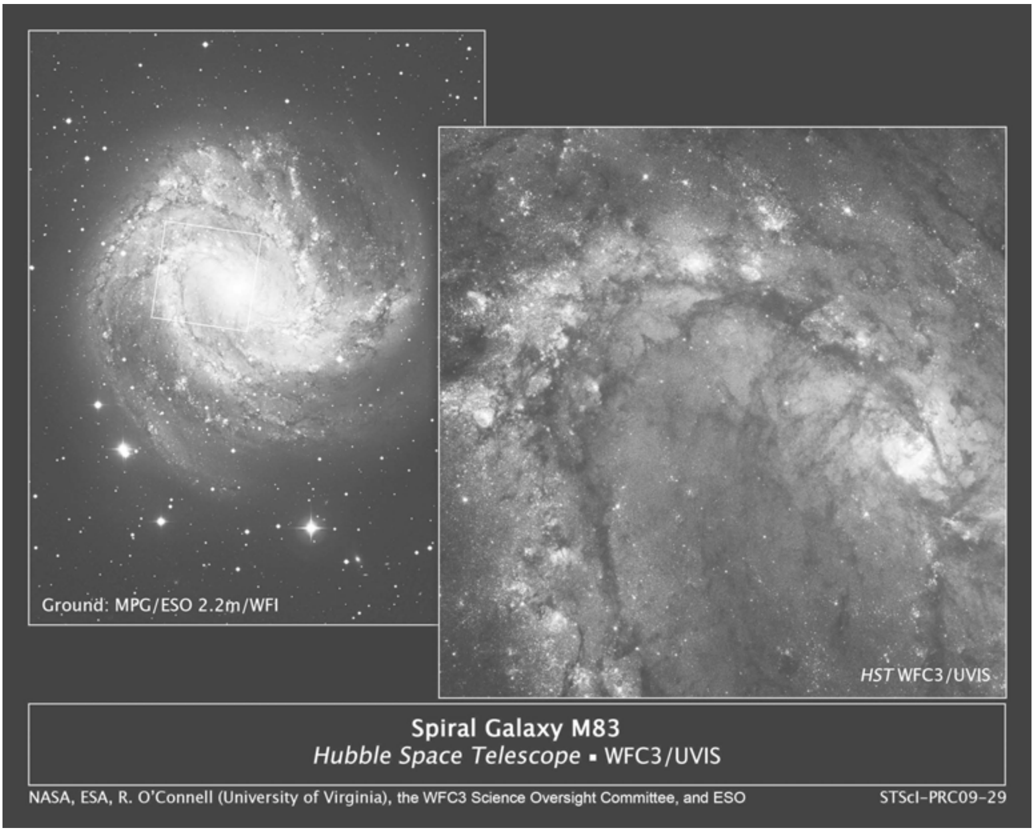
The study of big history places the history of humanity and Earth in the largest possible context, that of the universe. In 1991, David Christian coined the term *big history* in an article he wrote for the *Journal of World History*, although the first courses utilizing the concept of big history were taught in the late 1980s.

Describing the content of a typical course in big history may convey something of big history's scope and scale. Such courses normally begin with the origins of the universe and the first stars and galaxies, surveying some of the central ideas of modern cosmology and astronomy. The creation of new chemical elements in dying stars and supernovae allowed the creation of more chemically complex entities such as planets, and leads naturally to the earth sciences and biology. Big history courses survey the origin and history of our Earth and the origin and evolution of life on Earth—the only planet so far where we know for certain that life exists. The evolution of our own species, *Homo sapiens*, leads naturally to a survey of human history. Within this large story the distinctiveness of human history stands out, for we can see the large patterns that are hidden at the scales of traditional history teaching. We see how our species began to display a unique capacity for sustained adaptation and innovation, which allowed its members to extract more and more resources from the biosphere, to begin supporting larger populations, and eventually to create more complex human communities, which generated new adaptations even more rapidly in a complex but powerful feedback cycle. This accelerating process of adaptation through cultural change is easiest to see during the last 10,000 years since the appearance of agriculture, but it was already apparent in the Paleolithic (foraging) era in the technological innovations that allowed our ancestors to settle all the world's continents apart from Antarctica. Today we can see that our remarkable propensity for sustained and accelerating innovation has its dangers. So courses in big history inevitably raise large questions about the future of our species and its relationship with the biosphere, as well as about the future of our Earth and of the universe as a whole.

