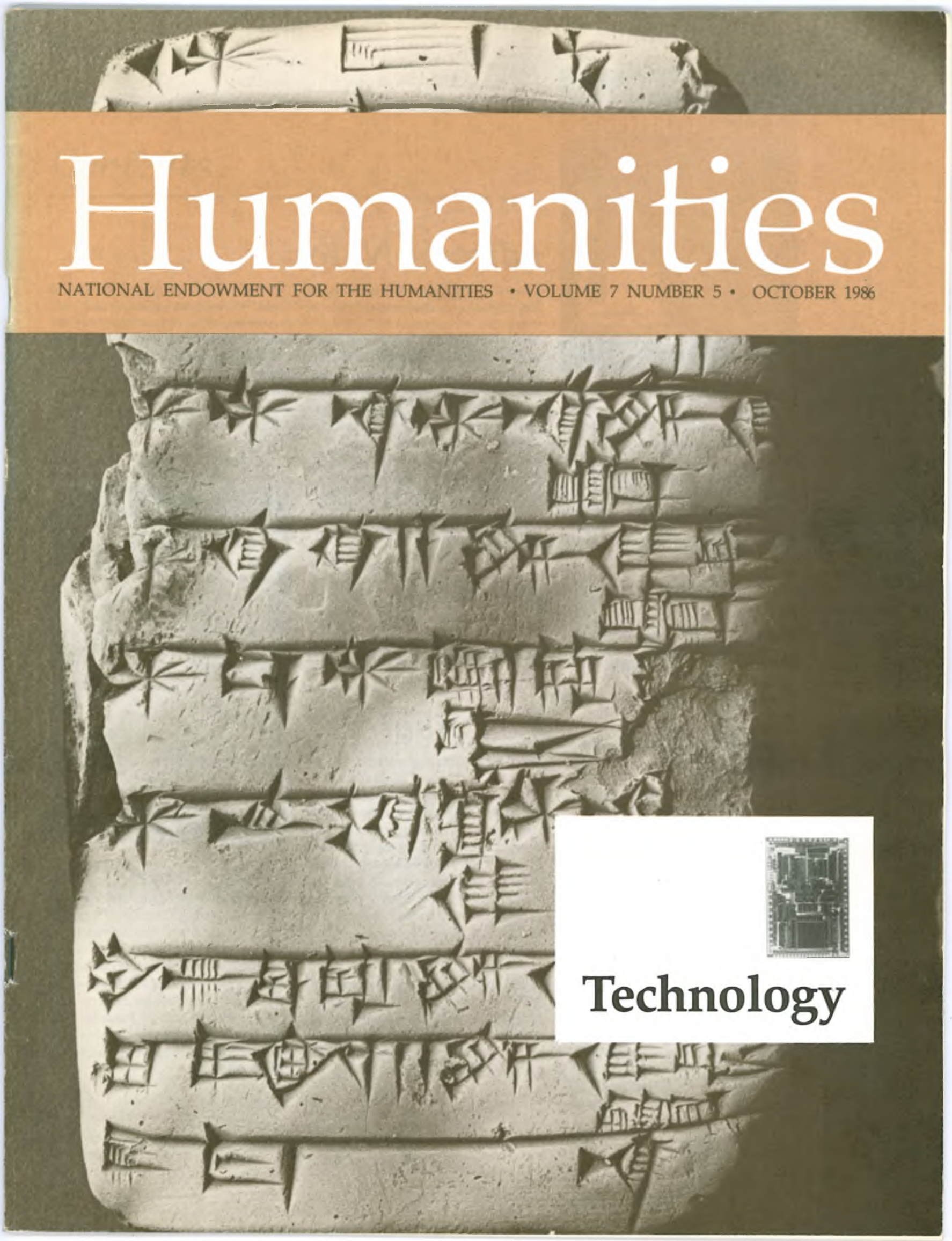
Humanities

NATIONAL ENDOWMENT FOR THE HUMANITIES • VOLUME 7 NUMBER 5 • OCTOBER 1986



Technology

The microchip is the latest refinement of the technology to manipulate, disseminate, and preseve data, first afforded by the clay tablet. This tablet from 21st-century B.C. Sumer records a magic incantation against a disease of barley plants. The incantation continues on the reverse (back cover). Both the tablet and the microchip are shown almost triple their actual sizes.

***Humanities* is a bimonthly review published by the National Endowment for the Humanities.**
Chairman: Lynne V. Cheney
Director of Public Affairs: Susan H. Metts
Assistant Director for Publications: Caroline Taylor
Editor: Linda Blanken
Managing Editor: Mary T. Chunko
Editorial Board:
Marjorie Berlincourt, James Blessing, Harold Cannon, Richard Ekman, Donald Gibson, Guinevere Griest, Pamela Glenn Menke

Designed by Maria Josephy Schoolman

Editor's Notes

Mary Shelley's monstrous metaphor for technology, the creature of science, has an ancestor in Greek mythology as well as a brood of offspring in the modern world. Francis Bacon, writing at the beginning of the seventeenth century (*Wisdom of the Ancients*), identifies the Theban sphinx as the symbol of science, "especially as joined with practice," because she proposed to her victims "certain dark and perplexed riddles." Contemporary horror films have added hostile computers and rebellious androids to the family tree.

As the essays in this issue of *Humanities* demonstrate, the history of science and technology provides remarkable evidence of the continuity of human experience, beyond the mistrust of science expressed in ancient myth, gothic novel, and contemporary film. Some of the specific riddles which humans are still attempting to solve, such as how to store and transmit information, were motivating technological advance in ancient Mesopotamia. Moreover, the method of problem solving that emerged there 4,000 years ago underlies scientific experimentation today.

Several of the essays in this issue describe recent trends which combine the methods and knowledge of science with those of the humanities. This cooperation is solving such persistent riddles as those posed by the incomplete records of Maya civilization, and may contribute to an understanding of the processes of interpretation and problem solving, so that the acquisition of knowledge might be removed from the mysterious realm of the monstrous.

—Linda Blanken

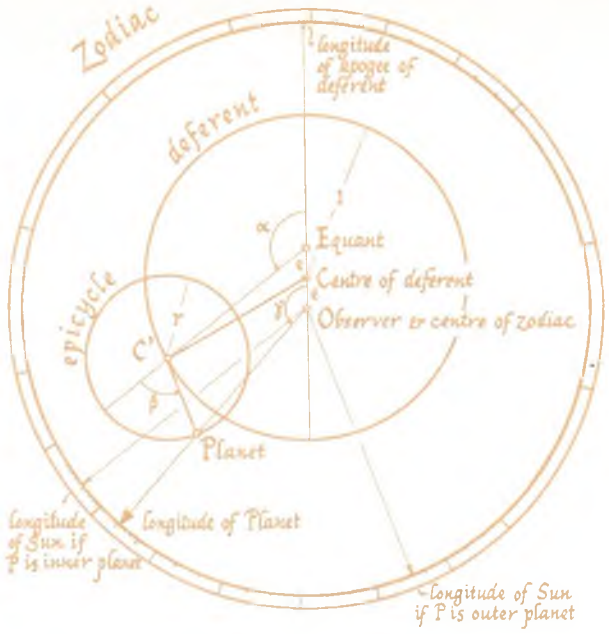
Contributors

MIGUEL CIVIL is Professor of Sumerology in the Oriental Institute of the University of Chicago and editor of the "Materials for the Sumerian Lexicon" (seventeen volumes to date) and member of the editorial board of the "Chicago Assyrian Dictionary." His forthcoming publications include "Sumerian Women's Dialogues" and literary sources for the history of Mesopotamian agriculture.

JOHN B. CARLSON, an extragalactic astronomer by training, is the founder and director of the Center for Archaeoastronomy and editor of the journal, *Archaeoastronomy*. Dr. Carlson's expertise is in Native American astronomy with a particular focus on the Maya. One current project involves the completion of a study of "Venus and Ritual Warfare in Ancient Mesoamerica."

KENNETH J. KNOESPEL is Assistant Professor of English at Georgia Tech and acting director of the Program in Literature and Sciences. In April of this year he gave lectures at universities in Sweden on literature and science. His book, *Narcissus and the Invention of Personal History*, was published by Garland Press in 1985. He is currently a fellow at the Society for the Humanities at Cornell University.

Contents



Calligraphy by Julian Waters

The Invention of Writing

It all began in the middle of the fourth millennium B.C. in the alluvial plain of Mesopotamia, between the Tigris and Euphrates rivers (the southern part of present-day Iraq). In the villages along the rivers, farmers, shepherds, tradesmen, and artisans started recording their accounts on small clay tablets with incisions, made with a reed stylus, representing amounts and commodities. Itself a technology, writing has profoundly affected the technological progress of the human race. By allowing the easy manipulation of large amounts of data, their geographical dissemination, and their preservation across forgetful generations, writing has made possible the step-by-step progress that has climaxed in the modern technical world.

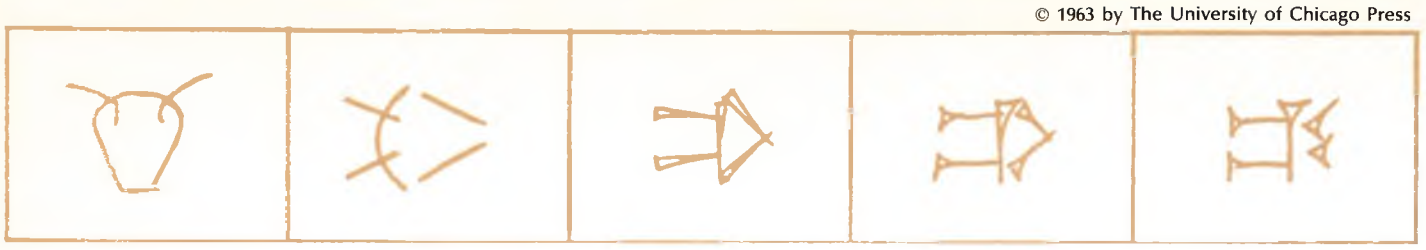
The appearance of the clay tablet was not a sudden, unexpected innovation. For centuries—as Denise Schmandt-Besserat has shown in recent studies—business accounts had been made with the help of small clay pieces or "tokens" of different shapes, one representing, let us say, sheep; another, jars of beer. It is likely that the ancestors of these tokens were simple pebbles. Because it is not always easy to find pebbles of a given color or shape, especially in the alluvial plains of Mesopotamia, clay tokens were a more efficient solution. Tokens belonging to the same account were often enclosed in a clay ball, safe from tampering and cheating. Making incisions, representing the number of tokens and their nature, on the outside of the clay ball was the next, natural step forward. At this moment the accountants must have realized that the tokens had become superfluous. One could just as well make the markings on a piece of clay. Small business inventories could thus be made permanent. Any attempt to alter the information would be easily detected once the clay was dry.

The invention of the humble clay tablet with scratched markings is one of the most significant events in history. With it prehistory ends, for the clay tablet would inexorably lead, sooner or later, to the invention of writing proper.

Writing is the first of the technologies aimed at preserving transitory visual and auditory experiences. (Millennia later, audio and visual recordings provide a perfect, stable image of such phenomena.) Once writing was invented, it became possible to record data of types not easily amenable to token manipulation, such as field surveying. Global accounts, manipulating and combining partial ones (the only ones feasible with clay tokens), became possible. These records required, on the one hand, the representation of arithmetic operations such as area computations and totals, and, on the other hand, some means to identify the parties associated with the transactions and the nature of the transactions themselves. The representation of the names of the individuals resulted in the decisive step in the invention of writing: the representation of speech sounds. From this moment on, rapid progress resulted in the creation of two new types of texts: lists of words and literary works. In the early part of the third millennium, three pillars of civilization were thus firmly established: the school where writing and the word lists were learned, the literature that recorded oral tales and poetry, and a more or less centralized administration. The new profession of scribe, builder, and caretaker of these pillars—and ancestor of thousands of future professions from dictionary maker to bureaucrat—became one of the noblest and most respected careers.

Ancient tablets of the eighteenth century B.C. vividly describe the traditional school activities. The students sit on the floor in a courtyard. They copy again and again on their tablets the models of the signs of the cuneiform writing that have been traced in front of them on the sand, as if it were a blackboard. They learn by heart long lists of words, among them an encyclopedia giving the names of practically everything: trees, manufactured wooden and clay objects, animals, garments, food, stars, and so on. The standard form of this encyclopedia has no less than twenty-four tablets of about 400 lines each. At that time, the population spoke Akkadian, a language related to Arabic and Hebrew, but the cultural language was the more prestigious Sumerian. Bilingual dictionaries are known from the twenty-fifth century B.C. on.

School life was not easy nor were the students always well behaved. A scribe reminisces that in his school days "the man in charge of keeping silence said 'Why did you open your mouth without my permission?' and he beat me, the man who makes the models in the sand said 'Why did you get up (stepping no doubt on his drawings) without my permission?' and he beat me, the doorman said 'Why did you go out without my permission?' and he beat me." And the litany goes on. Besides the vocabulary, the students learn multiplication and other mathematical tables and the algorithms to solve



The development of the cuneiform symbols for "water" (opposite page) and "cow" from **The Sumerians** *by Samuel Noah Kramer.*

problems. A pupil is admonished: "If you try to solve reciprocals, you cannot get back to one again, if they ask you to find a volume by combining the sides, or about squares and triangles, or circles and arcs, you cannot raise your hand (to offer an answer)."

The mathematical and astronomical knowledge of the ancient Mesopotamians is amazing. They used algebra and trigonometry, including the Pythagorean theorem, more than 1,000 years before Pythagoras. Donald E. Knuth, a computer scientist examining the old tablets, repeatedly expresses his admiration and declares a six-place table of reciprocals "an extremely impressive example of calculating ability." Without writing, such feats would have been unthinkable. Without writing, precise astronomical records could not have been transmitted from generation to generation.

The use of writing to record oral tales and poetry has technological aspects independent of aesthetic values. Before the invention of writing, "literature" consisted of performances or recitations before an audience. The "literary act" could be repeated, or more or less faithfully copied, but had no permanence. Writing fixed the performance, making possible its geographic dissemination and its preservation through time. In the beginning, the presentation of the sounds of the language was somewhat imperfect; for instance, a syllable with a voiced labial (b) and one with an unvoiced labial (p) could both be represented by a single symbol. A reader familiar with the language could easily decide which one to use in a particular case. More curious still, the early Mesopotamians disregarded the linear sequence of components and represented only the primary idea. Thus, to write the equivalent of "the herald sounded his horn there" they enclosed the words in an arbitrary order in one tablet case, for instance:

sound-		herald
	there	
horn		-ed

Predictable elements, easily filled in by the reader, like 'his' in this example, were simply omitted. The omission of predictable grammatical elements and sounds represents an intuitive application of the information theory of Shanon and Wiener, first formulated in the late forties.

Later literary texts represented the words of a sentence in a line and in their natural sequence. Hundreds of literary tablets have been preserved with the most varied contents: epic tales, religious songs, proverbs and riddles, and lyric poetry. Instructions for the tuning of musical instruments, studied by Anne D. Kilmer, mark the beginning of musicology. Nothing underscores better the power of writing than the fact that Kilmer has been able to reconstruct, in a playable form, tunes four millennia old.

A large empire, based on military power, may be conceivable without writing; there have been such empires in antiquity. However, one based on a solid economy and trade is difficult to imagine without an administrative system using written accounts. The art of accounting was one of the great achievements of the Mesopotamians. The accounting tablets could be rather large at times. Legend has it that in the twenty-third century B.C., King Rimush was stoned to death with tablets. They may very well have been tax records. Close to 25,000 administrative tablets (receipts, inventories, ledgers, etc.) have been preserved from a period of only about forty years at the end of the third millennium B.C. And this is but a small fraction of what the scribes of the period must have written. The economic history of the period is thus known in great detail. One detects at the same time the first unmistak-

Weather report from ca. 2200 B.C. describing a late spring storm:

The month of Ninmuk,
on the 6th day:
It was terribly cold.
The barley, already forming its ears,
was killed.
Ice formed on the city walls.
Eight days after
the weather improved.

Oriental Institute, University of Chicago

able signs of bureaucracy:

"(Today there were) no deliveries of fine beer,
no deliveries of ordinary beer,
no deliveries of fine bread,
no deliveries of ordinary bread,
etc.
Total: no deliveries of goods, fine or ordinary.
The 15th of the harvest month,
the 2nd year of King Shusuen [2035 B.C.]."

Writing also affected the administration of justice. The earliest law code dates from about 2090 B.C. (Ur-Nammu/Shulgi code) and was followed by others, culminating in the well-known Hammurabi code (ca. 1780 B.C.). Court records were kept in archives and copied in school. Thus was born a jurisprudence based on written codes and recorded precedents rather than on oral, traditional rules. A fascinating document of King Uruinimgina of Lagash (ca. 2350 B.C.) lists a series of abuses: excessive taxation, land grabbing, bribe taking, and so on, followed by the measures taken for their correction. "When a corpse was brought for burial, the undertaker perceived seven jars of beer, 240 loaves of bread, two measures of fine grain, one garment, one goat, and one bed; the 'technician' perceived one measure of grain." After the reform these amounts are cut to one third (except for the goat). In the first recorded case of featherbedding, the employer had to hire the workers two by two. This too was remedied along with many other abuses. The reforms, however, came too late, and the kingdom, weakened by bureaucracy and corruption, fell shortly afterwards.

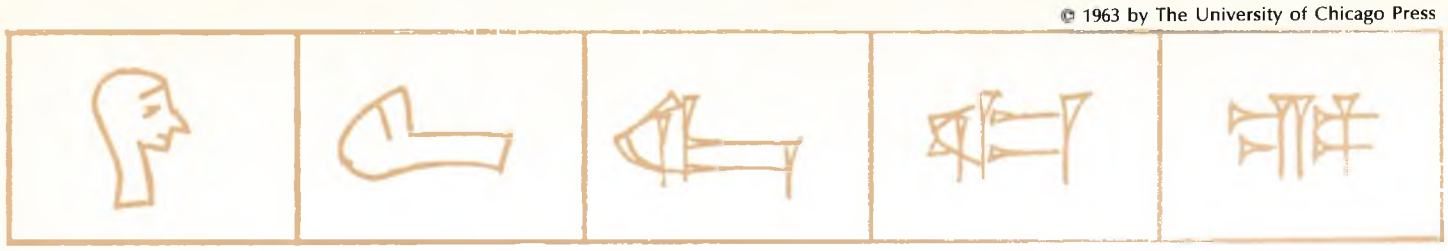
Thanks to writing, the cultic songs in Mesopotamian temples were the same for more than two millennia. Although no canonical religious book seems to have been composed in Mesopotamia, writing made possible the "religions of the book" (Bible, Koran, Avesta, and so on). Philosophical reflections on the ethics of everyday living and on the mystery of an apparently uncaring god are found in the eighteenth-century B.C. text "Man and His God." In a more mundane sphere, we have in cuneiform cooking recipes, pharmaceutical prescriptions, and instructions on how to assemble a plow and how to cultivate grain, with extremely detailed information about things like furrow spacing and seed amounts.

The latest dated cuneiform tablet found so far is an astronomical almanac giving the positions of the planets and the moon for the year 75 of the Christian era. The simpler and more flexible Greek alphabet replaced the complicated cuneiform. For three and a half millennia, cuneiform writing had served to express the most advanced sciences and techniques of the time. Diplomatic correspondence and treaties between Near Eastern powers had used this script for centuries. It had been used from the Mediterranean coast of Syria to Iran and from the Hittite court in Anatolia to Amarna in Egypt. Many languages were recorded in this script: Sumerian, Akkadian, Elamite, Hittite, Hurrian, Urartian, and even Egyptian. This remarkable tool of civilization started using symbols (pictograms) that represented the objects themselves with simplified designs on the clay. If one attempts to scratch a design on a clay surface with the usual technique of dragging a pointed object, it is hard to obtain a neat result, especially in curved lines. Small clay shavings are unavoidable. To circumvent this, the scribes pressed down the stylus making wedge-shaped impressions, hence the name "cuneiform" (from the Latin *cuneus* "wedge"). The symbols were progressively simplified until the object they originally represented became unrecognizable.

Object images were of course insufficient to represent the language. Abstract ideas such as "receipt" or "total" and the sounds of a senseless personal name, such as Ma-na-na or Ku-li-li, required an extension of the system. Cuneiform symbols can represent full words (logograms) or syllables (syllabograms). When they are not representations of sounds they are indicators (classificators or taxograms) of the semantic category of a word (plant, bird, tree, garment, etc.). Abstract words were generally derived from symbols of concrete objects with similar sounding names; the word for "tribute," gu(n), was written with the symbol for "neck," gu. Or they were derived from physically related objects; thus for "to walk" Sumerians used the symbol for "foot," with a different pronunciation.

Because this writing system is quite similar to hieroglyphic Egyptian or to Chinese, it is natural to inquire whether cuneiform may have been the inspiration for the other systems. No historical data provide an answer. It is possible, but one must remember that there are moments in the course of cultural progress when the next step flows so naturally from the preceding one that it becomes almost unavoidable. Mathematics was ripe for calculus when Leibnitz and Newton independently discovered it. Similarly, writing may have been an independent discovery by more than one civilization.

These logographic writing systems may appear cumbersome and difficult to handle when compared with an alphabetic system. Nevertheless they offer some technical advantages. A message in a purely logographic script is shorter—and therefore more "economical"—than its alphabetic counterpart, by a factor equal to the average number of sounds in a word. Furthermore, dialectal and historical language changes are not reflected in such a script, which can thus be used by people speaking quite different varieties of the same language; in certain cases it can even be read by speakers of a completely different language. Logographic writing is, in a sense, more "universal" than alphabetic writing, but, as the modern world



The development of the cuneiform symbols for "woman" (opposite page) and "head" over the period 3,000 to 600 B.C.

