

Worshipping Chronos

“Dating History: The Renaissance and the Reformation of Chronology” by Anthony Grafton, in *Daedalus* (Spring 2003), 136 Irving St., Cambridge, Mass. 02138.

“We look up the dates of events in biblical and classical history,” observes Grafton, a professor of history at Princeton University, “and rarely worry how this knowledge was obtained.” But chronology—the study of *when* events occurred in historical time—was once “a cutting-edge interdisciplinary field of study. In Europe’s great age of unrestrained, exuberant learning, it attracted the most learned writers of them all.”

Working through ancient texts in Hebrew, Greek, and Egyptian, scholars toiled during the Renaissance to define the order of events from Earth’s creation to their own time. Printed chronologies enjoyed enormous popularity. Denys Petau’s *On the Reckoning of Time* (1627), for instance, went through dozens of editions. But just as the discoveries of explorers in the New World were forcing cartographers to redraw ancient maps, chronologers began finding that texts of the classical world held secrets that threatened to unravel the standard notions of historical time.

All civilizations have attempted what Voltaire once dismissed as “the sterile science of facts and dates,” but the results have only been as sound as the sources. Most useful are records that link descriptions of events to astronomical observations—the passage of comets, for instance, or the phases of the moon. The sophisticated calendars of the Aztecs im-

pressed even their Spanish conquerors. In Europe, Renaissance chronologers faced a particular challenge. Not only had many ancient records been destroyed—as was the case in the city of Rome—but scholars also were forced to accept biblical notions of time as sacred and true. There was one big problem: The Greek and Hebrew Bibles did not agree on chronology. Working backward from the birth of Christ, and forward from the moment of the Creation—as European chronologers did from the 13th century onward—the Hebrew text suggested that the Creation occurred in 5200 B.C., the Greek, around 4000. (English archbishop James Ussher famously arrived at the precise date of 4004 B.C.)

Into this perplexing mess stepped a remarkable scholar, a Huguenot named



Renaissance chronologers pored over ancient texts to affix absolute dates to events, seeking to order history back to the moment of Creation.

Joseph Justus Scaliger (1540–1609). Working what Grafton describes as “bibliographical and philological miracles,” this “most arrogant as well as the most learned of men” relied on his knowledge of ancient languages and astronomy to fix dates from the fall of Troy to the fall of Constantinople. He was the first to establish a “coherent, solid structure” of historical time, “basically the one that scholars still use.”

Scaliger’s greatest achievement may have been to reveal the painstaking discoveries of a third-century chronologer, Eusebius of Caesarea (in present-day Israel), compiled in two volumes. The first, Grafton reports, contained “a vast amount of information, some of it quite worrying to a Christian reader,” including chronologies of ancient Egypt and Babylon. The second contained “something that seems to have been new: a comparative table of world history from the birth of Abraham onward”—showing no

dates, but correlating events in the history of the world’s great empires. St. Jerome had translated Eusebius’s second book into Latin in the fourth century (ignoring the troubling first book). But until Scaliger came across the two volumes in 1602, no one seems to have wondered why Abraham’s birth coincided with the 17th Egyptian dynasty. As Scaliger realized, tracing backward from this coincidence led to the inescapable conclusion that the kingdom of Egypt had existed before Creation.

Scaliger’s revelations touched off debates that lasted for hundreds of years. Dissenters used the evidence to discredit the Bible, while other scholars got so bogged down in arguing about niggling details of Egyptian and Chinese chronology that Voltaire and the other philosophes centuries later came to see *chronology* as a “synonym for sterile pedantry.” Time had finally passed chronology by.

SCIENCE, TECHNOLOGY & ENVIRONMENT

Hydrogen Hype

“Rethinking Hydrogen Cars” by David W. Keith and Alexander E. Farrell, in *Science* (July 18, 2003), American Assn. for the Advancement of Science, 1200 New York Ave., N.W., Washington, D.C. 20005.

Are hydrogen cars the next new thing? Hydrogen fuels, advocates say, could reduce air pollution, ward off global warming, and reduce dependence on foreign oil. President George W. Bush has proposed a \$1.7 billion, five-year plan to develop hydrogen-fueled vehicles and supporting infrastructure. But Keith, a professor of engineering and public policy at Carnegie Mellon University, and Farrell, a professor of energy and resources at the University of California, Berkeley, say that, at this point, it’s just so much gas.

“If hydrogen cars are ever to match the performance of current vehicles at a reasonable cost—particularly fueling convenience, range, and size—technological breakthroughs in hydrogen storage and energy conversion will be required,” the authors say. Costs will be very high. Just setting up a new hydrogen-fuel distribution system would cost more than \$5,000 per vehicle initially.

Hydrogen can be burned cleanly or used in fuel cells, thus virtually eliminating vehicular air pollution, Keith and Farrell acknowledge. But the improvement would come at a relatively high cost because “regulation-driven technological innovation” has already reduced emissions from gasoline-powered cars to low levels. It will cost less than \$16,000 per metric ton to reduce nitrogen oxide emissions to meet the latest Environmental Protection Agency standards for gasoline vehicles. More gains can be had at relatively low cost. But the additional reductions achieved by hydrogen would cost roughly \$1 million per metric ton.

And while hydrogen cars emit no carbon dioxide at the point of use, the production of hydrogen is likely to release that greenhouse gas. Why? Because it is much cheaper to make hydrogen from coal or natural gas than from non-fossil fuel sources. If reducing carbon dioxide emissions is the goal, the authors say, it would be far more cost effective