In the late 1980s the U.S. astrophysicist Eric Chaisson taught one of the first courses in big history; he was soon followed by David Christian in Australia and John Mears in the United States. (Christian actually coined the term itself in a 1991 article for the *Journal of World History*.) Today such courses are still rare, though their number has increased. Courses in big history can now be found in Russia and the Netherlands as well as in Egypt, Australia, India, and South Korea; analogous courses have also been taught in geology departments (by Walter Alvarez, for example).Their growth has been driven, at least in part, by the thirst of students for a more unified vision of the past and of scholarship in general, and for approaches that help overcome the extreme intellectual fragmentation of modern education and scholarship.

Universal History: An Ancient Tradition

Today, big history may seem anomalous. Yet the questions it pursues are ancient. Most societies we know of have tried to construct coherent and unified accounts of the entire past using the best information available to them, in order to explain the existence and



Spiral Galaxy M83 as photographed by the Hubble Space Telescope. Looking at the formation of other galaxies helps us understand the creation of our own. National Aeronautics and Space Administration.

nature of the universe we inhabit and the communities of which we are members. This is what traditional creation myths did. All literate cultures have also produced analogous accounts of origins at multiple scales. Christian cosmology described a universe approximately 5,000 to 6,000 years old, with the Earth at its center. That story provided the basic framework for historical thinking in the Christian world for 1,500 years, and some still think within the same framework today. Even after the Scientific Revolution had undermined the credibility of Christian cosmology, historical thinkers continued to construct universal maps of space and time, although now they did so within more secular traditions of thought whose basic parameters were provided by Newtonian science. Universal histories were constructed during the Enlightenment and during the nineteenth century. This was the tradition within which both Georg Wilhelm Friedrich Hegel and Karl Marx wrote. Even Leopold von Ranke, who is often thought of as the pioneer of modern traditions of detailed, empirical historical research, insisted that the ultimate goal of historical scholarship should be the creation of universal histories, and in his final years he attempted to write such a history himself.

Yet today this ancient tradition of writing universal history is barely remembered. It vanished, suddenly and decisively, at the end of the nineteenth century. Why it vanished remains unclear. Nationalistic perspectives on the past discouraged the search for commonalities between societies and encouraged geographical and cultural specialization. The growing prestige of the natural sciences raised standards of rigor and precision in all scholarly disciplines and showed how flimsy were the empirical foundations of even the most interesting attempts at universal history. Eventually historians turned away from large, speculative histories toward detailed empirical research, often modeling their scholarship on the techniques of archival research associated with the work of Ranke.

Many historians may have hoped that sustained empirical research would spontaneously generate new, more "scientific" accounts of the past at large scales. After all, something like that seemed to have occurred in biology, where Charles Darwin provided a wonderful model of how sharply focused empirical research might yield grand unifying theories. But in history no grand unifying story emerged, and the very idea of universal history began to seem Utopian. H. G. Wells attempted a universal history in the 1920s, but his work was ignored by professional historians, and probably with good reason. Like the great universal histories of the nineteenth century, Wells's *Outline of History* contained too much speculation and too little hard information, particularly about the deep past. Eventually many historians began to think there was something fundamentally different about history. R. G. Collingwood argued, for example, that history was different from the natural sciences because it dealt with an unpredictable world of conscious actions rather than merely with events. "The events of nature are mere events, not the acts of agents whose thought the scientist [i.e., historian] endeavors to trace" (Collingwood 1994, 214). The historian's goal, therefore, was not to seek general laws, but to "penetrate" the thoughts that motivated past actions. That was why historians seemed to occupy a different epistemological universe from natural scientists.

In the 1960s, Arnold Toynbee, one of the few historians who regretted the passing of universal history, complained in an interview with the writer Ved Mehta (1962, 143) that "the microscope historians

Within fifty years after the 1906–1907 excavations of the Iron Age burial grounds pictured here at Smörkullen (Alvastra, Östergötland, Sweden), radiometric-dating techniques began to revolutionize our understanding of the past.

. . . whether they admitted it or not, had sacrificed all generalizations for patchwork, relative knowledge, and they thought of human experience as incomprehensible chaos." But he also believed the days of microscope history were numbered: "in the perspective of historiography, they were in the minority, and Toynbee, in company with St. Augustine—he felt most akin to him—Polybius, Roger Bacon, and Ibn Khaldun, was in the majority" (Mehta 1962, 143).