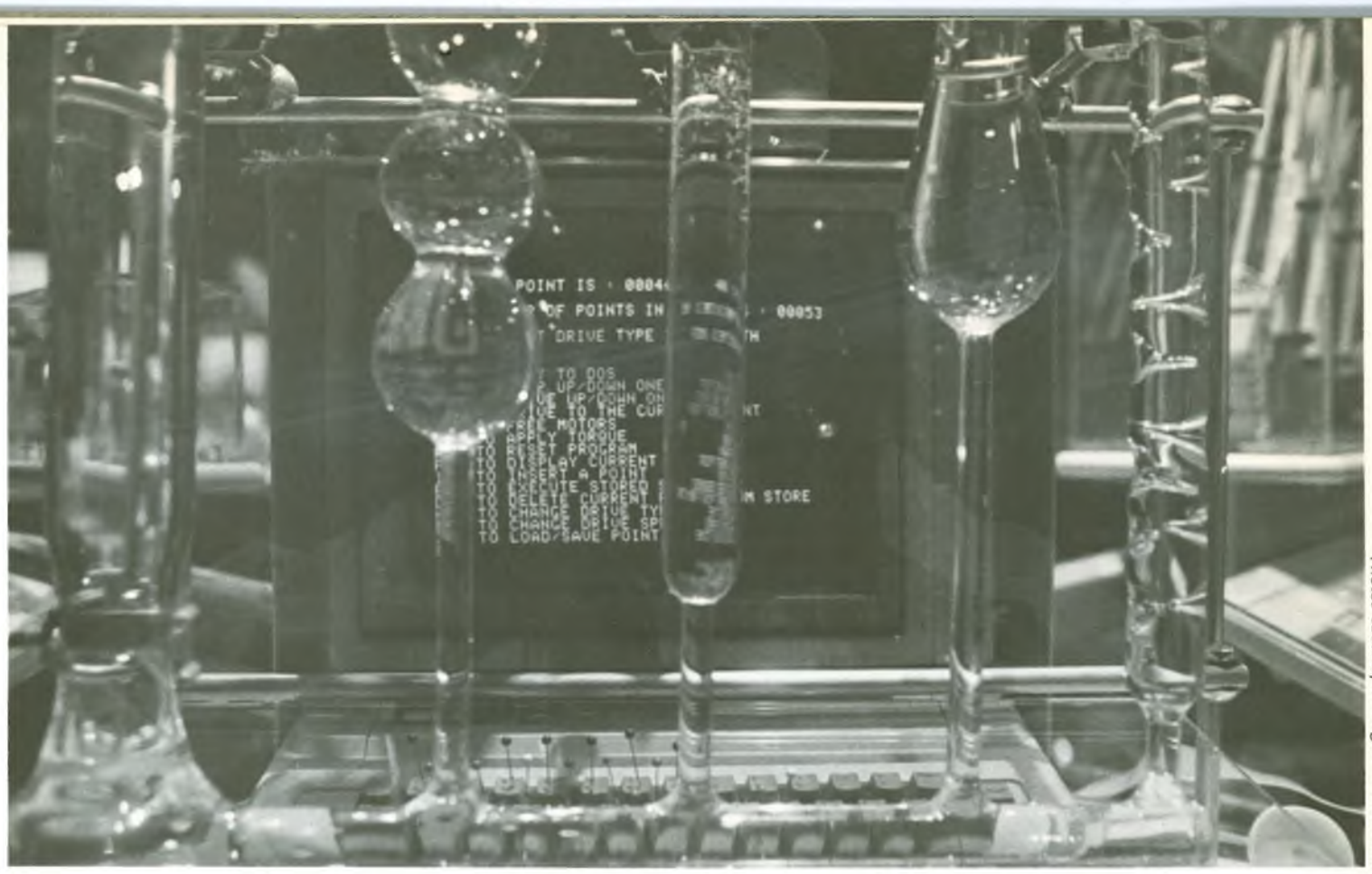
recognizes, technical progress is sometimes based on compromise. More advanced features may require the exclusion of old, but undeniably useful ones.

Alphabetic writing, considered after all a more efficient solution for human communication, replaced cuneiform 2,000 years ago. There is one aspect, however, in which the clay tablets are far superior to our written records. They have an almost geological permanence. When all of our books and papers, to say nothing of magnetic records, have disappeared, the cuneiform tablets will still look as fresh as the day they were written. When 4,000 years ago the scribes began a song to King Shulgi (2094–2047 B.C.) saying "this is the praise of his power, this is the song of his strength, this is the lasting record of the accomplishments of the wise one, to be passed down to future generations," little they knew how true their words were.

—Miguel Civil

Oriental Institute, University of Chicago

Fragment from the thirty-eighth tablet of a Sumero-Akkadian bilingual dictionary (late copy, ca. 500 B.C.)



Photos courtesy of Rogow + Bernstein

Chips and Changes

Reprinted with permission from History News, *August 1985.*

Technological exhibits have long fascinated Americans, but, in the past, the impact was generally proportional to size. The giant Corliss steam engine, with its eleven-ton walking beams and thirty-foot flywheel, driving thirteen acres of machinery at the 1876 Centennial Exposition in Philadelphia, became the most celebrated mechanical display of its time. Today, if one device could be regarded as the symbol of advanced technology, it would be the computer chip. About 3/8-inch square, containing hundreds of thousands of microelectronic components, it may change society even more than the huge engines that drove the Industrial Revolution.

Anyone from farm boy to poet who saw the Corliss engine gained, without explanation, a good idea of what it could do, a general understanding of how it worked, and some strong impressions of how it was likely to change the world. None of these things is obvious with today's computer technology. The microprocessor chip has gone so far beyond the limits of human sense perceptions that the uninstructed observer cannot understand enough even to marvel at its wonders. Only a carefully designed presentation that appeals to the mind more than to the senses can help us appreciate what microelectronics is and what it can do to, and for, society.

This is the achievement of "Chips and Changes," an exhibit now touring major museums from coast to coast. More than three years in preparation, the exhibit was produced by the Association of Science-Technology Centers and designed by Rogow and Bernstein of Los Angeles, with the aid of nationally prominent scholars.

Most of the academic advisers of the exhibit project are experts in humanistic or social science disciplines related to the interaction between technology and society. They include, among others, Bernard Barber of Barnard College, Melvin Kranzberg of the Georgia Institute of Technology, Bernard Cohen of Harvard University, Samuel Gorovitz of the University of Maryland, and Michael Mahoney of Princeton University.

The National Endowment for the Humanities, the Intel Corporation (a pioneer of the silicon chip), and eight other corporate sponsors contributed funds for the $1 million cost of "Chips and Changes." Nearly every major firm in the computer field also contributed in some way.

Far from being simply a display of marvels, the exhibit has well-considered educational objectives. It provides the basics of the background, development, production, and applications of microprocessors, and above all, it explores the benefits and costs to society that result from their use. In the eyes of its creators, this last goal most clearly distinguishes "Chips and Changes" from previous computer exhibits. According to Wendy Pollock of ASTC, the exhibit "is the first to explore not only the amazing technology of tiny computers-on-chips, but also their influence on people's hopes, fears, and options."

Upon entering the exhibit, which I saw at the Science Museum of Virginia, one immediately finds the subject placed in historical context. The very effective first panel depicts ten life-size individuals of decreasing ages from one hundred, each showing an "invention" that was relatively new "When I was ten." This presentation has much more impact and gives a more human perspective than the usual time line. The presentation shows also Americans' declining sense of wonder, from the woman who remembers the thrill of taking her own pictures with an 1888 Kodak No. 1 camera to the boy who says, "We've got a computer at home, but I don't know if it's so great." A seven-minute slide show, illustrating the development of communications and manufacturing technology since Edison's time, further emphasizes the historical context and provides an excellent introduction to the exhibit itself.

The attractive design of the 3,000-square-foot show includes pavilions illustrating the history of the computer, the design and manufacture of chips, the concept of artificial intelligence, and the basic operating principles of computers and software. The last topic, understandably, is least emphasized. In addition, seven exhibit islands demonstrate applications of the microprocessor to information systems, the "paperless office," automated factories and robots, "smart tools" (including weapons), home computing, health care, and games. There is also a section of "issues," although controversial questions regarding the positive and negative effects of computerization are not confined to that section.

Adjacent to the "issues" area is a computer programmed to solicit reactions from visitors. Users may see how their opinions compare with others and learn that "researchers are planning to publish the results." Elsewhere, four other computers offer quizzes about "facts and feelings" related to specific applications.

"Chips and Changes" is very much a hands-on exhibit. Displays lure visitors to participate, sometimes by speaking to them. Most important, what they get their hands on is the actual hardware, not contrived push-button demonstrations. Visitors work with high-tech devices in a nonthreatening environment, one in which it is possible to make mistakes and is necessary to experiment.

At the same time, "Chips and Changes" is an extremely literate production; it is not suitable for any "postliterate" computer generation, if one is coming. Surely, few exhibits of comparable size have contained more or higher quality written material, and the integration of written information and hands-on experience is exceptional. Everyone has seen children running through museums, pushing red buttons, scarcely pausing to see what happens, let alone ever reading anything. This is not possible here. Much of the equipment cannot be operated by novices until they are instructed on its use by accompanying explanations.

Of course, many young people go straight to the games section and stay there. They are confronted by a poster stating "Comic books are to literature what computer games are

(opposite page) A robotic arm, responding to the commands shown on the computer screen in the background, has performed the delicate task of pouring liquid into these vials. (this page) The mannequin's head holds sonar glasses, worn by blind people as an aid in perceiving objects. The glasses emit sonic waves which are then "read" with various kinds of buzzes. The keyboard on the right is an aid for speech-impaired people. The machine can be equipped with various vocabularies or menus, such as a health menu or an emotional menu. The user touches different printed words to prompt a synthetic voice to say things like "I am" "hungry."

to programming." One museum staff member at the Science Museum of Virginia remarked, "I wish we didn't have the games," but added that they serve at least to reduce crowds at and wear on more fragile demonstrations. The educational games selected undoubtedly accomplish more than that, and, in honest reflection, how many of us learned to read, at least partly, from comic books?

"Chips and Changes," though, is an adult show. Certainly children can learn from it, but they probably require guidance to learn much of what the exhibit is really about. It does not presuppose knowledge of electronics but does require a fairly long attention span and a good vocabulary. One notices that adults take more interest and spend much more time in all parts of the exhibit, except in the games section, than do children or teenagers.

Science museums have often been accused of promoting an uncritical faith in scientific and technological benefits. An exhibit that has received so much support from the high-tech industry might be more than usually open to this accusation. "Chips and Changes" does achieve its goal of presenting both positive and negative effects of computerization but mainly for those visitors who conscientiously read the labels. Well-written texts raise many controversial questions and leave them open. They also provide information that could lead to a less than optimistic view of the electronic future. Examples include evidence of the downgrading of skilled employees and the statistic that 19,000 computers have access to the FBI's central computer. However, visitors who simply look at, or put their hands on, the artifacts will see only the wonders of digital progress.

There is one outstanding exception. It is the gruesome head of Frankenstein's monster atop the automated factory-robotics display. No visitor can miss this. Its connection with the subject is eventually explained in the text, but it is more effective without explanation.

The learning experience intended by the original planners can be affected, perhaps adversely, by the arrangement of the pavilions and islands, a matter that is left to the discretion of individual host museums. Also, a few labels are printed in white on a light background, making them nearly unreadable. Items treated this way were probably judged less important, but some were quite interesting, such as the assertion by a Stanford electronics expert that "If you raise the philosophical objection that the machine does only what we program it to do, the answer is 'That is right, and what I program it to do is think.' "

Occasional petty faults do not detract from the overall quality of the presentation as a major educational experience. It takes about three hours to cover the exhibit completely. Those with less time may concentrate on a few parts and learn a lot about those areas. A quick glance at everything teaches little, but a thorough examination will give the intelligent novice a whole introductory education in microelectronic development and application. Even the experts will almost certainly learn something.

Does "Chips and Changes" teach us to stand in awe before the microprocessors as our ancestors stood before the Corliss engine? Undoubtedly not. Our technology no longer has mighty pistons and flywheels, and we no longer have the naive optimism the people had in the nineteenth century. These changes, and the appreciation of them promoted by such thoughtful exhibits as this, may give us a chance to do better than our ancestors in making the machine a servant and not an idol or a master.

—William Thorn

A child watches a computer play chess against itself. It can also play against a person, play at various skill levels, and replay games or moves to give players second chances.

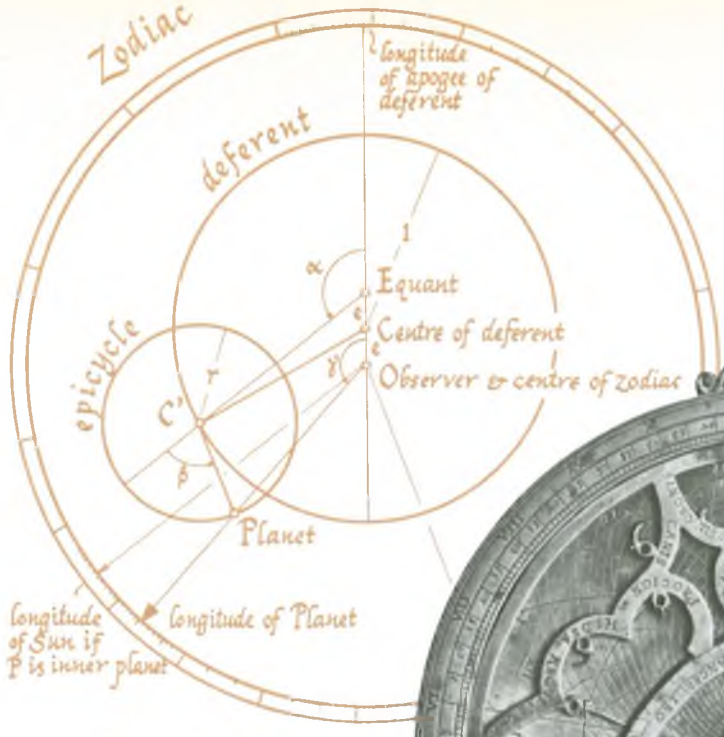


Diagram of Ptolemy's model of planetary movement; 16th-century astrolabe.

Adler Planetarium

The Invention of Science

Every person over the age of six or seven has performed an operation in Babylonian mathematics . . . every time he or she has looked at a clock. The convention that divides an hour into sixty minutes, and a minute into sixty seconds, is a direct descendant of the ancient Babylonian number system, which operated, as records from approximately 3,800 years ago show, on a base of sixty in the way that most modern number systems operate on a base of ten.

This is a trivial influence, if the most widely used, of the mathematical practices from "the cradle of civilization," or, roughly, what is known as present-day Iraq. Simple enough for schoolchildren, the system is used, if not recognized, by practically everybody. A far more subtle mathematical legacy of the Mesopotamian civilizations is, however, a far more crucial one.

"Babylonian mathematical astronomy was the origin of all subsequent serious endeavor in the exact sciences in the West," claims Asger Aaboe, a Danish mathematician, historian of science, and Assyriologist at Yale, who has taught both scientists and humanities scholars the significance of the body of recorded mathematical information from clay tablets translated only in the last fifty years or so. Last summer was the third in which Aaboe led a group of college teachers from various disciplines in the sciences and the humanities through the serious endeavors of the greatest scientific minds in ancient and medieval history. Aaboe's seminar, one of the NEH-supported Summer Seminars for College Teachers, is called "The Exact Sciences in Antiquity and the Middle Ages" and begins with Babylonian mathematics.

"We have now some 400 tablets and fragments of tablets of mathematical content which have been carefully copied, transcribed, translated, and explained in comprehensive and authoritative volumes," says Aaboe, who has himself deciphered some of the tablets in the British Museum, the owner of the largest collection of Sumerian clay texts in the world. "Most of the mathematical tablets date from a couple of centuries around 1700 B.C. and the rest from the last three centuries B.C."

As one of the first exercises in the seminar, Aaboe asks the group, which has included philosophers, physicists, mathematicians, historians, classicists, astronomers, and literature scholars, to decipher a clay tablet from the later period. By this time Aaboe has already demonstrated the Babylonian number system with one of the Old Babylonian tablets, containing a multiplication table, which shows that the value of a simple sign (made by a stylus in soft clay) depends not only on its configuration, but also on its place in a column. Moving a figure one place to the left means multiplying its value by sixty, in the same way that today, moving a figure one place to the left means multiplying its value by ten.

After this introduction to Babylonian sexagesimal notation, the class is given a Babylonian planetary table, an *ephemeris* of predictions of planetary movements. With the rudimentary knowledge of numbers, the class can perceive a pattern in the long columns of computed longitudes and velocities of the planet that is the subject of the particular text. By analyzing the pattern of repetition, the class reproduces the arithmetic function that generates the pattern. They discover in this way what Aaboe believes to be the

achievement of Babylonian astronomy: "The mathematical description of celestial phenomena capable of yielding numerical predictions that can be tested against observations." A similar procedure was enlisted when the mathematical relationships between mass, energy, and the speed of light posited by Albert Einstein in the 1905 paper, *The Electrodynamics of Moving Bodies,* were in part verified by Arthur Eddington's observation of the lunar eclipse of May 29, 1919. The theory of relativity is more complex, but it is not difficult to see similarities in its Babylonian forerunners.

The arcane task of deciphering a formula for planetary movement from a cuneiform tablet serves a purpose in Aaboe's seminar beyond the demonstration that the Babylonians were at the root of the invention of science as the Western world came to understand it. For scholars who are accustomed to consulting original sources, this introduction serves Aaboe's purpose of overcoming "the widespread belief among humanists that matters scientific or numerical are beyond—or beneath—their grasp. I have found that it is this attitude itself that forms the major barrier . . . and I aim at convincing them, as I have others, that these subjects are knowable. . . .

"In the seminar we are mostly concerned with reading and trying to understand the texts themselves."

From the astronomical cuneiform texts, the seminar moves back to earth, to Euclid's *Elements,* the first elegant articulation of the mathematical relationships between parts of earthly space. The language and logic of Euclid are so clear and so simple that they served as an introduction to geometry until approximately 1950, not having been improved upon for 2,000 years. Each participant in the seminar was required to prove one of the propositions in the first of the thirteen books of the *Elements,* both to discover the logical structure of the first book, and to gain the knowledge of the geometry of a circle necessary for an understanding of trigonometry, which they next encountered in the *Almagest* of Ptolemy.

In the *Almagest* Ptolemy sets forth his conception of the universe, an earth-centered system of planets revolving in a great continuous circle inside a larger, fixed circle of stars, known as the zodiac. The circumference of the circle on which the planets revolve about the earth, referred to by Ptolemy as the deferent, also marks the center of a smaller circle, the epicycle, which each planet described in a regular rhythm on its way around the earth. Ptolemy's model provided the image of the cosmos until Copernicus published *De revolutionibus orbium coelestium* in 1543, a text also on the seminar's reading list.

The *Almagest* illustrates another of the applications of scientific texts discussed by Aaboe. It is known that Ptolemy lived and worked in Alexandria around A.D. 150, not because the precise dates and details of his life have been reported by some contemporary biographer, but because the *Almagest* itself supplies the evidence for placing him in the middle of the second century. In this work he quotes his own observations of identifiable astronomical events, such as a lunar eclipse that is known to have taken place on May 6, 133.

Besides providing historians with such precise dates, scientific texts provide clues concerning cultural transmission among early societies. Babylonian influence may be detected in Euclid's formulation of quadratic equations, for example, and in Ptolemy's subdivision of a circle into 360 degrees, a reflection of the Babylonian base-60 number system.

In addition, a knowledge of ancient astronomy is useful in the interpretation of medieval and Renaissance literature. "One might as well try to read Chaucer, Dante, and Shakespeare in total ignorance of the Bible as without any knowledge of the authors' contemporary astronomy and astrology," Aaboe believes.

Basil Clark, a Chaucer scholar and literature professor at Saginaw Valley State College in Michigan, who attended Aaboe's 1982 seminar, adds Milton to the list of writers whose work is better understood by readers with at least a general knowledge of astronomy and astrology. Milton had read Copernicus; he had visited Galileo in confinement. According to Clark, his creation, therefore, of an earth-centered universe in *Paradise Lost* must have thematic significance for the poem.

Chaucer's *Treatise on the Astrolabe,* one of the texts studied in the seminar, is not the only work by the poet that contains information about astronomical and astrological subjects. Besides the familiar astronomical allusion in the Prologue to *The Canterbury Tales,* "The sun has run half his course in the ram," Clark points to astrological details in the Franklin's and the Knight's tales.

"The chief accomplishments of the seminars like the ones that I gave," reflects Aaboe, "are that they enable humanists and scientists to work together, bringing their particular skills to bear on the same problem.

"The notions that scientists think of humanists as people who babble idly, endlessly, and affectedly to impress rather than to inform, and that the humanists reciprocate by viewing scientists as semiliterate technicians with narrow minds, if any, are, of course, caricatures. But like all caricatures, good or bad, they contain an amount of truth, however small. It was, then, a great satisfaction to me to have scientists and humanists collaborate on a problem, bringing to its solution their several particular competences and realizing for the first time, that the two groups have indeed problems in common."

The two groups have been working since the middle of the nineteenth century to excavate the tablets from archaeological sites, to decode them, and to draw their separate records together in a coherent narrative. Aaboe recalls his visit in 1968 to Abu Salabikh, Iraq, which had been excavated for two seasons. He had come from the British Museum where only 10 percent of the collection of tablets had been examined, let alone described and published. "From where I stood, I could see, wherever I looked, the tels—with thousands of clay tablets yet to be unearthed—rising up from this broad Iraqi plain." It is pleasant to imagine a Sumerian scribe in the same location looking toward the sky and overwhelmed by the vastness of undeciphered knowledge.

—Linda Blanken

"Exact Sciences in Antiquity and the Middle Ages"/Asger H. Aaboe/Yale University, New Haven, CT/1982, $55,647/1985, $69,526/Summer Seminars for College Teachers

Capital Children's Museum

A child examines a phenakistoscope, one of the early devices of animation, invented in 1832, and on display at the Capital Children's Museum.

The ABC's of Communication

Children begin a tour of the communication exhibition at the Capital Children's Museum by "stepping back" 20,000 years into an ice-age cave. Walking into the dark, cramped passage of this replica of caves in southern France and northern Spain, they hear the sound of water dripping, the echo of rocks falling, and the faint trill of a flute. On the wall, the image of an antelope appears, and they can trace its outline and touch the swell of its abdomen shaped from the natural curve of the cave wall. Deeper inside the cave, more animal images come to life in the dim light. Nearby are curious dots and grids; next to them, human hand prints.

Some of the children will be able to view a video program that explains the significance of these mysterious images through a recorded conversation between children and a scholar. One of four video (and one audio) programs funded by NEH, the question-and-answer show acts as an electronic docent in the museum to make sure that young people are learning from the displays that they can touch and play with. According to project director Stanley Woodward, who is also director of MEDIAWORKS, the museum's program for youth and media, "The scholars offer a historical perspective as well as an introduction to the questions of values raised by the technological inventions. They not only answer the children's questions but ask questions that highlight the dilemmas and choices between competing values."

In the film that will explain the Altamira replica, children ask John Pfeiffer, professor of archaeology at Rutgers University, the questions that occurred to them as they walked through the cave: Who made these mysterious markings and what do they mean?

"Scholars don't know what these paintings mean, but we do know that they held important information," replies Pfeiffer.