Fifty years later, Toynbee's remarks look more prescient, as universal history makes a comeback in the new form of big history. Why are some historians returning to the idea of universal history? The main reason is that we can now study universal history with a rigor and precision that was unthinkable in the nineteenth century. A century of detailed research, not just in history, but also in neighboring disciplines such as archaeology, paleontology, linguistics, and genetics, has revolutionized our understanding of the human past, extending it both in time and space. Meanwhile, the natural sciences look more historical than they did a century ago. Astronomy became a historical science with the rise of big bang cosmology; the theory of plate tectonics re-affirmed the historical nature of the earth sciences; and the discovery of DNA clinched the evolutionary nature of biology. One of the most fundamental changes has been the appearance of new dating techniques that have revolutionized our understanding of the past at all scales. Sixty years ago, absolute dates could be confidently assigned to past events only if there existed written records. So no reliable historical timeline could extend back more than a few millennia, and all earlier periods were lost in a sort of chronological haze. In the 1950s, Willard Libby established the first reliable techniques of radiometric dating, based on the regular radioactive breakdown of carbon-14. As radiometric methods have been improved and applied more widely, and eventually joined by other chronometric techniques, we find ourselves able to construct rigorous timelines that extend back not just to the origins of our species (c. 100,000 years ago) or even of our Earth (c. 4.5 billion years ago) but to the very beginnings of the universe, which we can now date, with remarkable precision, to about 13.7 billion years ago. This dazzling "chronometric revolution" has provided the chronological framework for a new, scientific account of the past at all scales (Christian 2008a and 2009).

Some Themes in Big History

Can there be any thematic coherence in a discipline that spans so many different spatial and chronological scales, and such a diversity of modern scholarly disciplines? It is already apparent that there is a coherent story of origins to be told within big history as it surveys the origins of the universe, the Earth, of life on Earth and of humanity. But unifying themes are also emerging. All the entities that stand out in the story of big history are complex: they are composite entities, formed according to precisely specified patterns, and they display novel "emergent properties." They are also characterized by significant energy flows that sustain their complexity. So it is no accident that complex entities such as the biosphere can be found on the surface of bodies close enough to a star to benefit from the huge energy flows that stars pump into the cold space surrounding them. As the astrophysicist Eric Chaisson has pointed out, the density of these energy flows may allow us, loosely, to order complex entities by their degrees of complexity. Such calculations suggest that living organisms may be significantly more complex than stars or planets, and modern human society may be one of the most complex entities we know of. These considerations suggest that the slow emergence of new forms of complexity can provide a common theme and a common research agenda, encouraging scholars in many different disciplines to explore similar questions about complexity itself, and the different forms it takes within our universe.

The theme of rising complexity also suggests that human history may be peculiarly interesting. If living organisms are distinguished by their remarkable capacity to adapt to changing environments, our own species is distinguished by the fact that it can adapt continuously. While most species (including highly intelligent species such as the great apes), are limited by their genetic endowments, humans can adapt continuously because the remarkable efficiency of human speech allows us to exchange learned information in great volume and with great precision. As a result, learned information can accumulate culturally, and that is why our species alone seems to continually develop new patterns of behavior and new ways of extracting resources from its environment. This remarkable ability, which we can call "collective learning," shapes the evolution of human societies as powerfully as natural selection shapes the evolution of biological species, but it operates much faster. And eventually it explains the increasing size and complexity of human societies. Our ability to learn collectively is the glory of our remarkable species, but also potentially its downfall, for we have acquired such power over our world that we are in danger of laying it to waste.

Observe constantly that all things take place by change, and accustom thyself to consider that the nature of the Universe loves nothing so much as to change the things which are, and to make new things like them. • **Marcus Aurelius (121–180 CE)**

Big History and World History

There is a natural affinity between world history and big history. Big history considers the past at such huge scales that it can attempt, as more conventional types of history cannot, to understand the trajectory of human history as a whole. Because of its willingness to draw on information from multiple disciplines, it is not confined, as traditional "Rankean" forms of scholarship were, to the several millennia since the appearance of writing. It therefore provides a natural framework for the type of world history that will be needed increasingly in a world facing challenges (from the threat of nuclear war to that of ecological collapse) that cannot be tackled nation by nation. Big history provides a natural framework for the construction of a modern history of humanity.