Pfeiffer explains to the group of children in the film, that 20,000 years ago there was an information explosion probably the consequence of a population explosion. "People were living in larger groups, and, just like us, they argued and fought. They needed rules. They also began to hunt differently in order to feed more people; instead of killing one animal, they began to kill whole herds. They also began to hold ceremonies in caves. Participants crawled on hands and knees, in the dark, until suddenly they reached a room like this where music was played and, in the flickering light of the torches, the animals on the wall might seem to move."

The fear, the drama, and the beauty of the ritual, probably made it more likely that this information—which could mean the difference between life and death—would be remembered. The cave could have been a mnemonic device, says Pfieffer "a solution to a communication problem when man had no other means of storing information except in his head."

The other video and audio programs are planned to explain in this way other parts of the exhibition that contain similarly sophisticated ideas. The challenge was, says Woodward, "to find a way to teach subtle and complex ideas to children."

"We believe that nobody teaches children like children. We let them take their own questions to the experts for answers," says Woodward. And they filmed the results.

One of their first questions was "What is a humanities scholar?" Armed with video equipment and guided by the staff, the children asked the man and woman on the street. Most of the briefcase-carrying adults interviewed in downtown Washington were stumped, so the children decided to go straight to the top and interviewed John Agresto, then acting chairman of the NEH.

Other scholars they interviewed answered questions about the specific technologies featured in the exhibition. They asked Elizabeth Harris, historian of graphic and print media at the Smithsonian Institution, about the history of printing; Thomas Sebeok, director of the Research Center for Language and Semiotic Studies, about codes, symbols, and communications across time; Tony Schwartz, author and media producer, about how the power of the media shapes public opinion. An interview with historian Daniel J. Boorstin, director of the Library of Congress, is scheduled. These interviews provide a commentary on the history and significance of the succeeding advances in communication, which can be followed through the exhibition in a thematic, but roughly chronological order.

The exhibition explores how human beings create, receive, integrate, store, and retrieve information; the constant nature of communication needs across time and cultures; and the importance of who controls and has access to information. The "hands-on" approach allows children to see, hear, touch, turn, pull, jump, draw, trace, push, and twirl the various technologies that humans have invented from the Pleistocene era to the present in order to "get the message across." Each exhibit is easy to reach and easy to work. Information labels are succinct.

From the cave, museum visitors continue through the exhibit into Code Hall where they learn that, before codes, the only way to get the message across distance was to shout, run with it, or send someone on horseback. Africans invented intricate drum patterns to send messages. The Greeks used a system of torch signals placed on high cliffs which could be seen six miles, a distance based on the curve of the earth. Using electrified torches, children send messages to the other side of the room: "The Persian navy has been sighted"; "The ships are armed"; "Row faster!"

Code Hall jumps to the nineteenth century with a braille typewriter, (an invention that led someone to the bright idea that this writing machine might also be good for sighted people). After typing their names on the typewriter, children can send signals with naval signal lights, watch words signed in sign language, and beep out a message in Morse code.

The American hobos in 1890–1920 had a code of their own. They painted "symbols" on gates, barns and houses to tell other hobos what to expect—be it a "fierce dog," "women only," "angry man," or "food for work."

The development of the Chinese writing system is also explained in Code Hall. The system is based on 40,000 glyphs—symbols that look like objects. The Chinese glyph for "orphan" came from the image of a single melon on the vine. Over the centuries, shapes of the characters changed; today, they bear little resemblance to the objects they represent.

The introduction of a more complex code, a simple phonetic alphabet in which the symbols represent sounds and combine in myriad arrangements to produce meanings, disrupted, according to some scholars, a great civilization based on an oral tradition. The children learn that the Greeks did not have a written language until the seventh century B.C., long after their neighbors in Egypt and Mesopotamia had built great empires with governments based on writing. The Greek political system was based on dialogue, and the information about their gods and heroes was sung by their poets. Socrates did not write. In one of his dialogues, Amon argues with Thoth, the Egyptian god who invented letters: "This discovery of yours will create forgetfulness in the learners' souls because they will not use their memories."

In the Scriptorium, children learn about the development of printing

by L. Blanken

and its importance for communication. They begin by scratching out their names with a quill pen—the state-of-the-art technology in the Middle Ages. The lifetime production of a scribe might be only five or six books, which only few could read. After Gutenberg invented the first printing press with movable type in the fifteenth century, a good printer on a good day could produce 300 sheets.

They then try their hands at the museum's press, a miniature but authentic replica of the one used by Benjamin Franklin and Thomas Paine. The children ink the plate, lay the paper, lower the frisket, push the rounce (handle) to wind the bed from under the press, pull the devil's tail (lever), push the devil's tail, lift the frisket and pull out the print—one single sheet. It is hard work that teaches them why, after doing this 300 times in one day, printers named the lever "the devil's tail."

The next "gallery" in the exhibition is reached by climbing the Language Tower, where the voices of children speaking fifty different languages is heard. At the top of the stairs is a model of RCA's SatCom I, a satellite that sends and receives messages around the globe in seconds. Here, visitors enter the electronic era of communication.

They walk inside a three-dimensional replica of the Whirlwind computer, built at the Massachusetts Institute of Technology in the 1950s. The three-room-sized Whirlwind held 256 words in memory and cost $5 million. Today's microcomputer sits on a table top, holds 256,000 words in memory, computes in a fraction of the time, and costs $400.

"Hey you over there, come talk to me," says the voice of Wisecracker, a voice synthesizer-computer that speaks the words and sentences that children type into it. Other computers (there are more than fifty in the exhibition) have easy-to-use music and art programs. The Future Center, a prototype of a twenty-first-century classroom with twenty computers, serves 15,000 students, ages three to eighty-three, in one year.

Ann Lewin, the director and founder of the Capital Children's Museum, believes the electronic segment of the exhibition to be one of the most important for children to understand. "When the radio was first invented, it was seen as a mysterious technical force of interest only to scientists," she said. "Few Americans saw any reason to have them in their living rooms.

"Whereas telephone and telegraph had made it possible for one person to talk to another over great distances, radio and television enabled one person to reach hundreds of thousands," says Lewin.

With the guidance of museum staff, a group of children has been producing programs in the museum studio, which have been broadcast on commercial and public radio.

Here nine-year-olds research, write scripts, meet deadlines, and do postproduction work that goes into creating a radio program.

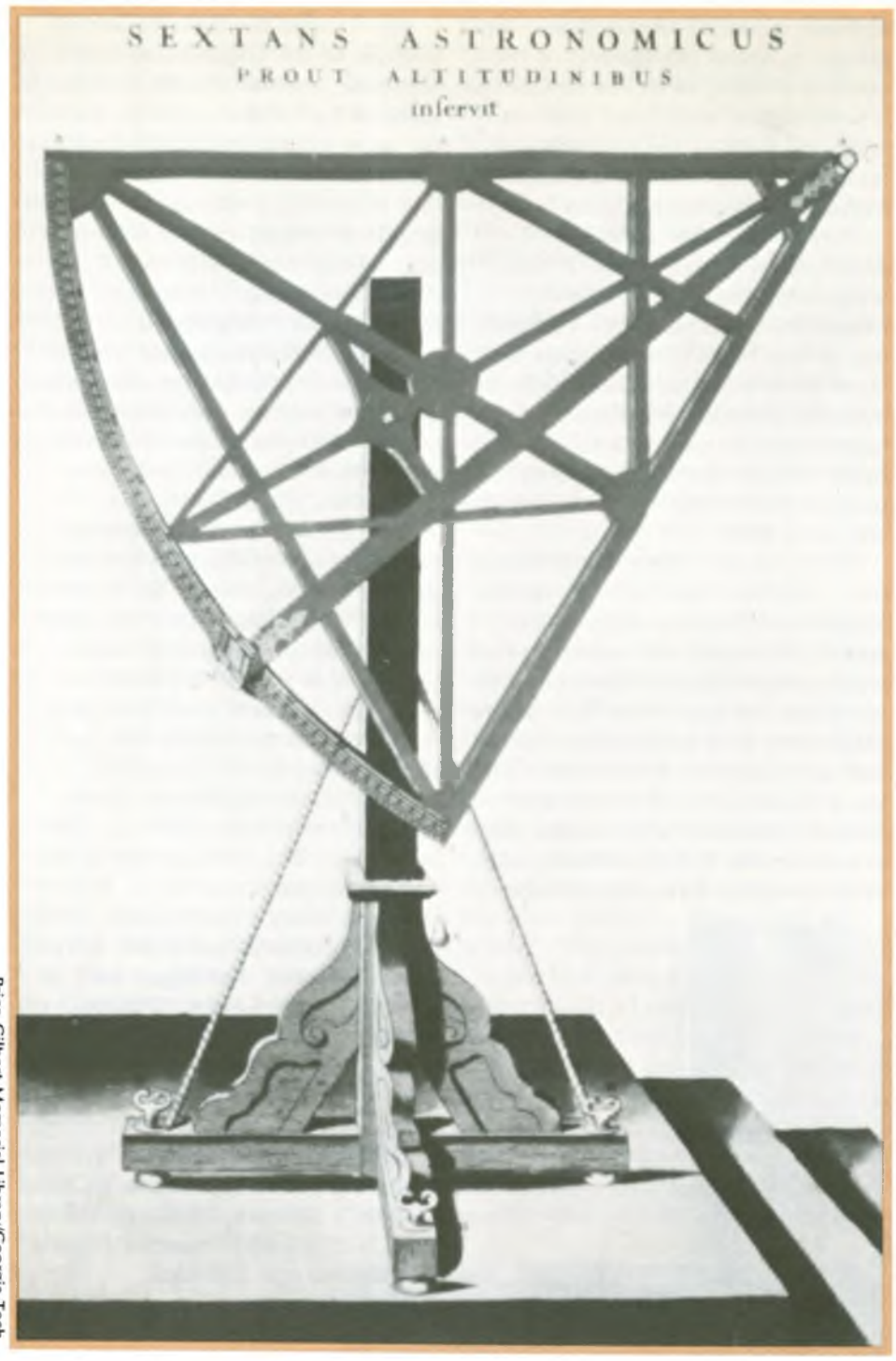
Through the exhibition, children not only have their hands on the technology but, through the video and audio programs, begin to "understand today's information explosion as a continuation of the story of communication that began back in the cave," says Lewin. "We build on the thoughts of all those who lived before us."

—Susan Rasmussen Goodman

"Audiovisual Interpretation for Communication Exhibit"/Ann W. Lewin/Capital Children's Museum, Washington, DC/ $292,345/1984–86/Humanities Projects in Museums and Historical Organizations

Photos courtesy of Capital Children's Museum

The illustrations accompanying this article are taken from a collection of rare books in the history of science and technology at the Price Gilbert Memorial Library at Georgia Tech and part of an exhibition cosponsored by the Program in Literature and Science. The sextant has become the symbol for the program.



Price Gilbert Memorial Library/Georgia Tech

Interpretive Strategies and the Two Cultures

After overhearing a lively exchange I was having with several students about the accuracy of Galileo's lunar observations, a student approached and expressed interest in a physics course which included Galileo's experimental method. When I explained that the course we were discussing was offered by the English Department, he looked at me in disbelief before asking how he could register. Such response has become frequent as more students learn of the new Program in Literature and Science being developed with NEH support in the English Department at the Georgia Institute of Technology. Since their introduction in 1984, the courses have attracted growing enrollments and the attention of other schools in the United States and Europe.

Until recently "literature and science" denoted courses that affirmed the culturally perceived differences between the sciences and the humanities. Often these courses have viewed the humanities as a spiritual and moral refuge against an ever-encroaching, amoral science. The defensive posture inherent in such courses resulted in the elaboration of the humanities in a setting where real consideration of the sciences was all but impossible. Historically such courses evolved within an educational system that by the end of the nineteenth century had established divergent disciplines. Such separation has been decried frequently and most notably by C.P. Snow, but the critics have provoked little pedagogical change for the simple reason that assumptions are often rooted deeply in our educational institutions and widely disseminated by the media.

Rather than emphasize differences between the sciences and the humanities, the courses being developed at Georgia Tech explore the ways in which the disciplines complement each other. Rather than stressing the different objects considered by the chemist and the literary critic, we have asked how knowledge is achieved by each discipline. We have moved, as Jerome Bruner has observed in his recent book *Actual Minds, Possible Worlds* (Harvard, 1986), "from the *products* of scientific and humanistic inquiry to the *processes* of inquiry them-

selves." In effect we ask in what ways problem solving—so manifest within the positive sciences—bears a relation to the interpretive work a student encounters when reading a novel or poem.

Students frequently come to our courses with the assumption that there is no relationship between a calculus problem and a poem. In their minds science tolerates only a single universal answer, while the humanities promote a proliferation of answers. In practical terms students have the impression that anything goes when one interprets a poem. Consequently, when they read, students would rather have a meaning fixed to a poem *before* they read it so they can seek to substantiate the reading they are given. Instead of locating meaning by themselves, they would replicate the security they experience when working on an equation or formula which leads to an answer that is definitely either right or wrong. In other words there is an anxiety about reading a polyvalency. It is not farfetched to think of all our courses as courses in reading in the sense that reading demands an ability to make distinctions among a range of conceptual matter evoked by a particular text.

Another problem exacerbates the fear of reading and interpretation. Although students quickly acquire expertise in certain aspects of their major discipline, they have little experience in devising critical contexts for the work they do. Their unfamiliarity with analyzing how a particular unit or component fits into a larger intellectual process becomes especially evident when they are urged to think historically. By thinking historically, I do not mean demonstrating familiarity with facts about a certain period, but an awareness that ideas change over time. History shows in a graphic manner that knowledge—whether in the natural or social sciences—is not gained by the uncritical acceptance of information but by an awareness of how what we know remains under continuous interrogation. History itself is a form of interpretation.

Interpretation is hardly restricted to the humanities. In working an equation or explicating a poem, the problem solvers' responses depend on hypotheses or questions they have learned to ask. In the broadest sense, conceptual assumptions inform the conclusions one is able to reach, whether the problem is in spectroscopy or deconstructionism.

The interpretive questions we ask of literary and scientific texts in our courses are related to the shift that has occurred in the study of literature. Since the 1960s literary studies have expanded from the close study of individual texts to include a thorough examination of the epistemological and social assumptions governing the approach to a literary work. In part the study of literature has provided a setting for the resurgence of philosophy and the expansion of hermeneutics. Hermeneutics, which originally was associated with the interpretive problems accompanying biblical texts, has come to be applied not only to literature and historical writing but to science itself. Modern culture has become committed to critical explanations. People are simply no longer focused on a single metaphysical explanation but have come to expect, as my colleague Paul Armstrong has argued, a plurality of accounts that continues to invite an ongoing practice of accommodation. Rather than expecting a single, exclusive way to the truth, scholars require a rigorous critical diplomacy that will permit the exchange of varying critical viewpoints.

These are the larger theoretical questions that inform our development of specific courses at Georgia Tech. Five courses are currently offered in literature and science. Although the courses may be taken separately and in any order, students are encouraged to complete the Introduction to Literature and Science before taking any others, because the introductory course provides a good orientation to the other courses.

Study of (1) models and paradigms, (2) the changing description of nature, and (3) problems of interpretation constitutes the Introduction to Literature and Science. In the first module students are introduced to the role played by models or paradigms in the organization of experience. The notion of conceptual models and how one becomes aware of their presence is introduced through study of *Portrait of the Artist As a Young Man* by James Joyce, *Double Helix* by James Watson, and excerpts from Thomas Kuhn's *Theory of Scientific Revolutions*, Paul Feyerabend's *Against Method*, and Karl Popper's essay "The Dangers of Normal Science." Together the texts show how models not only order experience but how they come to change. In Joyce students consider the shifting role of family, country, religion, and art in the growth of Stephen Daedalus. In Watson they find how breaking away from stubborn adherence to a preconceived molecular model

Price Gilbert Memorial Library/Georgia Tech

***The renowned collection of maps in the nine-volume* Atlas Major, *published by Joan Blaeu in 1664–65, was accompanied by text relating the cultural and natural history of various lands. This illustration of sea lions in the Siberian Sea is from the first volume of the* Atlas.**

leads to the revolutionary discovery of the configuration of DNA. In Kuhn, Feyerabend, and Popper they are introduced to debates about the place of models in science. The discovery of a conceptual vocabulary that permits the intelligent comparison of models in literature and science is the most important pedagogical object of the first section.

Consideration of the changing depiction of nature in poems and paintings from the Renaissance to the modern period further exercises ideas of conceptual models and world views. Through a comparison of poems by poets such as Gray, Wordsworth, Arnold, and Eliot, students learn to articulate the view of nature implicit in each and explore the relation it may have to a prevailing scientific doctrine. That science influences how we see nature is exemplified even more vividly through the study of the way nature appears in painting. For example, after the reception of Newton's work on optics, colors are depicted differently. Discussion of painting and ideas of representation have been introduced either through E. H. Gombrich's *Art and Illusion* or John Berger's *Ways of Seeing*. Gombrich leads to detailed questions about the psychology of perception, while Berger demands that we ask questions about the social setting of the images we view.

In the final section, the interpretive problems raised by literature are studied more fully. Two different strategies have been devised. One approach has examined the role of pluralism in interpretation and the other has looked at society's perception of scientific inquiry. In the first, students read Ford Madox Ford's *The Good Soldier* and consider divergent critical views of the novel. Does the novel lend itself to *any* interpretation, or are interpretations finally limited and even legislated by a community of readers? In the second approach students read Robert Pirsig's *Zen and the Art of Motorcycle Maintenance* and analyze his representation of the sciences and the humanities.

Besides the introductory course, four period courses are offered devoted to investigating literary and scientific work in the ages of Galileo, Newton, Darwin, and Einstein. Each course critically engages both scientific and literary texts by posing questions about the assumptions that govern during the respective periods. Because of the ever-increasing demands placed on students in their science courses, they have virtually no opportunity in them to raise questions about the history of their chosen scientific field, to reflect on the philosophical implications of scientific laws, or to consider the relation their study has to other forms of inquiry. As a result the courses in literature and science have become a setting where students can learn to formulate questions and explore possible answers.

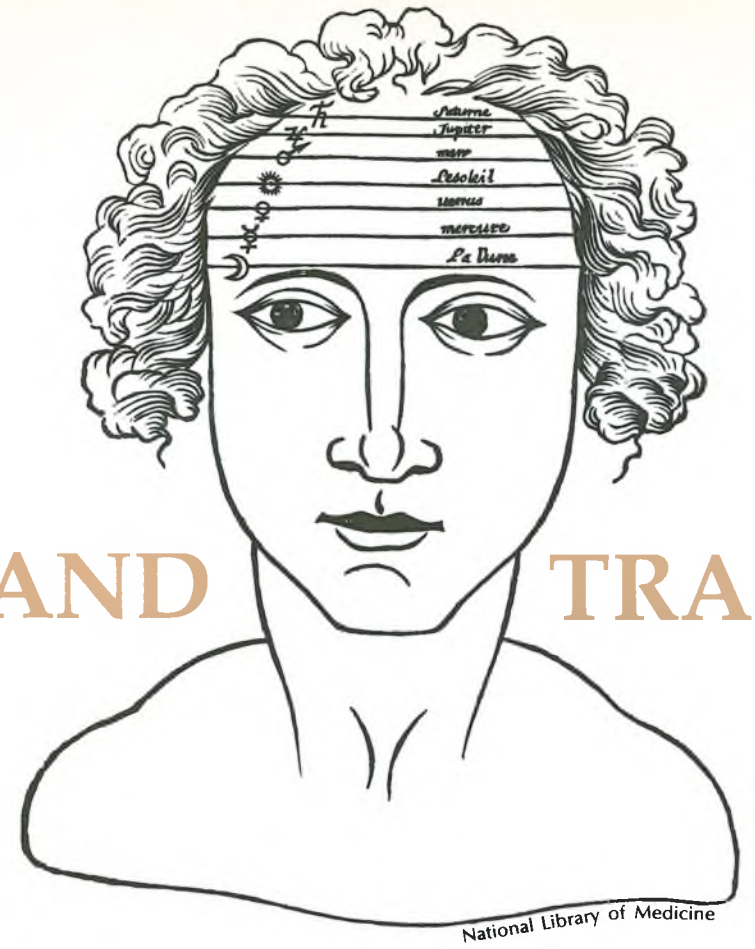
We literature professors have learned much in two years about science and our own discipline. We have become aware how much literary study can gain by expanding a literary canon shaped at a time when the humanities were defensive about their relation to science. We have also discovered the many ways science itself comprises a literature that may be studied with tools often restricted to literary texts. The success of our work has come in no small measure through the thorough involvement of the faculty. A successful program in literature and science can thrive only if students see their teachers in the sciences and humanities alike meeting to wonder about their common inquiry.

—Kenneth J. Knoespel

"Literature and Science Introductory Course"/Paul B. Armstrong/Georgia Institute of Technology, Atlanta/$98,941/1984–86/Improving Introductory Courses

***Stonehenge was depicted in the volume of Blaeu's* Atlas Major *on England in antiquity. The text that accompanied the illustration was drawn principally from Camden's* Brittania.**

TEXT AND TRADITION



National Library of Medicine

This diagram by 16th-century physician Girolamo Cardona indicates a theory relating astrology and medicine.

In Washington University's College of Arts and Sciences, close to one-third of entering freshmen declare the goal of a career in medicine or health, and at least one-quarter of the students finally do take degrees in the sciences. Psychology (common for "premeds") and economics are becoming increasingly popular majors as well. Ultimately, an average of 25 percent of graduating students will attend medical or dental school, and 15 percent, law school. Although the university is proud of the quality of its preprofessional and career-oriented programs and their excellent placement records, faculty are nevertheless concerned that students in such programs often forgo liberal arts courses, choosing instead to specialize early and, as a result, overconcentrating.

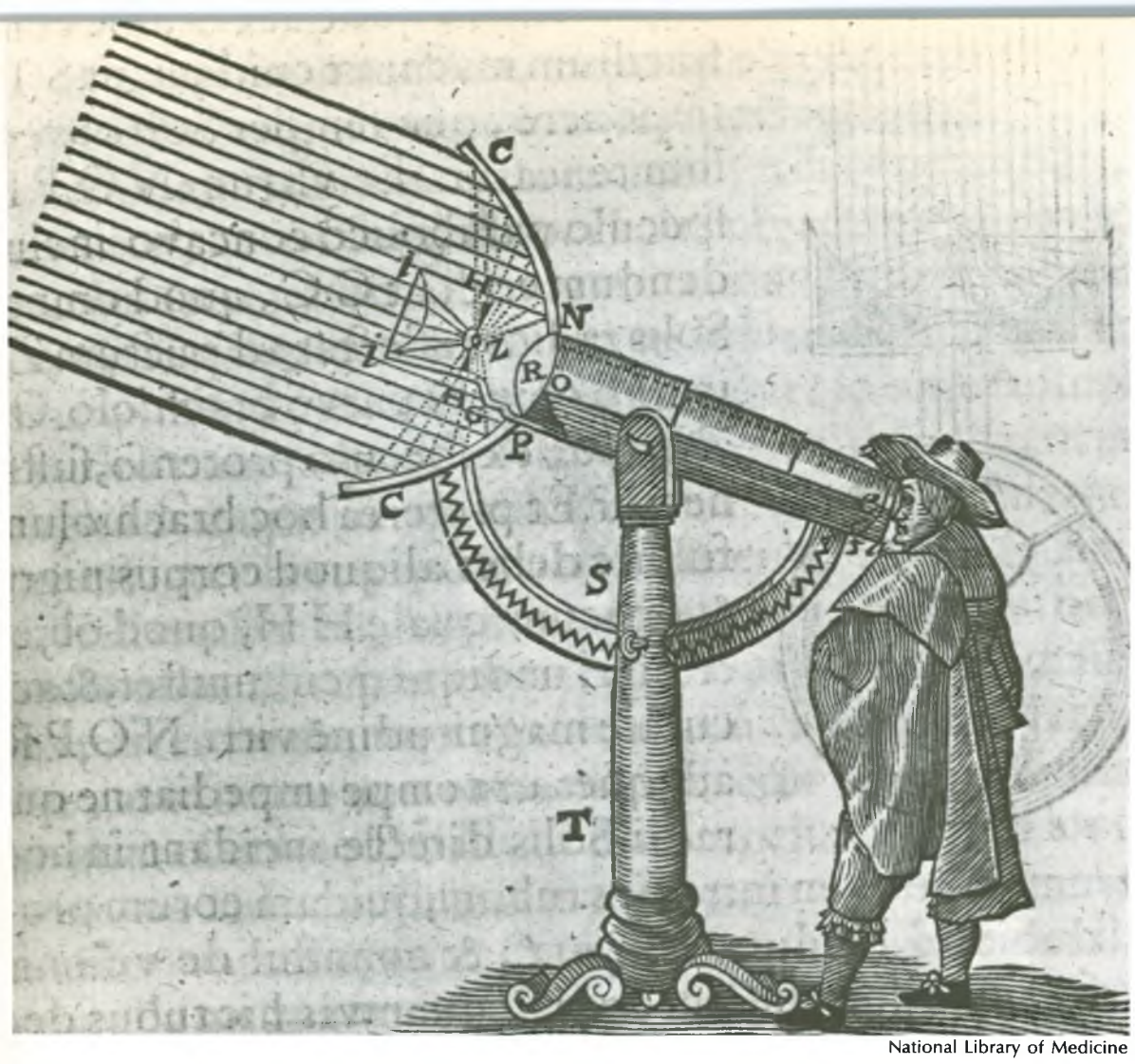
Like many colleges and universities recovering from the curricular shocks of the sixties, Washington University has reestablished stricter requirements for graduation through a series of curricular reforms in the last decade. An NEH-funded program, Text and Tradition, is the most recent of these reforms. Designed for science students, although not restricted to them, Text and Tradition seeks to attract preprofessional and career-oriented students to a "great books" minor that allows a liberal education and a highly specialized curriculum to coexist peacefully.

According to Linda Salamon, dean of the college and director of the program, Text and Tradition provides "the history of Western culture, including the development of inquiry and institutions in science and in social science as well as the humanities, by focusing on great Western texts."

During the 1985–86 academic year, only the first year of the Text and Tradition sequence was offered: a literature and a history course in the fall semester and a literature and a history of science course in the spring. During 1986–87, these first-year courses will be repeated, and the second year of the sequence will be introduced: in the fall a modern history course and a course in the ideas of the social sciences, and the final seminar in the spring. Thirty-five students registered for the program this past year; as these students continue with the second year, another thirty-five will begin the first-year sequence. Because students had to be turned away even the first time the program was offered, Dean Salamon expects to add two or three more sections after the initial two-year sequence is completed.

From an educator's point of view, Text and Tradition has two main advantages. First, the courses are not taught as surveys. "The context is important," says Salamon, "but we want, more than anything, for the students to engage the ideas in the text." So the classes focus on such topics as, "What is Cicero saying about liberty?" "What is it to be free?" "How can freedom exist in Rome, a slave society?" In this way the program provides an education at once more basic than surveys aimed at specialists and more comprehensive than a random choice of distribution requirements.

Second, Text and Tradition encourages new ways of thinking. According to Dan Shae, who teaches "The Emergence of the Modern Mind," one of the literature courses in the sequence, "There is sometimes in the science student a lack of flexibility. They want the answer, and sometimes they think that either the instructor or the writer is holding out on them, that they shouldn't use what literary critics call 'baffling structures' of irony or paradox because it throws them off. Ultimately, I think the science students will be better served by exposure to that kind of thinking. I assume flexible thinking is a considerable benefit in the sciences."



National Library of Medicine

Diagram from the **Opera philosophica** *on Rene Descartes showing the lines of vision and light through the lenses of a telescope.*

Each course in the program is organized by a central theme. For example, Salamon's co-coordinator George Pepe designed the ancient and medieval history course, which he taught with Peter Riesenberg, to cover "not just a sequence of texts from the classical period through the beginnings of the Renaissance but a sequence of texts that can be discussed around a couple of ideas, especially the notion of freedom." Last year Pepe and Riesenberg's students read Herodotus, Thucydides, Plato's *Republic*, Apuleius' *Golden Ass*, selections from Tacitus and Cicero, Augustine's *Confessions*, *The Cid*, *The Little Flowers* of St. Francis, and Machiavelli's *Discourses*.

Barbara Salert has designed the history of the social sciences course in the same way, focusing on the concepts of capitalism and democracy. The course examines how these concepts developed and changed over time, whether they are rational ways of organizing economic and political lives, and what is meant by "political" and "economic." With the courses offered for the first time this year, her students are reading selections from Adam Smith's *Wealth of Nations* and de Tocqueville's *Democracy in America*, Mill's *On Liberty*, Marx's *Communist Manifesto* and *Eighteenth Brumaire*, Freud's *Civilization and Its Discontents*, Keynes's "The General Theory of Employment" and "My Early Beliefs," Mancur Olsen's *Logic of Collective Action*, and Robert Axelrod's *Evolution of Cooperation*.

Dan Shae announced no general theme in his modern literature course, but he found that "constellations of themes" inevitably recurred. A reading list that included *Paradise Lost*, *Candide*, part one of *Faust*, *Notes from Underground*, *Madame Bovary*, *Walden*, *The Waste Land*, *One Hundred Years of Solitude*, Kierkegaard's *Fear and Trembling*, Nietzsche's *Ecce Homo*, and Freud's *Civilization and Its Discontents* consistently raised such topics as conscious rational thought versus the unconscious; declarative statements versus subversive, ironic statements; belief and unbelief; self-destructiveness; and heroism. "No sooner did we finish *Paradise Lost* than *Candide* raised the issues of the paradise of El Dorado, the Fall, and the nature of man generally," says Shae.

Students in the inaugural year of Text and Tradition welcomed the chance for discussion in small classes. "These are students," Salamon says, "who are spending the rest of their lives at the university in seventy-person calculus classes and 200-person chemistry classes where they never get to open their mouths." Because Text and Tradition is a two-year program requiring only two courses each semester, it can be pursued concurrently with a full freshman- and sophomore-year load of science courses. The program therefore allows science students to fulfill their requirements outside the sciences in a coherent way and to get credit for a minor in the process.

The program has also been popular with the faculty. Riesenberg remarked, "It's the kind of teaching I like to do. It's meeting the kids early on, bright kids who have indicated a certain commitment or a certain excitement for ideas at the beginning of their college career. You attempt to grab them by effective teaching, by effective choice of texts, to grab them with the excitement of these books, why they have survived. . . . It's dangerous teaching, if you will; at the same time it's responsible teaching." Shae found himself discovering the texts along with the students: "You're not a specialist, so there's a similarity in the way you approach the material."

Text and Tradition will not be officially evaluated until next spring. But its popularity as a minor with both faculty and students seems already to have ensured its retention, and some students have expressed interest in expanding the program into a major. Of course Dean Salamon and her colleagues want students to adopt the program for its excitement and value, not just because it is an easy way to fulfill distribution requirements. The goal of Text and Tradition is summed up in Pepe's pitch to the students: "If you sell these books at the end of the year, then we've failed. These are not books you ought to sell."

—Joseph H. Brown

"A New Minor in Humanities Texts and Traditions"/Linda B. Salamon/ Washington University, St. Louis, MO/ $481,182/1986–88/Fostering Coherence Throughout an Institution

by Dennis O'Brien

The magnetometer that found Santa Catalina

Sparsely populated, as it has been for most of the past 300 years, St. Catherines Island is unknown to most modern Americans. Yet, symbolically, this remote coastal island may be one of the most important sites in North America's early history.

Because of its strategic location along the coastline of what is now Georgia, it was an important area of Indian settlement for 4,000 years before Europeans arrived. About 1,000 years ago, the Guale (pronounced wha-leh) tribe took control of the island and remained the most powerful tribe in the region. Here indigenous peoples and Europeans met for the first time along the eastern seaboard. The island was one of the northernmost permanent settlements of the Spanish colonists in America. And it was the scene of an important clash between British and Spanish forces in the struggle for control of the southern end of the east coast of what would eventually become the United States.

Most of this history would have remained forever buried were it not for dramatic technological developments in archaeology. The work of David Thomas and the St. Catherines Island project is a showcase of the archaeology of the 1980s—a meeting of advanced technology and traditional methods.

A Rich Past—Buried

In 1568, Spaniards moving up the coast from the new settlement of St. Augustine established a Catholic mission, Santa Catalina de Guale. The Indians they met were the first on the continent to be converted to Christianity, and in the years that followed more Guale came to the mission settlement, assuming Spanish customs.

In 1597, a rebellion by the Guale left the mission a burnt ruin and several Franciscan priests murdered. But the Spanish maintained control and rebuilt the mission during the following years. Late in the seventeenth century, the British began to exert pressure southward. In 1680, they attacked Santa Catalina. Outnumbered twenty to one, the Spanish and Guale defenders fought off the British but decided to flee south to St. Augustine.

Santa Catalina de Guale was abandoned, a marker of the eclipse of Spanish power in the region, and the Guale Indians, many of whom were converted to Christianity, left their home territory forever and were resettled mostly in Cuba, where in time their tribal identities faded into the Spanish culture.

Captain Dunlop, an English seaman, gave an account three years later of the deserted settlement, majestic but already being swallowed up by wild vegetation. That was the last anyone would see of Santa Catalina for three centuries.

A Needle in a Haystack

When David Thomas arrived on St. Catherines for the first time in 1974, he faced a mammoth task: discover and realize the archaeological potential of a 14,000-acre island of messy swamps, briars, live oak, palmetto, dead trees, and an assortment of pests ranging from chiggers, ticks, and spiders to alligators, rattlesnakes, and cottonmouths.

In 1981, after seven years of clearing, exterminating, and excavating, the archaeologists located and began uncovering Santa Catalina de Guale. They found the church, rectory, and barracks. They located the mission's well. The site contained many Spanish artifacts. And within the confines of the church, which according to seventeenth-century Spanish custom also served as the cemetery, they found the remains of 500 converted Guale, arranged evidently according to their social status. The work on St. Catherines is contributing to the revision of early colonial history, which was previously almost entirely biased by a British viewpoint that made light of the century-long Spanish presence along the eastern seaboard.

The Spanish mission of Santa Catalina de Guale might never have come to light had it not been for great strides in technology that have come into the hands of archaeologists in recent years, especially during the past decade. When Thomas arrived in 1974, there was no evidence that any structures of the mission remained; and if they did, he knew only that they would be somewhere on the western side of the Manhattan-sized island. Without the new equipment, Santa Catalina would have been virtually impossible to find. The only recourse would have been, as Thomas describes it,

Aerial photograph of Santa Catalina mission complex with a graphic overlay showing buildings and fortifications.

"destructive test trenching and obnoxious heavy-duty operations that would have destroyed so much that we wouldn't have known what we were looking at."

Fancy Gadgets

Thomas began with a systematic survey of the entire island, testing a 20 percent random sample of sites. During this survey stage, promising spots were investigated using one of the simplest and crudest of the tools of modern archaeology—the power auger. "It's really high-tech," Thomas jokes. But this machine, which is basically a power post-hole digger—used by archaeologist Kathleen Deagan in the mid-1970s—revolutionized the process of pinpointing where within a large area one should excavate. "You have a couple of people go out and dig some holes in no time. Then you screen the stuff coming out," Thomas explains. "It's primitive; you're sacrificing stratigraphy and maximizing area coverage. But it causes minimal subsurface destruction.

"Every part of archaeology is destructive. We're one of the few sciences that manages to destroy our own data. We always have to weigh to what degree we are willing to destroy it."

The 20 percent random sampling uncovered about 135 sites, suggesting that the island, fully excavated, would yield 650 to 700 sites. Fifty more sites were found by other means.

The random sampling also indicated that the probable site of Santa Catalina could be narrowed from an initial area the size of 100 football fields to one the size of twenty-five. Late in 1980 at a party in Knoxville, Thomas heard about a device called a proton precession magnetometer.

A magnetometer measures slight variations in the strength of magnetism between the earth's magnetic core and the device's sensor. The variations need not be caused by iron or metal. When hundreds of measurements are arranged on a grid, a magnetic map is created.

Quickly he arranged to get one of the devices, and several technicians from Texas A&M University conducted the survey. "Most of what we're taking is a spinoff from oil prospection," Thomas says. "It was initially set up to work on the scale of kilometers, and we're reducing it to meters."

The survey took only one week. Anomalies that appeared on the map pointed Thomas to the Santa Catalina well and to fallen walls of two missionary structures, including the church.

But the archaeologists at St. Catherines didn't stop with the magnetometer. Thomas's strategy is to use numerous techniques in an effort to get as many perspectives of the site as possible. What one method may miss, another may detect; what one may hint at, another may corroborate.

Researchers from the University of Georgia and the University of Florida did an electronic resistivity survey. Four electrodes are placed in a line in the ground at prescribed distances. A current is passed between the most distant ones, and the center two electrodes measure the resistance. Many readings help to create a map that, like the magnetometer mapping, can point to features or objects below the surface.

The innovation Thomas seems most excited about is ground radar, a technology just being developed for sensing directed into the ground instead of into the air.

The archaeologists have also taken to the air. Low-level aerial observation and photography—infrared, color, and black and white—from a helicopter hovering several hundred feet above the site permit them to see things that elude observation at ground level.

With sites located and excavated, and with objects and remains removed, the archaeologist's job is by no means over; examination of the objects must be made. Here, too, new technology has come to the fore. Members of the St. Catherines team are attempting to refine dating methods that have been popular in prehistoric archaeology—radiocarbon dating and thermal luminescence testing.

Physical anthropologist Clark Larsen of Northern Illinois University, a former student of Thomas, has made many important discoveries about mission life through use of paleoautopsy. By meticulous study of the bones—which are being carefully handled, then properly buried in accordance with Catholic rites—Larsen has painted a thorough picture of the diet, diseases, and general health of the Christianized Guale. He has shown that the Indians suffered a decline in general health after converting from their native ways to Spanish customs.

The Dig of the Future

Despite these exciting developments, the heart of archaeology remains the painstaking, manual excavating process—trowels, toothbrushes, dental picks, and work that progresses by inches per day. Little advancement has been made in these tedious practices. Does technology hold anything in store for this vital aspect of the science? David Thomas envisions a radical leap in how archaeologists approach sites. And this leap is not far way. "Within a decade," he suggests.

"We're defining data in a new way. Many people, and many archaeologists, think data are the objects you hold in your hand—the gold coins or bronze medallions that you can present in a museum. Those aren't data; those are objects. Scientists' data are the observations on those objects. We're creating a new conceptualization of what data really mean. We're scratching that surface now. We're already generating meaningful data; there are things that we know about Santa Catalina that we have yet to see.

"As archaeologists we've always done tactile sensing—you know it's real because you can hold it. Now we're moving to remote sensing, where it can be just as real, even if you only see it from a distance." Thomas sees an analogy between archaeology today and medical science over the past two or three decades.

"Today surgeons perform pinpoint arthroscopic surgery on athletes' knees; they do laser surgery on the cornea. They minimize the destruction of the surrounding tissue with pinpoint work. The more doctors can do with CAT scans and mapping, the better; and it's the same problem, whether you're mapping the brain or an archaeological site—getting its configuration before going in physically. We won't have what happened with archaeologists of earlier generations, such as Schliemann, who actually dug through the Troy he was looking for."

At St. Catherines, the entire mis-

sion area has been studied by remote sensing, but when Thomas's work there is complete, the team will have excavated no more than 30 percent of the site. However, Thomas decided to uncover completely the cemetery with its 500 skeletons and many artifacts, such as crucifixes, medallions, jewels, and ceramics. The unique opportunity of working with an entire population, not just a small sampling, was too important to pass up. The relatively advanced state of technology in bone studies—as reflected in Larsen's work—was a prime factor.

The cemetery discoveries, along with the thousands of everyday items—pottery, utensils, tools—provide a detailed picture of life in the seventeenth-century Spanish mission. But 70 percent is being left intact. Walls are being left intact, and parts of buildings have been exposed, but deliberately left unexcavated. It is a difficult decision for an archaeologist, but one that recognizes the limitations of today's technology. Five years ago, remote sensing clearly showed a 45-degree angle of a building corner. They dug and found nothing. Thomas put a stop to the work. By this year, weathering made that particular feature visible from the air.

"Ideally, we could generate a set of data on St. Catherines in 1986; and someone else could come in 1996 and generate a new set of data on those same objects and features, still buried; and someone could come in fifty years and generate another set of data. And none of us would ruin the data base by digging it up and taking it out of context.

"And each one comes not only with better technology, but better and more incisive questions. The questions you ask about all these data are all theory based, and they're generated from a body of epistemology—what we think we know and how we think we know it—and that changes. The archaeology of twenty-five years ago asked very different questions from those we're asking now. And archaeologists twenty-five or fifty years from now will ask far more sophisticated, subtle questions."

—Matthew Kiell

A documentary film about this project received support from the Georgia Endowment for the Humanities.

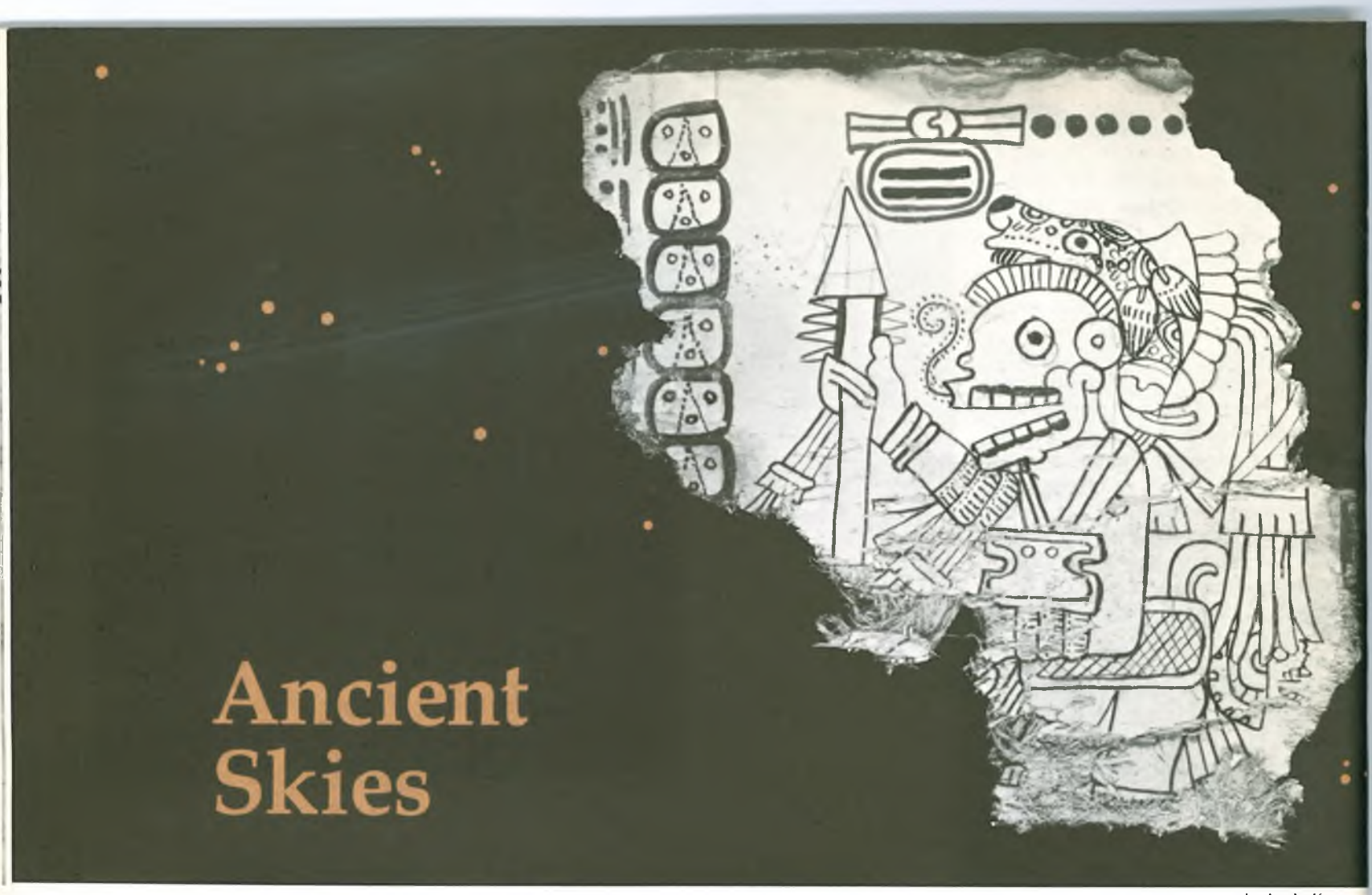
(clockwise from right) Researchers examine a computer readout from a ground-penetrating radar survey of the mission; Project Director David Thomas; swampland and tidal creek, St. Catherines Island; Mark Frank excavates majolica plates from the church burial ground.

by Dennis O'Brien

by Clark S. Larsen

by Lorann Pendleton

Ancient Skies



by Justin Kerr

Page 2 of the Grolier Codex shows one of the skeletal, evening-star Venus gods with a jaguar-pelt cap and spear.