David CHRISTIAN
Macquarie University, Sydney
Ewha Womans University, Seoul

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Agricultural Societies

Agricultural societies, in which the domestication of plants and animals provides a substantial part of human subsistence, are thought to date back as far as 10,000 BCE. Throughout time these systems have changed in intensity as populations increased or declined, and as old technologies gave way to the new.

All societies are pluralistic, encompassing multiple organizational and technological systems. In an agricultural society a substantial part of the means of human subsistence comes from one or more agricultural systems (i.e., systems of domesticated plants and animals that depend upon a specific technology and system of management). Ecologically, the major agricultural systems can be divided broadly into Old World and New World types. Organizationally, they divide into household/peasant, elite, and industrial. A society's agricultural systems interact with its kinship, political, religious, and economic systems, among others.

Within each organizational type in each ecological framework, agricultural systems differ in degree of intensity. Intensity means the total of inputs to and outputs from each unit of land, and can be measured in terms of calories of energy. The most general trend in the development of agricultural systems is an interaction between population and intensification. Within the framework of a system, population builds up and intensification increases until it reaches its internal limits of sustainability. At that point the system either changes to permit still further intensification or it collapses.

Contrasting Ecologies

The difference between Old World and New World agricultural ecologies lies in the different ways they renew soil fertility. In long-fallow systems worldwide, such as swidden agriculture, this is accomplished by natural organic processes of plant growth and decay. By planting a field that has lain fallow the farmer brings the crops to the accumulated fertility. In short-fallow systems, by contrast, fertilizer must be brought to the crops. In Old World systems, this is accomplished with domestic animals, mainly ungulates. By converting parts of the crops the farmer cannot use into materials and foods that he can use, the animals reduce the total cropped area needed while their manure restores fertility. They provide additional organic material by the common practice of grazing beyond the farmed area in the day and returning at night. A variant of this system, important in Africa where the tsetse fly makes it impossible to keep cattle in fixed locations, is a symbiotic relation between mobile herders and sedentary farmers in which farmers allow the herders to graze cattle on their stubble in exchange for the herder keeping the cattle overnight on the farmer's land.

New World agricultural ecologies do not incorporate domesticated animals and hence have no manure cycle. Instead, fertilizing materials are generally brought to the fields by some form of water transport. This is done in two main ways: with water collection and with *chinampa*s, floating beds in lakes and swamps. Water collection mainly involves either waterborne silt from rivers carried in irrigation channels or flow from volcanic ash fields or eroding rocks. Although New World farmers recognized the value of organic methods such as fish buried with the seeds, these generally demand too much labor to use on a large scale.

Lacking all but a few domesticated animals, like llamas and guinea pigs, there were relatively few places in the New World where humans could depend wholly on agriculture, and those were surrounded by large areas where societies continued to be organized for hunting and gathering—sedentary pockets surrounded by mobile raiders. By contrast, agricultural communities of the Old World spread into much more of the total landscape, settled it more densely, and consistently obliterated the hunting and gathering communities that remained in between their settlements. This difference had important consequences for the way their respective organizational systems developed.

Old World

Settled communities cultivating wild plants first appeared in the Old World about 10,000 BCE. Domesticated versions of these same wild plants first appeared in such communities around 7000 BCE, in the "fertile crescent" around the Jordan valley and on the flanks of the nearby Taurus and Zagros mountains; they included emmer and einkorn (ancient varieties of wheat), barley, lentils, chickpeas, pea, bitter vetch, and flax. Domesticated animals appeared shortly thereafter: sheep, goats, humpless cattle, horses, and pigs. The presence of domesticated plants necessarily implies that farmers are planting each new crop from seeds harvested previously. Once this practice is established the crops can be spread into wholly new areas and evolutionary change can occur rapidly.

Agriculture spread by both diffusion of ideas and cultigens from group to group and by the migration of whole groups, with migration apparently the most prominent of the two processes. Domesticated crops reached the Balkans in the seventh millennium BCE, brought by immigrants. Farming villages appeared in southern France by 5000 BCE. Beginning about 5400 BCE agricultural villages of a distinctive culture called Bandkeramik spread from the area of Hungary to the Netherlands. The first agricultural settlements in South Asia appeared in the beginning of the seventh millennium BCE in what is now southern Afghanistan, with a Middle Eastern mixture of crops and animals. However, roughly contemporary agricultural

"Irrigating Apple Orchard, Hagerman, New Mexico." Techniques, as well as crops, formed the basis for an agricultural exchange between the Old and New Worlds. New York Public Library.