An Egyptian priest standing out under a crystal clear desert night sky at Gizeh in Egypt 4,500 years ago would have many signs to interpret. The moon, near full, is rising in the east. There is still a hint of twilight to the west. He notices the bright, unblinking white light of the planet Venus, the "Evening Star," right beside the red eye of Mars—a close conjunction. If a modern astronomer were to look to the right, away from the north face of the Great Pyramid, he would see Polaris, the bright, white North Star, but the ancient priest sees a different sky. A wobbling movement in the earth's rotation on its axis (precession) has changed the orientation of the earth toward the stars. The Egyptian has never seen Polaris here. Instead he finds Thuban, a pale yellow star astronomers call Alpha in the constellation Draco, the Dragon.

The recreation of ancient skies—a specific evening like the one described at Gizeh in the Old Kingdom or at any other time and place—is just part of the fascination of archaeoastronomy, a new "interdiscipline" that benefits from the scholarship of the sciences and the humanities. Science, in the form of modern astronomy and astrophysics, can show us how that night sky would have appeared, in considerable detail. The planetarium is being used as a research tool for this purpose. But understanding how the priest interpreted those details is not a matter for science. Experiencing that unique evening through his eyes that see the sky alive with their powerful myths, portents, and pantheons requires the scholarship of the humanities.

In its broadest sense, archaeoastronomy is the study of the astronomical practices, sky lore, mythologies, religions, and cosmologies of ancient peoples and the surviving indigenous cultures of the world today. This latter category is often called ethnoastronomy where such topics as calendrical divination among the Highland Maya Indians in contemporary Guatemala or the star compass of the native navigators of Micronesia are explored. In these areas some of the best research has resulted from cooperative efforts. An anthropologist may team up with an astronomer or an art historian with an astrophysicist. Archaeoastronomy requires that researchers have a willingness to develop a working acquaintance with the language and scholarship of other fields. Often, a cultural anthropologist working with a people will find that individuals in the native society know much more about the workings of the sky than he. The ethnologist then seeks out an astronomer or planetarium director for help. Or, an astronomer using an observatory in some distant part of the globe becomes fascinated with the temple architecture, urban design, or art of some ancient civilization. He may find an architect or art historian who has been approaching the same questions for years from another perspective. Barely twenty years ago, this process of synthesis was random, but now there exist several pubications and organizations such as the Center for Archaeoastronomy that serve as clearinghouses for the field.

A rapidly growing "invisible college" aids this process of intellectual matchmaking. Since the early 1970s, an increasing number of conferences and symposia under a range of sponsors have been de-

by J.B. Carlson

Detail from the facade of the Palace of the Governor, Uxmal, shows a long-nosed rain god mask. The glyph for the planet Venus appears on the lower eyelids.

voted to archaeoastronomy and ethnoastronomy in general and to specific cultures such as the Megalith Builders of Europe or the Maya of Mesoamerica. At one such event, "The First International Conference on Ethnoastronomy: Indigenous Astronomical and Cosmological Traditions of the World," participants from more than a dozen disciplines within the sciences, arts, and humanities were represented. Sponsored by the Center for Archaeoastronomy at the University of Maryland, the Smithsonian Institution National Air and Space Museum, and the Historical Astronomy Division of the American Astronomical Society and made possible by a grant from the National Endowment for the Humanities, this weeklong conference at the Smithsonian in September 1983, provided a forum for seventy presentations covering most of the major culture areas of the world.

Archaeoastronomy differs from the history of astronomy because it is a less restricted field devoted to broader questions about a broader range of data. In the history of astronomy the scholars tend to be historians dealing with textual sources. By and large, they have been interested only in the Western tradition: the "exact sciences" and mathematical astronomy of the Sumerian, Babylonian, Egyptian, Greco-Roman, Islamic, and Renaissance traditions that have led to modern Western science. The mathematics and astronomies of ancient China and India and the developments of, say, the Classic Maya civilization have been all but ignored because these scholars are usually historians of science and have been interested in indigenous classification schemes and divinatory practices such as astrology only in so far as they seem to lead to modern science.

The renowned historian of science Otto Neugebauer was instrumental in encouraging broader studies, like those in archaeoastronomy through a criticism of the conservative father of the history of science, George Sarton. Neugebauer's classic note in the June 1951 *Isis* on "The Study of Wretched Subjects" responded to Sarton's review of a then recent publication of the Mandean "Book of the Zodiac" as "a wretched collection of omens, debased astrology and miscellaneous nonsense." In Neugebauer's words, "Because this factually correct statement does not tell the whole story, I want to amplify it by a few remarks to explain to the reader why a serious scholar might spend years on the study of wretched subjects like astrology." He concludes his critique of Professor Sarton with the observation that, "When the recognized dean of the History of Science disposes of a whole field with the words 'the superstitious flotsam of the Near East,' he perhaps does not fully realize how much he is contributing to the destruction of the very foundations of our studies: the recovery and study of the texts as they are, regardless of our own tastes and prejudices." From the perspective of archaeoastronomers, Neugebauer was correct, but presents a narrower view than that represented by this emerging field. His interests were the pursuit of the textual sources of the history of the "exact sciences." Archaeoastronomy is the study of all such systems of astronomy and related practices in their cultural context, for all cultures, and using all types of available data.

Even Western science is pursued by archaeoastronomers as part of culture to be understood as such. From the cultural perspective of archaeoastronomy, there are no "wretched" subjects, data, or cultures. To understand Babylonian astronomy one must seek the Babylonians themselves through their art, architecture, and the archaeological evidence as wells the written record they have left. The history of science is only one part of the study of the history of culture, and the history of astronomy is a branch of what has come to be called archaeoastronomy.

The Venus cycle in the world of the Maya of ancient Middle America illustrates the methods and results of archaeoastronomy. During the first millennium A.D. largely in the lowland jungles of Mexico, Guatemala, Belize, and Honduras, Maya-speaking peoples created one of the brilliant civilizations of the New World. They developed a unique system of hieroglyphic writing, a sophisticated mathematics and astronomy, and perhaps the most elaborate ritual calendar the world has seen. Two of the most vital components in this system are a 260-day divinatory almanac (composed of two intermeshed cycles of 13 numbers and 20 named days) and an unadjusted 365-day "year" composed of 18 months of 20 days each and an epagomenal month of five days to complete the count.

The Maya were intensely interested in the appearances and disappearances of the planet Venus, a god whom they saw as a manifestation of the Plumed Serpent called Kukulcan. They were aware that it appeared in the east, rising ahead of the sun to become the morning star, only to disappear into the Maya underworld to transform into the evening star in the west. The full "synodic period", as astronomers call it, from the first appearance of Venus as morning star through its evening star manifestation, then back to morning star again takes almost exactly 584 days. This period was used by the Maya to create a complex almanac commensurating the 584-day Venus calendar with the 260-day and 365-day cycles. They gloried in the astronomical coincidence that five Venus cycles of 584 days exactly equaled eight years of 365 days giving a total of 2,920 days. They further compounded this with the 260-day almanac creating the Great Venus Round of 37,960 days, that is 65 Venus cycles, 146 260-day cycles, and 104 years. Now a modern astronomer can tell us that the synodic period of Venus is actually 583.92 days on the average, not 584. After the 104-year Great Venus Round, the almanac will be an average of 5.2 days off from astronomical reality. The Maya knew of this discrepancy and came to use a correction scheme that gave their tables a long-term accuracy of one day in 6,000 years!

How do we know this? Of only four Maya books that have survived the destructive forces of time and the Spanish Conquest, one, the Dresden Codex, contains the most elaborate version of the Maya Venus Almanac complete with correction table. Ernst Förstemann, the librarian of the Royal Public Library at Dresden, was the first to decipher the basics of the tables and published his results in 1886. Near the turn of the century, the great German Americanist Eduard Seler described three additional Venus almanacs found in other pre-Columbian books from Central Mexico elaborating the gods and rites associated with Venus. But the question still remained: For what purpose did the ancient Mesoamericans use these astronomically sophisticated Venus almanacs?

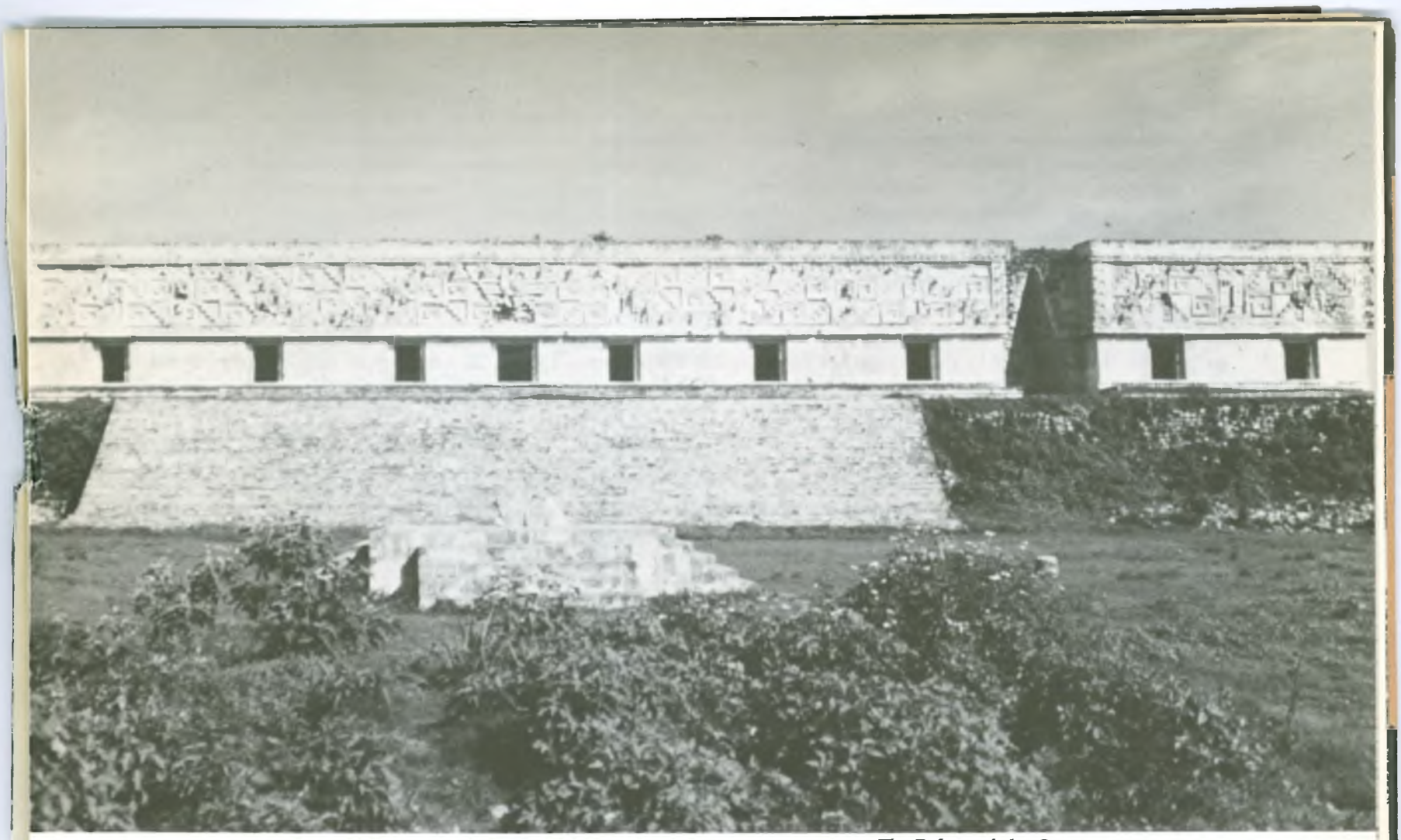
The real picture of Venus in the Mesoamerican world has begun to emerge only in the last decade or so, and the discoveries depend on the type of interdisciplinary cooperation called archaeoastronomy. Three major developments have taken place. First, in the early 1970s astronomer Anthony Aveni began a long professional collaboration with Mexican architect and urban planner Horst Hartung to explore and measure the alignments of buildings and site plans of ancient centers. Among the most intriguing of their discoveries were buildings aligned to the extreme rise or set positions of Venus on the horizon. The spectacular Palace of the Governor at Uxmal is the most impressive example.

Uxmal was a Late Classic Maya city that flourished in northern Yucatan during the latter half of the first millennium A.D. The Palace of the Governor is perhaps the greatest Maya edifice extant with the tallest

by J.B. Carlson

corbel vaulted arches known. The facade is decorated with elaborate masonry mosaics that include numerous masks of the long-nosed Maya rain god, "Chac." These masks routinely adorn the temples of Maya buildings throughout this area in Yucatan, but Eduard Seler long ago noted that the rain god faces on the Palace of the Governor all had Venus hieroglyphs on their lower eyelids. This was the same glyph found for the planet by Förstemann in the Dresden Codex Venus tables. We now know that this is the only appearance, with one exception also at Uxmal, of the Venus glyphs in conjunction with such Chac masks.

The Palace of the Governor faces to the southeast and this structure as well as the massive artificial platform on which it is built are skewed in orientation 19 degrees clockwise from the common axis of most of the other buildings at the site. Aveni and Hartung were intrigued with this and have carefully measured the line looking perpendicular to the facade at some 28 degrees south of east on the flat Yucatecan horizon. They found that precisely on the line



The Palace of the Governor, Uxmal.

there is a bump on the horizon. This is a 25-meter-high temple pyramid six miles away at another site named Nohpat—almost certainly located there in this relation to the Palace of the Governor by design. Not only does the line from the central doorway of the Palace point to the principal pyramid of Nohpat, but it also indicates the position where Venus would have risen at its maximum southern excursion about A.D. 800 when the structure was erected. We may remember that the five Venus cycle/eight-year period was important to the Maya as demonstrated in the Dresden and other tables and in carved inscriptions on monumental architecture.

Recently art historian Jeff Kowalski, who has studied the Palace of the Governor, made the significant discovery that the ruler of Uxmal who made this his residence had the same name glyph as that used in the Maya codices for the rain god, Chac. There are a great many detailed arguments in Kowalski's careful analysis of the hieroglyphic inscriptions and early colonial documents that attest to ancient rulers of Uxmal with Chac in their names such as Hun Uitzil Chac. It does now seem convincing that a great Maya lord who took the name of the powerful rain deity for his own constructed a palace with a significant Venus alignment and decorated it with more than 350 masks of Chac with the Venus glyph inscribed on each of the lower eyelids. But, what was the significance of Venus for the Maya?

The second major development in the unveiling of the Maya Venus involves a diverse group of scholars working on seemingly separate problems. Maya epigraphers such as anthropologists David Kelley, Berthold Riese, and Peter Mathews had identified a verb in the hieroglyphic inscriptions that functioned as a battle, raid, or war event. Captives were often taken for later sacrifice. This hieroglyph, in several different forms is usually called the "shell/star event" because the Venus glyph is part of its composition. Why? Kelley and mathematician Michael Closs had come close to solving the puzzle, but anthropologist/linguist Floyd Lounsbury made the breakthrough with the stimulation of questions posed by an art historian.

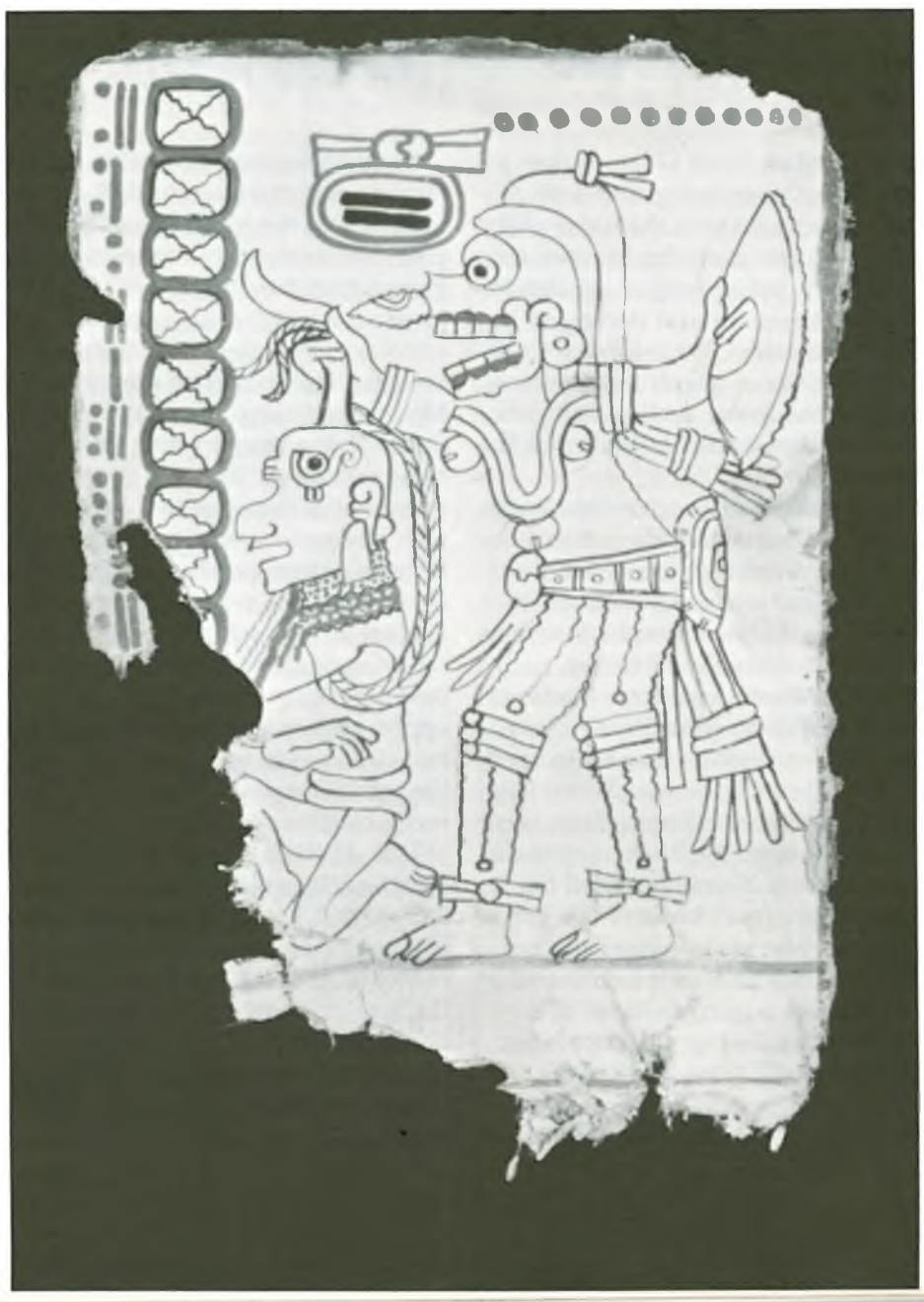
Mary Miller was researching the famous polychrome murals found in the 1940s at the Maya site of Bonampak. Her analysis of scenes suggested that they record an heir designation event, which involved an astrologically timed ritual battle and the final celebration of the victors. More specifically, she found evidence in the imagery and inscriptions to suggest that the great battle event had something to do with Venus. She collaborated with Lounsbury to determine that the battle event most likely took place on A.D. August 2, 792, which was both a rather special "inferior conjunction" date for Venus (it would likely first appear as morning star the next day) and it was also solar zenith passage day—the day the sun would pass directly overhead.

This discovery of an astrologically timed battle involving the planet Venus started Lounsbury on the track of a major discovery that has demonstrated that the "shell/star event," the war event of the classic inscriptions, contained the Venus glyph because such events were timed for significant stages in the Venus cycle. A picture of the astrology of Classic

Maya ritual warfare had emerged with Venus as the chief protagonist. In this research Lounsbury had solved, to most scholars' satisfaction, the old problem of the correct correlation of the Maya calendar with our own. He also found a new glyph for Venus, a toothy skull, which usually functioned in the context of Venus as evening star.

The third chapter in the Venus warfare story involves the comparatively recent discovery of the fourth known Maya book which has come to be called the Grolier Codex. This fragment of a screenfold Mesoamerican Codex book composed of stuccoed, painted bark paper was apparently found in a dry cave in Mexico in the 1960s and acquired by a Mexican collector of antiquities. Anthropologist Michael Coe saw the Codex, decided it was genuine, and arranged to have it exhibited in 1971 in New York at the Grolier Club exhibition on Maya art and writing. It immediately created a sensation that polarized the scholarly community. Was the Codex genuine or a modern forgery? The paper was radiocarbon dated and found to derive from the thirteenth century A.D., but some claimed it was a modern forgery on ancient paper.

The Grolier Codex was easily recognizable as a fragment of a Maya Venus almanac resembling the calendrics of the Dresden Codex. However, it differed stylistically, reflecting a hybrid of non-Maya influences that were common at the time it was composed. It depicts an array of Venus gods, manifestations presiding over all of the stations of the eight-year Venus cycle. Quite the opposite to Venus in the Western world—the Ishtar of the Babylonian cultures or Aphrodite-Venus in the Greco-Roman tradition—Mesoamerican Venus gods were hostile, death-dealing entities that speared or decapitated their victims, particularly at first or last appearances in the cycle. Venus is essentially the "Mars" or war god of ancient Mesoamerica. This realization and its implications have only recently become apparent.



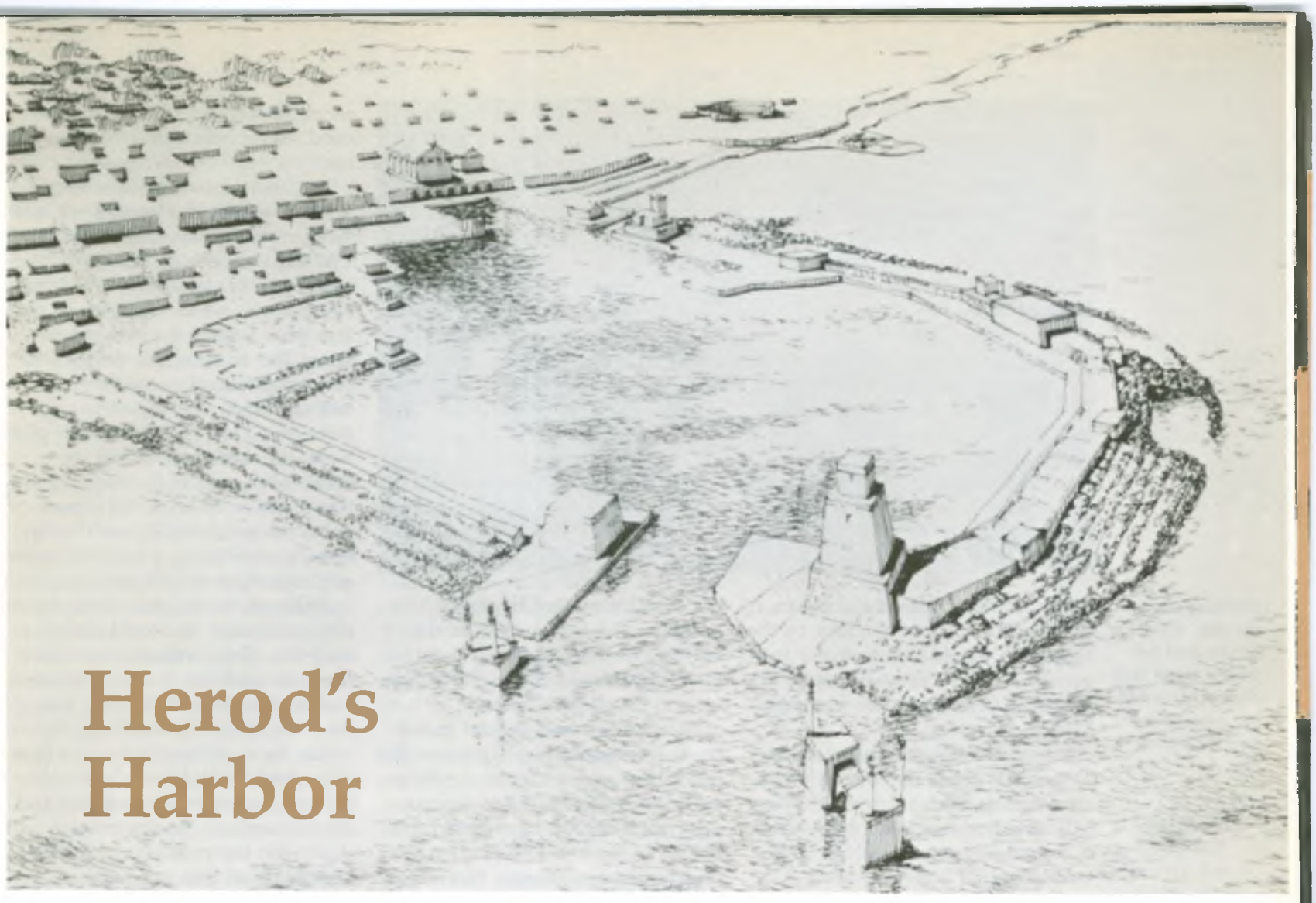
by Justin Kerr

Page 6 of the Grolier Codex shows a skeletal, evening-star Venus god decapitating a bound captive. Recent interdisciplinary studies have uncovered a relationship between these figures and those on monumental architecture (see photo, page 25). The discoveries have explained the purpose of the intricate Venus almanacs.

While studying the Grolier Codex and other Venus almanacs, I made discoveries that authenticated the Codex as a genuine pre-Columbian book and extend the implications of Venus as a god involved with the astrology of ritual warfare in broader Mesoamerican contexts. Essentially, I was able to show that the Grolier contained information that could not have been known to an alleged fabricator in the 1960s. It is genuine. Fragments of what were thought to be two pages (10 and 11) were shown conclusively to be portions of the same page. The resulting figure of a skeletal Venus god presiding over first appearance of Venus as evening star then fit into a pattern of such skeletal evening star gods discovered the previous year by Lounsbury. This and additional evidence weave for us a more complete picture of the Venus almanacs. Their structure had been known but their purpose was a mystery. They are now seen as the almanacs governing ritual warfare, sacrifice, and related activities for a broader spectrum of Mesoamerican cultures. For additional reasons, it now seems likely, though unproved, that the "flowery wars" of the Aztecs of Central Mexico, battles arranged in advance so warriors could prove their prowess and obtain captives for sacrifice, were timed according to the cycles of Venus by calendar priests using these and related almanacs.

The promise of archaeoastronomy as a new venture in interdisciplinary scholarship is to show us the ancient skies—not merely the sky of Uxmal in A.D. 800 projected on a planetarium dome, not even the celestial realm of the Maya calendar-priest astronomer with his astronomical observations, planetary tables, and "exact sciences." We would stand beneath the skies of Lord "Chac" of Uxmal and experience with his court and the people of his kingdom the cosmos through the eyes of their culture. Neither the physical sciences nor the humanities can approach such problems alone. It is the union of the two that will give us these ancient skies, and, I believe, the skies of the future as well.

—John B. Carlson



Herod's Harbor

Artist's conception of the "modern" harbor built in Herod's city, Caesarea, on the Mediterranean coast of Israel.

On the coast of Israel at a point midway between the modern cities of Haifa and Tel Aviv lie the ruins of the ancient city of Caesarea Maritima and its harbor Sebastos. As the capital and major seaport of ancient Palestine for more than 600 years, Caesarea was the economic, political, and cultural focus for the entire eastern Mediterranean. Sand dunes now cover much of the area, and only from the air when the sea is calm can the ruins of the ancient harbor complex be seen clearly in the form of two shadowy, sunken breakwaters, extending outward into the sea.

The city and harbor were built by Roman engineers for King Herod the Great sometime around 22 B.C. on the site of a small Hellenistic port called Strato's Tower. According to the Roman historian Josephus (*Jewish War* 1.408–14; *Jewish Antiquities* 15.331–41), the harbor was completed and dedicated to the emperor Augustus in 10 B.C.

Josephus was born in about A.D. 37 and therefore did not witness the actual construction of the city and its harbor, but he provided a fairly detailed account of the harbor's structural features. He wrote that a roughly circular harbor was created by extending two breakwaters out from the shore, which runs north to south. The south breakwater ran west and curved to the north at its seaward end. The shorter north breakwater extended westward to within about 50 or 60 meters of the end of the south breakwater. A wall with towers ran the length of the southern breakwater (Josephus gives its breadth as 100 Roman feet), and at the entrance of the harbor were six colossi—three on either side.

Since 1950, limited archaeological explorations conducted at Caesarea Maritima have confirmed the site's potential for unveiling more than a thousand years of history. Except for a kibbutz built nearby in 1940, the area had not been inhabited since the late thirteenth century A.D., and most of the area of archaeological interest was readily available for exploration and excavation.

Underwater explorations of the submerged sections of the harbor were conducted by the Undersea Exploration Society of Israel and the Center for Maritime Studies of the University of Haifa in the 1960s and early 1970s. In 1979 the Caesarea Ancient Harbour Excavation Project (CAHEP), which has received support from NEH, was formed to develop and implement a plan for systematic, stratigraphic excavations in the entire harbor complex.

"If we look at the ancient past," says project codirector Robert Hohlfelder of the University of Colorado, "we can be very impressed with the temples and the cities and, in this case, the harbors of the Romans and, before them, the Greeks. But what we don't know is *how* they were built. This type of information just simply doesn't come down to us in literary sources, given the biases of the writers, who were far more interested in capitals and kings than in how to build a ship or how to build a crane. Because we don't know how things were done, the ancient monuments have to speak for themselves."

The builders of Sebastos, whose names have not survived in records of that era, were sent across the Mediterranean from Rome to build a

Drawing shows the size of the blocks that fell from a tower into the Caesarea harbor sometime before the Byzantine era.

harbor for King Herod the Great, who had been given the area by the Emperor Augustus as part of a reorganization of the Roman Empire following his victory in the war with Mark Antony.

It was not a good site for a harbor—no cape, no bay, an unstable coastline, and a current running from south to north along the shore (a longshore current), which constantly carried a great deal of sediment, assuring that erosion and siltation would be problems. In addition to an inadequate supply of drinking water, frequent heavy storms buffeted the coast, making it possible to work only a few months out of the year.

To build this harbor required daring solutions to extraordinary engineering problems. It required inventing the technology to deal with siltation and underwater construction. And, judging by the fact that it was finished within less than a decade, it also may have required meeting deadlines that only a king ill-versed in the realities of harbor construction could demand.

Traditional methods of harbor construction—carving the harbor into the coastline, taking advantage of natural features—probably would have sufficed had there been any good natural features at Caesarea, but Herod also wanted the port itself to extend out into the open sea. There is no archaeological evidence that building structures on the breakwaters themselves had ever been attempted, says Hohlfelder. Fortunately, the Romans had recently stumbled upon a new building substance called hydraulic concrete, and by the time of the building of the harbor at Caesarea, Hohlfelder thinks they were beginning to experiment with it.

The Romans had noticed that if they used lava rock as aggregate, the concrete would set more rapidly—even under water. The physical principle involved—the more rapid release of heat—was unknown to these ancient engineers. Nevertheless, twentieth-century concrete used in underwater construction exhibits the same heat-releasing features as those the ancients had discovered.

The Roman engineers, perhaps deciding not to take any chances with local materials, imported the critical ingredient, a volcanic rock from the Bay of Naples, by ship from Italy to Israel. They also imported all of the building material for the wooden frames into which the concrete was to be poured.

Harbor excavations in 1982 revealed that a significant portion of both breakwaters was composed of blocks of concrete, some as large as 150 square meters, which were poured into wooden formwork under water. Some of the wooden beams that held the forms together have also been discovered. The immense concrete blocks had specialized uses. Some enclosed the end of the northern breakwater. Others lined the seaward face of the southern breakwater, which was composed of smaller rubble on a gravel foundation, protecting it from the force of the waves and the strong longshore current. This arrangement, Hohlfelder says, is the same used for rubble-mound breakwaters today.

The ancient builders also found a way to mitigate the force of wave attack on the breakwaters. The CAHEP team has discovered a platform of rubble wider than the breakwater itself and as much as .80 meters thick laid on the sandy ocean floor. This feature was designed to prevent the breakwater from undertrenching by weakening the force of the waves. Without the platform, the waves would hit the breakwater, and as the force of the waves drove down to the ocean floor, the sand would wash away, thereby undermining the breakwater and causing it to collapse.

Although the builders chose not to rely exclusively on local building materials, they probably did search for local solutions to local problems. Hohlfelder thinks it is likely that they might have roamed up and down the coastline, looking at how other harbors had been built earlier—perhaps visiting Sidon and Tyre to see how the Phoenicians had dealt with the problems of the longshore current that ran south to north, carrying silt from the Nile and the Sinai.

At these harbors, there would be evidence showing how Phoenician builders centuries before the Romans had dealt with siltation by leaving channels in the enclosing arms of their natural harbors to cleanse the harbor of silt. Archaeological research at other sites has shown that similar systems were common to other Levantine ports constructed hundreds of years before Caesarea.

At Sebastos, the excavation team found evidence of channels or moats cut into the breakwaters and running north to south. One such channel contained grooves cut into the rock to hold wooden sluice gates that would have controlled the flow of water toward the entrance of the outer harbor. When the waves were high—as they would be for at least nine months during the year—the channels would catch the crest of breakers smashing against the breakwater. The excess water flowing through the narrow channels created a current within the harbor that carried silt and flotsam outward toward the sea.

When the harbor was dedicated at the end of the first century B.C., the city literally stretched out over the sea. There were warehouses and walkways along the length of the breakwaters. Ships did not have to go into the land to unload as had been done in the past. They could stay at anchor in the outer harbor during the winter and then make the dash for Rome when sea conditions permitted in the spring.

Excavations have shown that the vast harbor complex consisted of four distinct harbors: an outer harbor and an inner harbor and a bay to the south, which was probably a fair-weather anchorage, and then about 500 meters north of the major complex a harbor dating from Hellenistic times that was in use during the construction of Herod's city.

The inner harbor appears to have been designed as a military or royal harbor, and the outer harbor as a commercial area. Hohlfelder believes that there may have been areas within the outer harbor with specialized functions: perhaps an area near the lighthouse where commercial activity was prohibited; perhaps another area devoted to ship repair and shipbuilding; perhaps another for unloading ships importing foodstuffs and dry commodities such as nuts or grains, and taking aboard luxury items like silk and spices as well as wine, olive oil, and various types of agricultural commodities destined for foreign ports. The south bay was probably devoted to local, coastal traffic.

Early in the sixth century A.D., Procopius of Gaza mentioned that the harbor facilities at Sebastos had been in ruins prior to that time and reported on a renovation by the Emperor Anastasius probably shortly after A.D. 502 ("Panegyricus in Imperatorem Anastasium" in *Patrologiae Cursus Completus, Series Graeca prior*, vol. 87, part 3, 2817–18). The city continued to prosper in the late Roman and early Byzantine periods, apparently reaching its zenith some time in the fifth or sixth century. In fact, because the harbor could be used as a base of operations that allowed the Byzantines to be resupplied from the sea, Caesarea was one of the last cities to fall to the Arabs after a seige that lasted for seven years.

In A.D. 1101, Frankish knights under Baldwin of Jerusalem captured the site from the Arabs, who had controlled it for four centuries. Finally, in A.D. 1265, Caesarea was taken by the Sultan Baybars and later razed.

Divers' reports and artifacts recovered at the site indicate that, sometime after the city was abandoned, the outer basin of the harbor at Sebastos slipped 5 to 8 meters below sea level as the result of seismic action. Data produced from an extensive coastal survey conducted in 1975 by the University of Haifa Center for Maritime Studies showed at least one major fault line about 150 meters from the present shoreline. The CAHEP team has concluded that it was tectonic activity along the coast of Israel, and not a rise in sea level over the course of the centuries, that caused the structures seaward or west of the fault line to sink into the sea.

It has taken more than five years of underwater surveying and excavation to bring to light some of the methods used by the ancient builders. And yet, says Hohlfelder, none of these methods adequately explains how it was done so quickly.

Knowing the limitations of the technology available to the Roman engineers and the Palestinian Jews who worked on the project, the archaeologists are perplexed at how the Romans could have built a breakwater out into the open sea for a distance of more than 800 meters for the southern breakwater and 300 meters for the northern arm—all in less than a decade. "We think that they did," says Hohlfelder. "We think that the harbor was actually functioning about 15 B.C. before the city was actually dedicated. How could they work that quickly when the sea conditions along that coast meant that they could work only about three months a year?"

Hohlfelder has an idea that the Romans let the sea do some of the work for them. They built hollow cells of concrete blocks within the breakwater and allowed the sea to fill these cells with sand. "We have found pockets of pure sand deposited by the ocean within the core of the southern breakwater itself," he says. "It's quite clear that the sand was not deposited by man because it's totally devoid of pottery shards, which is an anomaly in Caesarea."

In future excavations, the team hopes to find a well-defined cell encased by concrete blocks that would prove Hohlfelder's theory and provide yet another example of the harbor builders' ingenuity and mastery of their craft.

—Caroline Taylor

"Excavations in the Ancient Harbors of Caesarea Maritima, Israel"/Robert L. Hohlfelder/University of Colorado, Boulder/$240,114,/1983–85/Interpretive Research-Projects

Aerial photograph of the Caesarea harbor today. A diving barge is positioned at the entrance to the harbor; the shadowy areas mark the disintegrated breakwaters.

Before the Greeks

photos by Herbert Barghusen

Project Director Joan Barghusen discusses the colossal statue of King Tutankhamun with a group of teachers.

The pyramids were not built by slaves, but rather by skilled quarrymen and peasants in the agricultural off-season. The Code of Hammurabi was less a compendium of legal principles and more a ruler's effort to ingratiate himself with his bosses, the gods. Far from being obsessed with death and the afterlife, the ancient Egyptians were, thanks to the stability and productivity of their society, a rather optimistic and practical people.

Many commonly accepted myths about the ancient Near East were dispelled at a summer institute for twenty-five high-school teachers, conducted by the Oriental Institute of the University of Chicago and supported by the Illinois Humanities Council. As conceived by project director Joan Barghusen, the institute not only deepened teachers' knowledge of the ancient Near East; it also provided them with the resources to bring these civilizations alive in the classroom.

In this sense, the institute was a logical outgrowth of the Oriental Institute's ongoing Museum Education Program, headed by Barghusen, which has produced slide talks, curriculum kits, and guide sheets to museum exhibits. It grew from the simple realization that, as Barghusen notes, "teachers cannot teach what they do not know." The three-week summer institute, bracketed by a Saturday orientation in May and a follow-up seminar in October, was a combination of lectures by more than a dozen scholars, readings of ancient texts, and gallery and archive study. "It's difficult for the teachers to be put in the middle of a whole new historical period—one with no familiar touchstones—and be treated like graduate students in the field," says Janet Hellman, the museum's volunteer coordinator. "But they react to the challenge with almost overwhelming enthusiasm."

One of sixteen summer programs supported by the Illinois Humanities Council, this institute, offered in 1984 and again in 1986, was directed to teachers of history, social studies, art, and general humanities courses. The first week was devoted to the civilizations of ancient Mesopotamia, the second to Egypt, and the third to other Near Eastern cultures such as Persia and Syria/Palestine, all explored through the historical records, art, literature, law, and architecture they left behind. The teachers also learned about curriculum resources available from the museum.

Because archaeology is an important source of knowledge about ancient civilizations, one of the summer institute's first sessions disabused teachers of what Richard Zettler calls "the Indiana Jones" stereotype of the profession.

Zettler, now a professor at the University of Pennsylvania, was the primary instructor for all but the Egypt section of the institute. He notes that since the 1950s, the excavation site has become the workplace of new kinds of experts—geomorphologists, paleobotanists, physical anthropologists—whose analyses of soil, of bones, of the residue in a jar or the blood on a flint instrument are beginning to tell us more about the entire physical and social environment of a society. Says Zettler, "We have based our reconstructions to date on so little evidence that one small new find can almost completely turn interpretations around."

For this reason, another of the summer institute's goals is to introduce teachers to scholarly journals and other literature in the field. This is particularly important because school textbook sections on the ancient Near East tend to be dated and prone either to oversimplification or to presenting only one interpretation of limited data. The teachers spent the month of August preparing research papers, acquiring in the process a working knowledge of the extensive materials in the Oriental Institute's archives.

To give teachers a thorough understanding of the Oriental Institute's museum holdings, the summer institute integrated gallery tours with lectures and readings. One of the world's major collections of antiquities, the museum galleries display huge, dramatic Assyrian reliefs and art treasures along with objects from daily life that integrate individual lives with the sweep of a civilization.

In the ancient Egyptian galleries, teachers view the development of Egyptian writing. There, hieroglyphics are carved into stone and ivory, and written on papyrus, itself one of our clearest legacies from ancient

Egypt. John Larson, museum archivist and principal instructor for the Egypt section of the summer institute, notes that a form of simplified hieroglyphics used by Egyptian miners in the Sinai became a primitive alphabet, and, through the Phoenicians, could be seen as the basis of Western systems of writing. The Oriental Institute Museum galleries also display examples of demotic, a simplified hieroglyphic script used in Greek and Roman times, and of Coptic writing, which employed the Greek alphabet and seven additional figures to represent Egyptian speech in the early Christian era. Summer institute teachers read the epic of Gilgamesh, the best known of all ancient Mesopotamian legends, which tells the story of a young king who embarks on a quest for immortality because of the death of his friend. Gilgamesh's perilous journey eventually leads him to Utnapishtim, the sole survivor of the Babylonian flood (whose own story bears striking resemblances to that of the Biblical Noah). Despite the aid of Utnapishtim, Gilgamesh does not learn to escape aging and eventual death, and he returns home with the consolation that immortality must come from good works.

Although there is a Gilgamesh on the Sumerian king lists, which date his reign to the first half of the third millennium B.C., there is no historical evidence for these exploits. Nonetheless, after reading the epic, the summer institute teachers found visible traces of the story everywhere in the galleries. In the exhibit on magic are figures of devils, of the sort that plague Gilgamesh throughout his travels. At the beginning of his reign, Gilgamesh builds his city of "burnt brick," meaning kiln-fired bricks rather than the sun-dried mud ones in common use; samples of both are in the galleries for comparison. In one of the epic's most vivid scenes, Utnapishtim tells how the gods decided to destroy man and forbade Ea, one of their number who was sympathetic to man, to warn him about the impending flood. Ea instead speaks to the walls of Utnapishtim's dwelling, saying, "Reed hut, reed hut, build a boat." In the museum, photographs show how these reed huts are still made in Mesopotamia today, and carved cylinder seals depict the friendly god Ea, mankind's savior.

A ten-ton bull's head from the ancient Persian capital of Persepolis dominates the museum hall at the Oriental Institute, University of Chicago.

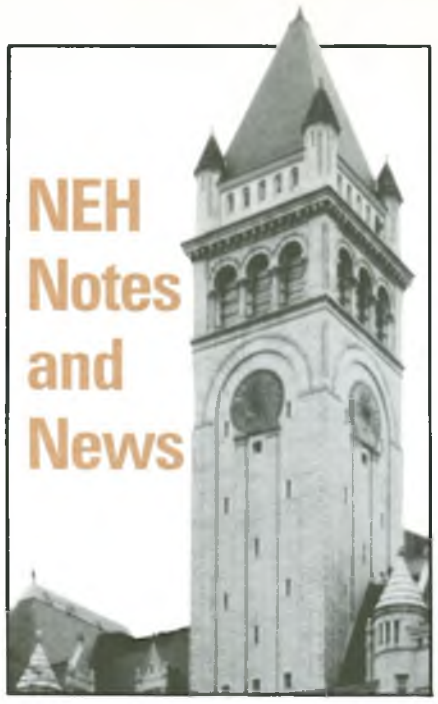
Several of the stories studied in the Egypt section of the institute convey a sense of the isolated, ethnocentric view that ancient Egyptians held of their civilization. In "Sinuhe," a high-level administrator flees Egypt after his pharaoh dies, fearing a plot to kill him. He lives for many years among the Bedouins, establishing a family, wealth, and position, but always longing for his homeland. Eventually, the new king hears of him and invites him back; he returns, content that in Egypt he will "not be buried in an animal skin," but rather in the civilized fashion with a tomb and a representative sampling of his wordly goods. These stories, combined with actual historical texts, like a treaty between the Egyptians and the Hittites, gave the teachers a sense of how the Egyptians interacted with other peoples of their time, and how they, like the later Greeks, viewed others as barbarians.

Studies of legal documents provided even more fundamental clues to the thinking of ancient civilizations. Mesopotamian expert Zettler notes that famous codes like that of Hammurabi were basically long lists of specific "if-then" situations—"If a surgeon causes a man to lose his hand, then his own hand shall be cut off"—rather than general statements of law. "The Mesopotamians did not formulate principles," he says. "They listed examples." The Mesopotamians' apparent lack of interest in reasoning from the specific to the general, suggests Zettler, is one reason why modern Western civilization traces its roots to the Greeks and often stops there.

There is a similarly un-Western perception in the ancient Egyptian calendar, which began completely anew at the beginning of each king's reign. Without a reckoning from a fixed point in time, the Egyptians had a cyclical perception of history, regularized by the yearly flooding of the Nile, but stretching back only a generation or two of living memory. The Greeks, who reckoned from the Olympiad, set a pattern more familiar to minds living in A.D. 1986.

Because of this cultural tendency to begin study of Western civilization with the Greeks, the summer institute made a point of tying ancient Near Eastern civilizations into the classical world. The great library at Alexandria and the Seleucid kingdom of the third century B.C. are a

(Continued, next page)



Soviet Archives

Scholars of Russian and East Slavic studies can anticipate the publication next year of another volume of Patricia Kennedy Grimsted's unique guides to the collections and reference tools housed in Soviet archives and manuscript repositories.

Unlike its predecessors, the forthcoming third volume, *Archives and Manuscript Repositories in the USSR, volume 3: Ukraine and Moldavia*, is divided into two books. The first, *General Bibliography and Institutional Directory* describes the current archival holdings of institutions in Soviet Moldavia, and more extensively in Kiev, Lviv, Kharkov, and other oblasts (political districts) of the Ukrainian SSR and Soviet Moldavia. Brief histories of the institutions will include a genealogy of their earlier names and archival components. Most important is the description of current holdings. A table correlating geographic names in different foreign languages will aid the researcher, along with an extensive annotated bibliography of all available finding aids, an author-title index, and an index of names.

As with Grimsted's earlier directories for the archives and manuscript repositories of Moscow and Leningrad, and of Estonia, Latvia, Lithuania, and Belorussia (published by Princeton University Press in 1972 and 1981, respectively), book one of the Ukrainian guide will be complemented by the concurrent publication in 1987 of a catalogue of coordinated microfiche editions, finding aids, and other reference tools produced by the Inter Documentation Company of Zug, Switzerland. These IDC microfiche editions will provide scholars throughout the world with access to many rare Soviet finding aids, several of which were not previously available abroad.

Book two of Grimsted's Ukrainian guide, *An Historical Survey of Archives and Recordkeeping Practices in Ukraine and Moldavia with Appended Reference Aids*, will supplement the institutional directory by 1988 with a historical examination of the development and fate of archives and manuscript collections in the Ukraine and Moldavia.

Grimsted explains that the Soviet Ukraine presents a particular challenge for scholars seeking archival materials because its constituent territories did not comprise a single political entity until 1954. Many important Ukrainian records, therefore, reside in the archives of the external political regimes that once ruled Ukrainian lands. Records are scattered from Moscow and Leningrad to Poland, Romania, Budapest, Istanbul, Vienna, and Rome.

In addition, political consolidation of Ukrainian lands under Soviet rule and centralization of archives and libraries in the Ukraine under Soviet state archival authority have resulted in the transfer and division of collections previously scattered among multiple archival systems. Existing reference publications take liberties with institutional founding dates and original names. In some cases, renamed institutions supplanting or formed by combining earlier collections further cloud the record.

To clarify matters, book two will contain charts and maps of the changing administrative-territorial and ecclesiastical divisions in the region, together with a gazetteer of place names in various languages. Charts of major record-producing agencies in different periods will be correlated with present archival locations and a glossary of Ukrainian archival terms. The book will also include addenda and corrigenda for the directory and bibliographic coverage of the first Ukrainian volume. Each volume will contain an index with cross-references.

In the future Grimsted, a research associate at the Harvard Ukrainian Research Institute and a fellow at the Russian Research Centre at Harvard University, will computerize data supplementing her earlier coverage of archives and manuscript repositories in Moscow and Leningrad, making this information available to researchers in advance of its eventual publication.

As an outgrowth of her research, Grimsted has prepared an annotated bibliography for Russian scholars and those studying Eastern Europe covering ancillary historical disciplines, including paleography, watermarks, diplomatics, genealogy, and historical geography. This reference aid will be published by Princeton University Press within the next two years.

—Meryl Nash

"Directory of Archives and Manuscript Repositories in the USSR"/Patricia K. Grimsted/Harvard Ukrainian Research Project/Cambridge, MA/$345,165/1984–86/Reference Materials–Access

---

BEFORE THE GREEKS
(Continued from previous page)

well-known nexus. A new lecture in the 1986 institute discussed a fruitful area of current scholarly research—how Greek historians viewed Mesopotamian civilizations. Richard Zettler notes that except for Herodotus, who actually traveled in the Near East and whose accounts were "occasionally accurate," most Greek historians just repeated folk legends about Mesopotamia, seeing it not as a cradle of their own civilization or even as a relative backwater, but rather as a primeval world grounded in mythology.

In this, they were perhaps not altogether different from modern school textbook writers, on whom, as one institute instructor commented, "the curse of the mummy continues to lay its dead hand." By closing the gap between modern myths and current scholarship, the summer institute enables teachers to place the ancient Near East in a continuum of historical development.

—Jennifer Newton

Children of the white owners and the negro tenant, men and women, working in the field together, topping and suckering tobacco, Granville County, North Carolina, July, 1939. [LC USF 34 20048-C]

courtesy of Pete Daniel

The Disappearing South

Until 150 years ago, the only significant change in rural societies was the gradual and familiar cycle of seasonal growth, death, and rebirth. Generation after generation, farmers' lives kept pace with the seasons as they probed the soil to discover what stimulated it to produce abundant crops. Farm implements and methods of cultivation improved, but slowly.

Farming in the southern United States conformed to this pattern, and both under slavery and post-Civil War sharecropping, farmers' implements and practices changed little. Within forty years after the turn of the century, however, southern rural society and work habits were transformed by mechanization, economic depression, and government policies that affected the tenure system, farm credit, implements and methods of cultivation, and community organization.

The process that changed the rural structure of the South is the subject of historian Pete Daniel's *Breaking the Land: The Transformation of Cotton, Tobacco, and Rice Cultures since 1880* (University of Illinois Press, 1985), winner of the 1985 Herbert Feis Prize of the American Historical Association. "The sources of the present agricultural structure," says Daniel, "date to the nineteenth-century notion that American farms should utilize labor-saving implements and that science should rule every sphere of rural life."

Daniel's study raises many questions about the benefits of technology and government intervention to the lives of southern farm people. The most recurrent of these calls for a redefinition of what is meant by "progress." Was progress in the form of increased mechanization inevitable, or are there realistic alternatives to large-scale agriculture?

With the invention of the cotton gin in 1793, "King Cotton" came to dominate southern agriculture. Between 1793 and 1861, cotton cultivation expanded from South Carolina through the Black Belt of Georgia and Alabama and into Mississippi and Louisiana. With it, a way of life also spread from the eastern seaboard across the Mississippi River. The cotton "culture" was a class-bound society run by planters and fueled by slave labor. "The peculiar needs of the crop dictated the way cotton farmers ordered their lives," explains Daniel. "Cotton had its cycle of land preparation, sowing, chopping, and harvest. After breaking the land in the late winter, rows were run and then the cotton was planted. After it sprouted, the work force passed through the fields, thinning the plants and chopping out the weeds. Plowing alternated with chopping until around July, when workers laid the crop by—a term that a simply meant they ended fieldwork. Then there was time for fishing, religious revivals, and leisure. In September or October bolls filled out and burst into white puffs of lint, and then workers moved through the fields with sacks, picking out the cotton. As additional bolls burst, the task continued throughout the fall until the field had yielded its crop."

This work cycle changed little from the late eighteenth century to the twentieth century. With the end of slavery, land tenure in the cotton culture changed as ownership of land became concentrated in fewer hands, but it was not until the 1930s that methods of cultivation and work habits changed.

After the Civil War, former slaves and increasing numbers of whites became sharecroppers, dependent

on the big planters for housing, food, fuel, and hunting and fishing rights. "The rural labor system that evolved after the Civil War increasingly became codified in the statute books," writes Daniel. "Coercion that drove reluctant blacks and impoverished whites came from the law, which progressively tightened its grip on workers; from the contract, which became a year's sentence on a few acres; from violence, which gave object lessons to those who resisted the system; and from illiteracy, which placed the worker at the mercy of the literate elite and kept him from seeking jobs that required more skills than plowing, hoeing, and picking."

The boll weevil infestation of Texas cotton fields began in 1894 and led to government intervention that "helped the more educated farmers to survive, while driving the marginal farmers off the land." Ultimately, the weevil forced cotton into western growing areas that were less vulnerable to the pest. In addition to the boll weevil, Mississippi River floods in 1912, 1913, 1922, and 1927, along with the 1930 drought, the Depression, and New Deal agricultural programs further reduced the South's farm population. By the late 1930s, the gasoline tractor had begun to replace sharecroppers, and when International Harvester perfected the cotton picker after World War II, millions of sharecroppers, tenants, wagehands, and small landowners abandoned southern farms.

If Daniel's account of the cotton culture exemplifies an almost stereotypical vision of southern agriculture, his description of the rice culture of the Gulf Coast presents a very "unsouthern" profile. During the Antebellum, Civil War, and Reconstruction periods, the rice culture was concentrated along the coasts of the Carolinas and Georgia. Like rice cultures everywhere, the methods of cultivation were extremely labor intensive. With the emancipation of the slaves and the destruction of dikes in the Civil War, the workforce and infrastructure that supported the rice culture along the eastern seaboard collapsed.

In the 1880s a land promotion campaign in southwestern Louisiana attracted midwestern farmers, who brought the technology of midwestern wheat farming to the cultivation of rice. Within a few years, the highly mechanized Gulf Coast rice industry eclipsed the older areas of rice cultivation.

By delving into turn-of-the-century editions of the *Louisiana Rice Book, The Rice Journal, Gulf Coast Farmer*, and documents in the archives of Louisiana State University, Daniel has been able to trace the origin and development of the Gulf Coast rice culture which, he believes, "furnishes a classic example of the interaction of transportation developments, land promotion, and modern agricultural practices."

The agricultural development of the prairies and coastal marshes of Louisiana—long inhabited by Cajuns who fished, trapped, raised livestock, and grew subsistence crops—began in 1881 when the rail link connecting New Orleans and Houston was completed. This coincided with rising interest rates, unfavorable weather conditions in the Midwest, and a grasshopper infestation that plagued farmers in the Midwest throughout the 1880s.

Jabez B. Watkins, a Kansas banker, formed the North American Land and Timber Company, Ltd., in 1882 and bought some million and a half acres of Louisiana marsh land. The Watkins syndicate drained the marshes and flooded the Midwest with pamphlets describing the opportunities in Louisiana.

The midwestern immigrants had no success at cultivating wheat and corn, but they quickly learned to imitate the methods of rice cultivation practiced by the Cajuns. They also recognized the similarities between rice and wheat and began to adapt mechanized practices of wheat cultivation to the cultivation of rice. Within a few years they imported gang plows, disc harrows, and other implements from the Midwest. In 1884 Maurice Brien from Iowa adopted a grain binder to handle tough rice stalks, and by 1887 300 such binders were operating in the rice fields of Jefferson Davis Parish. In 1888, David Abbott took a small engine, some chain, and buckets and constructed a machine for irrigating his nineteen-acre rice field. The following year he improved the machinery and was able to irrigate 100 acres. By 1894, Acadia Parish had a canal network over fifteen miles in length.

The rice culture with its mechanized methods of cultivation had extended to the Gulf Coast of Texas and the Arkansas prairie. Daniel quotes G.W. Fagan, who in 1910, boasted that farmers paid cash for their supplies and the advance system, "which has proved the ruination of so many Southern agricultural communities, is practically unknown and not practiced at all."

Gulf Coast and Arkansas rice farmers were among the first farmers to organize when prices for their crops began to fall during the 1900s. By 1917 the Southern Rice Growers' Association had become a force in marketing rice throughout Texas, Louisiana, and Arkansas. Yet rice farmers were not immune from the collapse of farm prices in 1920. Daniel observes that "The collapse of demand in 1920 dramatized the fragile position of U.S. rice growers in international trade. Since the Civil War the United States had been a net importer of rice, and thus rice growers anxiously sought to protect themselves from foreign competition." He adds that "despite their small political base, rice farmers managed to protect their industry from imports; in that sense they were quite different from most southern farmers who traditionally opposed a high tariff."

Most of the rice crop that left the United States went to Puerto Rico and Hawaii. During the 1920s exports fell drastically. Even by using the most advanced methods, American rice farmers could not match the low prices of labor-intensive farmers in other countries. As in other commodity areas of the South, rice farmers lost their land, which became increasingly concentrated in the hands of corporate owners.

Tobacco was the last of the South's commodity crops to be affected by new methods of cultivation and harvest. According to Daniel, this technological lag was caused by the difficulty of designing a machine capable of harvesting ripe tobacco leaves, leaving unripened leaves on the plant. It was not until the 1950s, after the U.S. Department of Agriculture had developed a bright-leaf tobacco plant that ripened uniformly, that mechanization began to transform tobacco cultivation and the lives of farmers.

The generations of European-

courtesy of Pete Daniel

descended Americans who cultivated tobacco, starting with John Rolfe in the Jamestown Colony, perfected a work routine that required some 370 hours of labor per acre to bring the crop to market. Daniel writes that "Until the 1940s and 1950s most tobacco farmers used mules, oxen, or horses on their farms. Mules also snaked logs from the woods, hauled split wood to the barn, and then pulled the plows that prepared the land. There existed a special relationship between mules and men. A farmer spent so much time with his mules that he came to look upon them as friends, and so there evolved a mule culture that existed side by side with other aspects of rural life."

Like so many other segments of American society, tobacco farmers were hit hard by the Depression. And like cotton and rice farmers, they looked to the New Deal for hope and a sense of stability.

A new technology was influential in creating a consensus among rural folk about the benefits of government intervention in their lives. Franklin D. Roosevelt used the radio to spread the message of the New Deal with great effect. "No longer looking to a local landlord for furnish [groceries and supplies provided on credit to a plantation tenant by the owner] or to the community for emergency support," explains Daniel, "tenants and other victims of the Depression looked to Washington, to the bureaucracy, to Roosevelt. The more desperate the circumstances, the more likely a farmer was to believe that the New Deal cared for him. But in reality the most unfortunate farmers had less chance to qualify for such programs as FSA [Farm Security Administration] or subsistence homes. As the 1930s ground on and Congress enacted its programs and the bureaucracy carried them out and President Roosevelt explained how all were benefiting, many Southerners seemed transfixed, expectant, waiting. Surely, they thought, the promise of justice and prosperity would prevail. The constant doses of hope numbed the spirit of protest; many sharecroppers continued to think that the New Deal would save them."

Higher up the economic ladder, landlords and owners of large farms took advantage of government programs to implement the idea of progress advocated by agricultural planners. As machinery took over many tasks previously accomplished by human labor, sharecroppers and small farmers left the land to seek employment in the North and in southern towns and cities. With them vanished a way of life.

"An ambivalence has endured over the gains and losses involved in abandoning small-unit farming and driving off the refugees to cities. Those who left were offered no choice, and to many it must have appeared irrational to struggle to remain sharecroppers," Daniel concludes. "Despite the numbing aspects of the old tenure system, it existed in the context of a community life and culture that rural people built to protect and sustain themselves. Building on the strengths of the old culture and reforming its abuses, there were options that could have kept people farming and preserved the culture and community that gave a deeper meaning to life in the rural South."

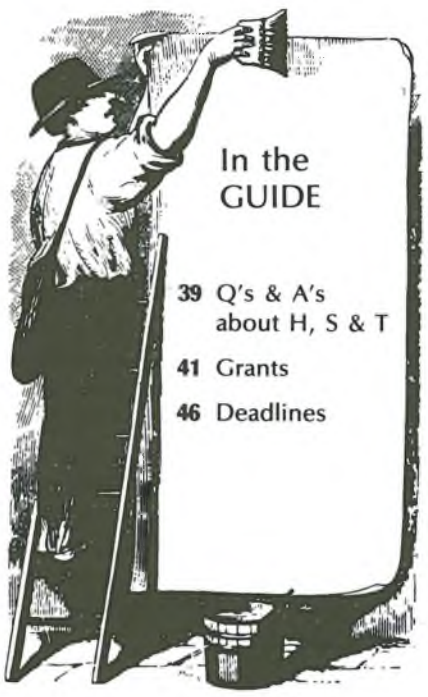
—Mary T. Chunko

"Southern Agricultural Labor, 1900–1950"/Pete Daniel/University of Tennessee, Knoxville/$17,950/1978–79/ Fellowships for Independent Study & Research

Farm accident, ca. 1920. The transition from ox and mule to tractor was not an easy one. This farmer may in fact be awaiting the arrival of a team of mules to rescue his equipment, whose weight was clearly too much for the wooden bridge. Pauling County, ca. 1920. [Vanishing Georgia, #PLD-8]

Humanities, Science and Technology

The Humanities, Science and Technology Category (HST) in the Division of Research Programs is named for a specific field of inquiry, yet it is not the only category in the Endowment that supports work in this field. All divisions of the Endowment receive applications that relate the perspective of the humanities to science and technology. Because HST is a category within the Endowment's Division of Research Programs, most grants support collaborative and coordinated research that uses the theories and methods of the humanities disciplines to interpret, analyze, or evaluate science and technology and their meaning for and place in human affairs. This research includes historical studies as well as studies of fundamental concerns underlying current issues in science and technology.



Through projects funded in the HST category the Endowment encourages both collaboration of humanities scholars with scientists and engineers and the improvement of interdisciplinary methods of research.

To gain an understanding of the types of projects that are eligible for support from the program and the specific criteria used in determining eligibility, applicants should read the program's guidelines, which are available from the NEH Public Information Office, 1100 Pennsylvania Avenue, N.W., Washington, D.C. 20506 202/786-0438. The following commonly asked questions and responses may also clarify the program's purposes and goals:

Is any project that applies the methods of the disciplines of the humanities to problems in the sciences and technology eligible for funding in the HST category?

No. HST is one category in the Interpretive Research Program. It funds collaborative research projects and other complex research projects, such as those requiring travel, consultants, or coordination of research assistants and services. All supported research is expected to lead to scholarly publication. Although HST does not serve as a clearinghouse for other NEH programs on the topic, an applicant who is uncertain which category of the Endowment is the most appropriate for a particular project can confer with a member of the HST staff.

Can grants in the HST category support the collaborative research of two scholars who teach at different institutions?

Yes. Usually one of the institutions receives the award and contracts for the salary of the scholar at the other institution.

My field of research crosses boundaries between the humanities and science and technology, but I am working as an individual, not collaborating with another scholar. Where should I apply?

Applications for the support of individual research for periods of a year or less normally should be submitted to the Division of Fellowships and Seminars.

What are the majority of projects funded through the HST category?

The majority of projects supported through the HST category are in the well-established academic disciplines of the history and philosophy of science. A typical example of a project in the history of science is an investigation of the historical development of physical organic chemistry through an analysis of the use of models and conventions in nineteenth- and twentieth-century chemistry. The project includes a comparative analysis of experimental work and puzzle-solving strategies by two research communities: the London-Manchester circle, which is associated with the English mechanical tradition, and the Paris-Strasbourg circle, associated with the French phenomenalist tradition.

Interdisciplinary studies in emerging fields, such as literature and medicine or the philosophy of technology, are also represented among recent applications. The HST category encourages research in these fields and has supported a

number of projects in the humanities and medicine. An excellent example of a project in this field is an exploration of human pain as it is understood through medicine and literature. The project director, whose background is in literature, will collaborate with a neurologist in the study, which will result in a book investigating representations of pain in written sources, including works by Homer, Pope, Melville, Tolstoy, and Beckett, as well as autobiographies written by entering patients at a well-known clinic for the treatment of chronic pain. This integration of medical and literary perspectives will serve to develop two arguments: first, that pain in earlier periods and in other cultures has been understood as an occasion that demands or entails emotional growth and an encounter with meaning, and second, that today responsibility for understanding pain has been relegated almost exclusively to medicine. The study will argue that, as a result of its separation from the humanities, pain threatens to become meaningless. Reviewers of the proposal applauded this integration of literary study and medicine and were also impressed by the collaboration of humanist scholars and medical specialists.

National Library of Medicine

Anatomical drawing by Vesalius

Does the HST category support archival processing or the creation of research tools or finding aids?

The HST category supports archival processing only as one step in a larger interpretive research project to reconstruct the history of a particular movement, discipline, or event. For example, the Charles Babbage Institute of the University of Minnesota is currently undertaking a study of Engineering Research Associates, Inc., an early computer research and development firm, to understand its influence on an industry that, near the time of the firm's dissolution in 1957, was having a profound influence on the world economy. As part of the plan of work for this interpretive study, the researchers will define and assemble the records that would illuminate the history. Because many of the papers are now in private hands, the researchers are arranging for deposit in a central archive.

Projects to arrange or describe archives or otherwise to increase the availability of important research collections can be supported through the Access category of the Research Division's Reference Materials Program.

Does HST fund oral histories?

Again, only as a component of a comprehensive historical research project.

Can HST provide start-up funds for research centers devoted to a specific topic?

Yes. The HST category makes a few grants each year that enable institutions to establish research centers or set up programs for research on a single topic related to the humanities. Such awards are available for up to three years and may be renewed once. A proposed research center or program should build on the existing and distinctive strengths of an institution—such as library collections or particular areas of expertise among staff members—and should involve senior and junior scholars from several institutions. Projects undertaken by the center or program should result in scholarly publications that contribute new knowledge of the humanities discipline or disciplines involved.

Does the HST category fund policy studies in science and technology?

No. Projects supported by NEH must have importance for the humanities. Projects that have importance for science policy are often supported by the National Science Foundation.

How are proposals reviewed?

All proposals submitted to the Division of Research Programs undergo a two-stage review process. First, proposals are sent to at least six reviewers outside the Endowment who are specialists in the disciplines of each proposal. Subsequently, HST program officers convene a panel whose members are familiar with the subjects and types of projects represented by the applications.

A new panel is put together for each cycle of applications; there are no standing panels. Each panel is chaired by a member of the Endowment's staff, who also participates in the panel discussions. Before the panel convenes, panelists read the applications, and prepare written comments. At the panel meetings proposals are discussed, along with the judgments provided by the outside specialist reviewers. These discussions result in individual and collective recommendations concerning each proposal.

What does the double stage of review mean in terms of writing the proposal?

Competitive proposals must satisfy the criteria imposed by two bodies: specialist reviewers who are often concerned with sound research design and the importance

(continued on page 45)

RECENT NEH GRANT AWARDS

Some of the items in this list are offers, not final awards.

Archaeology & Anthropology

American Schools of Oriental Research, Philadelphia, PA; Suzanne Richard: $10,000 OR; $15,000 FM. To complete the first phase of an ongoing excavation program at a third millennium B.C. urban site in Jordan. *RO*

Egypt Exploration Society, London, England; David M. Dixon: $4,000. To publish detailed epigraphic and architectural surveys of two Egyptian temples from the 15th century B.C. *RP*

SUNY Res. Fdn./Albany, NY; Gary H. Gossen: $70,000 OR; $5,000 FM. To publish the three-volume edition and translation of Chamula Mayan narrative texts. *RL*

U. of New Mexico, Albuquerque; John M. Fritz: $46,568 OR; $10,000 FM. To continue interpretation of archaeological data from Vijayanagara, the capital of the last great Hindu empire of south India. *RO*

U. of Oklahoma, Norman; John N. Drayton: $3,000. To publish the first historical monograph focusing on the Palace of the Governor at Uxmal, an edifice acknowledged as one of the masterpieces of Mayan architecture. *RP*

U. of Wisconsin, Madison; James O. Bailey, Jr.: $153,094. To develop four new courses and revise two existing courses in folklore. *EL*

U. of Wisconsin, Milwaukee; John W. K. Harris: $8,740 OR; $5,850 FM. To conduct an international conference workshop on the prehistoric art of sub-Saharan Africa. *RX*

Arts—History & Criticism

American Film Institute, Washington, DC; Stephen Gong: $75,000 OR; $187,500 FM. To prepare two volumes of the American Film Institute catalog, the definitive guide to American theatrical film production. *RC*

American Music Center, Inc., NYC; Eero Richmond: $33,850. To publish a catalogue of keyboard music by contemporary American composers. *RC*

Butler U., Indianapolis, IN; James R. Briscoe: $11,802. To present a series of lectures on the life and work of Franz Liszt at a Romantic music festival. *GP*

CUNY Res. Fdn./Bernard Baruch College, NYC; George R. Hill: $119,647. To compile a guide to music compositions published in collected editions, historical sets, and monuments. Information on composers, media, and titles will be available as a data base and through microfiche publication. *RC*

Northwestern U., Evanston, IL; Richard D. Green: $10,000 OR; $9,828 FM. To conduct an international conference on music bibliography. The conference will explore issues and problems in the use of primary and secondary sources in musicological research, and result in new directions for advancing research in these areas, including ethnomusicology. *RX*

Seton Hall U., South Orange, NJ; Petra T.D. Chu: $50,000 OR; $10,000 FM. To publish the critical edition and translation of the letters of the French Realist painter Gustave Courbet (1819–77), who corresponded with many leading figures of his time, among them Claude Monet, Victor Hugo, and Pierre-Joseph Proudhon. *RL*

Society of Architectural Historians, Philadelphia, PA; Adolf K. Placzek: $100,000 OR; $95,598 FM. To publish three of the first four volumes of a multivolume series, ultimately comprising the architecture of the whole country, organized state by state. *RO*

Southern Illinois U., Carbondale; Kenney Withers: $10,000 OR; $5,000 FM. To publish volumes 11 and 12 of a biographical dictionary of actors, actresses, musicians, and others who contributed to the theater in London from 1660 to 1800. *RP*

Syracuse U., NY; Peg Weiss: $40,000. To translate the letters from the Expressionist painters Klee, Kandinsky, Feininger, and Jawlensky to their American representative Emmy Galka Scheyer. *RL*

University of Chicago, IL; Karen G. Wilson: $10,000. To publish a critical study of French daguerreotype photography in the larger context of 19th-century French cultural history. *RP*

U. of Maryland, College Park; Hongnam Kim: $23,985 OR; $5,050 FM. To translate, with full annotation and extensive introduction, TU-HUA-LU (Lives of Painters), a collection of biographical sketches of Chinese painters from the Ming to the Qing dynasty in 17th-century China. *RL*

Yale U., New Haven, CT; Claude V. Palisca: $40,000. To publish a continuation of the Music Theory Translation Series that would add three texts, of the 15th and 16th centuries, to the 11 volumes already completed. *RL*

Classics

Boston College, Chestnut Hill, MA; Margaret A. Schatkin: $19,958. To prepare an edition and translation of the 4th-century treatise "To Those Who Oppose the Supporters of the Monastic Life" by John Chrysostom. *RL*

College of the Holy Cross, Worcester, MA; Deborah D. Boedeker: $10,178. To conduct an international conference on Herodotus, which will focus on his position between the old world of oral tales and the new one of scientific historiography, examined in the light of recent scholarly developments. *RX*

Princeton U. Press, NJ; Margaret H. Case: $8,885. To publish a study of the architectural and administrative changes made in the city of Rome during the reign of the emperor Hadrian. *RP*

U. of California, Irvine; Theodore F. Brunner: $98,520. To complete the Thesaurus Linguae Graecae, adding 5.2 million words to a data base containing all ancient Greek texts extant from Homer to A.D. 600. *RT*

U. of North Carolina Press, Chapel Hill; Lewis A. Bateman: $2,118. To publish a study of the first three books of Horace's Odes, which were published together in 23 B.C. *RP*

Washington U., St. Louis, MO; Jeffrey S. Rusten: $8,803. To translate a 3rd-century work written by Philostratus of Lemnos which discusses ancient Greek hero cults and their place in Greek religion. *RL*

History—Non-U.S.

American Oriental Society, New Haven, CT; Joel L. Kraemer: $35,000. To translate and annotate selected letters and responsa of Maimonides (1138–1204). *RL*

Art Institute of Chicago, IL; Susan G. Godlewski: $36,515. To edit and micro-film the Burnham Index to architectural publications and collections dating from 1875 to 1963. *RC*

Auxiliary Services Enterprise, Inc., Los Angeles, CA; Stanley M. Burstein: $30,000. To translate, with extensive notes, three surviving fragments of On the Erythraean Sea (i.e. the Red Sea), an ancient Greek source for the ethnography and geography of northeast Africa and the Red Sea basin, written by the Greek historian Agatharchides of Cnidas, 2nd century B.C. *RL*

Historic Deerfield, Inc., MA; Robert J. Wilson, III: $10,000 OR; $5,906 FM. To conduct a conference on Shay's Rebellion (1787). Political and social historians will meet to contrast their differing views and interpetations of this episode and its significance in this crucial period of American history. *RX*

John Carter Brown Library, Providence, RI; Norman Fiering: $10,000 OR; $7,031 FM. To conduct an international conference on the role of books in the Americas, especially in the development of colonial Latin American society and culture. *RX*

Johns Hopkins U., Baltimore, MD: Eric F. Halpern: $2,940. To publish a study of the writings of Renaissance authors, chiefly English poets, on death and dying. *RP*

Philip A. Kuhn: $14,550. To complete a guide to Ch'ing Dynasty (1644–1911) archives in Taiwan and Peking. *RC*

Louisiana State U., Baton Rouge; Beverly Jarrett: $3,632. To publish a study of the impact of Gunnar Myrdal's classic report on race relations in America after World War II. *RP*

Louisville Free Public Library, KY; Mary R. Somerville: $32,420. To produce four programs exploring the ethical issues raised in the use of heart implants, transplants, and heart surgery. *GL*

Minneapolis Institute of Arts, MN; Jane H. Hancock: $16,550. To plan for an interdisciplinary television program which examines Dutch maritime art in its relation-

ship to social, political, and economic conditions in the 17th-century Dutch republic. *GN*

Suzanne M. Noffke: $31,000 OR; $10,000 FM. To continue the translation from the Tuscan Italian of The Letters of Catherine of Siena. *RL*

Pacific Artists Representatives Consortium, Berkeley, CA; Todd Wetherwax: $53,842. To conduct a series of four programs for presentation in eight California libraries. They will introduce and analyze aspects of the medieval world through studies of manuscripts, oral traditions, and music. *GL*

Princeton U. Press, NJ; Margaret H. Case: $5,700. To publish a study of the emergence of a bureaucracy in Tuscany between the 16th and the 18th centuries. *RP*

Princeton U. Press, NJ; Margaret H. Case: $5,000. To publish a study of the economic and financial effects of the Seven Years' War on the old regime in France. *RP*

SUNY Res. Fdn./College at Buffalo; Leendert G. Westerink: $39,577. To prepare a critical edition and annotated translation of the Greek and Latin transactions of the Constantinopolitan, or Eighth Oecumenical Council, whose decisions led to the breach between the Greek Orthodox and Roman Catholic churches. *RL*

Saint John's U., Collegeville, MN; Julian G. Plante: $110,000 OR; $20,431 FM. To microfilm 3,500 early manuscripts in Portuguese and West German repositories. *RC*

Southern Educational Communications Assn., Columbia, SC; Jeanne Phillips: $100,000 OR; $50,000 FM. To produce three 90-minute radio programs in history, literature, archaeology, anthropology, linguistics, folklore, mythology, music, and political philosophy for children. *GN*

Stanford U., CA; John B. Dunlop: $25,000 OR; $21,000 FM. To prepare a guide for the Boris I. Nicolaevsky collection of Russian and European pamphlets, journals, newspapers, letters, and manuscripts. *RC*

Stanford U., CA; Mary Jane Parrine: $34,000. To write an annotated bibliography of recent (1960–85) studies on poverty and crime in early modern Europe. The published work will be organized by geographical area. *RC*

James Ross Sweeney: $21,500 OR; $5,000 FM. To translate, with annotation, the medieval laws of Hungary, a country which then included Czechoslovakia, Austria, Yugoslavia, Rumania and a corner of the Soviet Union. These laws reflect the transformation of a seminomadic society into the royal realm of the Angevin kings. *RL*

U. of Cincinnati, OH; Steven B. Bowman: $12,000. To translate a tenth-century Hebrew text, the Sepher Yossippon (The Book of Joseph), which presents legendary, biblical, and secular histories of the peoples of the ancient world. *RL*

U. of Hawaii, Manoa; George Akita: $70,000 OR; $15,000 FM. To publish the critical edition, transcription, and translation of the papers of Yamagata Aritomo (1838–1922). *RL*

University of Maryland, College Park; Frank J. Shulman: $50,000 OR; $49,817 FM. To prepare a guide to a collection documenting Japanese education during the Allied occupation. *RC*

U. of Massachusetts, Boston; Esther R. Kingston-Mann: $10,000 OR; $7,686 FM. To conduct an international conference on the peasantry of pre-revolutionary European Russia. *RX*

U. of Minnesota, Minneapolis; James D. Tracy: $10,000 OR; $13,387 FM. To conduct a conference on changing patterns of international trade in the early modern period (1350–1750). *RX*

U. of Missouri, Kansas City; Linda E. Voigts: $73,000. To prepare a guide to scientific and medical manuscripts in Old and Middle English. *RC*

U. of Southern Maine, Portland; Martin A. Rogoff: $28,500. To conduct a summer faculty seminar and develop the first two courses of the university's new honors program. *EL*

U. of Southern Mississippi, Hattiesburg; Jay P. Anglin: $7,021. To conduct a two-day workshop to discuss and assess the inclusion of world civilization in core courses for 30 history professors from colleges and universities in Mississippi. *EL*

Wellesley College, MA; Eugene L. Cox: $8,000 OR; $3,000 FM. To translate, with explanatory material, the Chronicle of the Abbey of Vezelay, a 12th-century monastic document detailing the Benedictine abbey's tumultuous relationship with the neighboring nobility and papacy. *RL*

History—U.S.

American Antiquarian Society, Worcester, MA; John B. Hench: $9,200. To conduct three public lectures examining American appetites as witnesses to the cultural, social, and economic history of the United States from the country's foundation to 1876. *GL*

American Enterprise Institute, Washington, D.C.; Robert A. Goldwin: $49,544 OR; $200,000 FM. To produce a series of three conferences and three books of essays on constitutional issues. *GB*

Archives of the Lutheran Church in America, Chicago, IL; Elisabeth C. Wittman: $28,710. To arrange and describe records and papers of individuals who formed new churches or institutions during the 1970s schism in the Lutheran Church-Missouri Synod. *RC*

Boston U., MA; Richard M. Candee: $150,000 OR; $50,000 FM. To prepare two concluding volumes in the Bibliographies of New England History series. *RC*

Carleton College, Northfield, MN; Michael P. Zuckert: $90,000. To produce six 30-minute radio dramas presenting the personal and political relationship between John Adams and Thomas Jefferson. *GN*

Case Western Reserve U., Cleveland, OH; David D. Van Tassel: $30,000. To complete *The Encyclopedia of Cleveland History,* which contains over 3,000 entries recounting the life and achievements of a major midwestern American city. *RO*

Edison Institute, Dearborn, MI; Cynthia Read-Miller: $82,438. To produce a visual index to a 300,000-image collection of photographs commissioned by Henry Ford documenting the automotive industry, technological and design history, and labor and social history topics, 1900–50. *RC*

El Camino College, Torrance, CA; Nadine I. Hata: $15,000. To conduct a faculty development seminar for one week during the academic year and for three weeks during the summer to read texts in the social sciences and to decide the nature of the college's social science graduation requirements. *EK*

Film Arts Foundation, San Francisco; James S. Culp: $317,170. To produce a 60-minute documentary film about the American experience in China during the Nanking Decade, 1927–37. *GN*

James Agee Film Project, Charlottesville, VA; Ross H. Spears: $73,480. To conduct postproduction of a feature-length documentary about the impact of the Civil War on American society, culture, and national identity. *GN*

Lancit Media Visions, Inc., NYC; Cecily Truett: $20,000. To plan a two-hour television drama focusing on Nathan Gordon, the only man ever convicted and executed for importing slaves into the U.S. *GN*

Louisiana State U., Baton Rouge; Beverly Jarrett: $4,002. To publish a biography of a mid-19th-century southern physician and racial theorist, Josiah C. Nott. *RP*

New England Library Association, Acton, MA; Leah Glasser: $245,444. To conduct a series of programs focusing on the framing of the U.S. Constitution and on the character of 18th-century New England. *GL*

New York Public Library, New York City; Diantha D. Schull: $194,446. To create a major interpretive exhibition and programs illustrating the drafting and ratification of the U.S. Constitution. A catalogue, brochures, essays, and bibliographies will accompany the programs and exhibition. *GL*

Orange County Public Library, CA; Emily L. Jackson: $97,577. To conduct a seven-week program illuminating the daily lives of groups who inhabited Alta California until the mid-19th century. *GL*

Rutgers U., New Brunswick, NJ; Virginia Yans-McLaughlin: $113,716. To script a 60-minute documentary film on Margaret Mead and her influence on American culture. *GN*

SUNY Res. Fdn./Binghamton, NY; Elizabeth Fox-Genovese: $85,000. To conduct a collaborative study of the social and intellectual life of southern slaveholders, 1790–1861. *RO*

SUNY Res. Fdn./College at Geneseo, NY; Martin L. Fausold: $42,207. To conduct a series of public lectures and a conference on the presidency and the Constitution. *GB*

Temple University, Philadelphia; Ellis Katz: $75,000. To research American federalism and conduct a three-day conference on state constitutional law with the participation of scholars in history, law, and political science; justices from state supreme courts; foreign jurists and scholars. *GB*

U. of Illinois, Urbana; Barton M. Clark: $70,893. To organize, index, and microfilm a collection of 2 million advertisements from 1890 to 1970. *RC*

U. of Louisville Research Fdn., KY; Dwayne D. Cox: $30,000. To conduct a two-day symposium in April 1987 on the life and works of Louis Brandeis which will coincide with the opening of an exhibition of archival materials on Brandeis from the university library. *GL*

U. of Nebraska, Lincoln; Paul W. Wilderson: $7,268. To publish the third volume in a new and definitive edition of the Journals of the Lewis and Clark Expedition. *RP*

U. of Texas, Arlington; Frances M. Leonard: $125,370. To develop and circulate a program package about European historical and cultural dominance in the New World and American cultural traditions. *GL*

U. of Virginia, Charlottesville; Timothy G. O'Rourke: $58,326. To videotape seven Court Days Forums to be held at various historic locations in Virginia. *GB*

Interdisciplinary

American Library Association, Chicago, IL; JoAn Segal: $145,153. To conduct workshops that will assist scholars and librarians in developing public humanities programs in libraries. *GL*

Aston Magna Fdn. for Music, Inc., NYC; Raymond Erickson: $200,000 OR; $75,000 FM. To conduct a multidisciplinary series of lectures on the cultural history of modern Europe with accompanying demonstrations of music and dance. *GP*

Barnard College, NYC; Mark C. Carnes: $44,000. To conduct a series of faculty development workshops that will lead to the development of new freshman seminars that integrate the study of Western and

non-Western cultures. *EK*

Bowling Green State U., OH; Linda M. Fidler: $76,713 OR; $10,000 FM. To catalog a collection of 12,000 popular music LPs recorded in the United States between 1950 and 1970. *RC*

Catholic U. of America, Washington, DC; E.M. Macierowski: $33,000. To prepare the edition and translation from medieval Arabic of the lost Greek treatise Peri Logou Apotomes (On Cutting off a Ratio) by Apollonius Pergaeus (c. 210 B.C.), a mathematician in the Euclidean tradition whose analytic method was only surpassed by Descartes in the 17th century. *RL*

Cornell U., Ithaca, NY; Charles B. McNamara: $70,104 OR; $70,000 FM. To recatalog in machine-readable form 9,000 titles from one of the world's leading Dante collections. *RC*

Dartmouth College, Hanover, NH; John R. James: $9,115. To plan for New Hampshire's participation in the U.S. Newspaper Program. *PS*

De Paul U., Chicago, IL; Robert L. Rotenberg: $90,730. To conduct faculty workshops to improve the teaching of a required freshman program that integrates the teaching of writing with the teaching of a world civilization course and a European civilization course. *EK*

Patricia K. Grimsted: $125,000 OR; $20,000 FM. To prepare a Ukrainian volume in a series of guides to archives and manuscript repositories in the USSR. The Ukrainian volumes complement previously published works on Moscow, Leningrad, Estonia, Latvia, Lithuania, and Belorussia. *RC*

Johns Hopkins U., Baltimore, MD; Henry Y.K. Tom: $1,645. To publish A Guide to Documentary Editing, a practical introduction and reference book on the editing of historical and literary documents and texts. *RP*

Latin American Bibliographic Fdn., Redlands, CA; George F. Elmendorf: $100,000 OR; $140,000 FM. To compile a bibliography of books and other publications printed in El Salvador, written by Salvadorans, or about El Salvador between 1800 and 1983. *RC*

Lurleen B. Wallace State Junior College, Andalusia, AL; Bev E. Smith: $11,230. To use three consultants to review current survey courses in the humanities, to assess library holdings, and to develop independent faculty projects. *EK*

Minnesota Historical Society, St. Paul; Lydia Lucas: $58,989. To arrange and describe the papers of Thomas Barlow Walker and his family covering the lumber industry, real estate, and philanthropy for the period 1881–1965. *RC*

Modern Language Association of America, NYC; John J. Morrison: $163,127 OR; $105,000 FM. To revise volume one of a three-volume guide to works published in English or in lands under British rule, 1641–1700. *RC*

National Humanities Center, Res. Triangle Pk, NC; Wayne J. Pond: $125,000. To produce 52 30-minute radio programs featuring conversations in the humanities with fellows and visitors at the National Humanities Center, and to plan for a series of five-minute radio modules. *GN*

New York Public Library, NYC; Betty Gubert: $70,000 OR; $70,000 FM. To convert to data base format an existing index to articles on black history and culture found in serials and ephemeral publications issued in the United States, Africa, Latin America, and the Caribbean from 1948 to 1985. *RC*

North Texas State U., Denton; John Kincaid: $200,000. To conduct faculty, course, and curriculum development activities for a humanities core. *EM*

Northeast Document Conservation Center, Andover, MA; Ann E. Russell: $140,000 OR; $230,000 FM. To prepare the field services program, which provides information, training, and on-site evaluation services to archives, libraries, historical societies, and museums throughout the Northeast, and to purchase microfilming equipment in order to upgrade NEDCC's preservation microfilming capability. *PS*

Piedmont Virginia Community College, Charlottesville; Evelyn Edson: $18,550. To plan a process in which a faculty task force will use consultant assistance to complete an assessment of the humanities requirements and to plan for course revision and faculty development. *EM*

Princeton U., NJ; Frederick W. Mote: $80,000. To complete the annotated catalogue of facsimile copies of rare Ming Dynasty literary works. This particular collection is the most extensive of its kind in North America. *RC*

RI Dept. of State Library Services, Providence, RI; Deborah B. Brennan: $82,657. To conduct programs on diverse aspects of Rhode Island history and culture to be held in public libraries throughout the state. *GL*

Rollins College, Winter Park, FL; R. Barry Levis: $40,922. To develop an introductory humanities course to be required of all entering students in the division of continuing education. *EG*

Saint Joseph College, West Hartford, CT: Barbara A. Kathe: $135,000. To develop a weekend college program in American Studies for nontraditional learners. *EG*

Southwest Museum, Los Angeles, CA; Daniela P. Moneta: $100,000 OR; $73,000 FM. To catalogue 18,000 monographs and 500 manuscript collections on the ethnology, archaeology, and history of native Americans of the Southwest. *RC*

Teachers College, Columbia U., NYC; David M. Ment: $45,333. To conduct archival processing of the records of Bank Street College, a leading institution in the progressive education movement. *RC*

Tulane U. of Louisiana, New Orleans; Richard F. Teichgraeber, III: $70,384. To support the development of five required courses for a new program in political economy which will emphasize the historical and theoretical aspects of the disciplines of economics, political science, and jurisprudence. *EL*

U. of Albuquerque, NM; Yvonne M. Jehenson: $10,695. To plan a series of five or six multifaceted programs in Albuquerque public libraries, focusing on an aspect of southwestern culture. *GL*

U. of Chicago, IL; Susan E. Abrams: $7,239. To publish a biography of Sewall Wright, a major figure in 20th-century evolutionary thought. *RP*

U. of Chicago, IL; James Nye: $159,990. To prepare a bibliography of works on classical and ancient India which have been published in monographic series from 1849 to 1984. *RC*

U. of Delaware, Newark; Mary B. Williams: $80,000. To develop humanities courses with significant writing components for science courses: biology and literature, computers and human nature, the culture of science, the nature of scientific inquiry, and philosophy of mind. *EL*

U. of Denver, CO; William B. Gravely: $283,302. To revise two courses, create a third course, and conduct a faculty development seminar for teachers involved in the university's core curriculum. *EM*

U. of Minnesota, Minneapolis; Andrea Hinding: $86,691. To continue a project to arrange and describe the archives of the YMCA of the U.S. from 1885 to the 1970s. *RC*

U. of Oklahoma, Norman; John N. Drayton: $10,000. To publish a study of Iroquois masks and maskmakers and of the role of the masks in tribal culture. *RP*

U. of Tennessee, Chattanooga; Robert C. Fulton: $200,000 OR; $100,000 FM. To promote faculty and curricular development activities related to a new honors program. *EM*

University Press of New England, Hanover, NH; Charles Backus: $5,000 OR; $2,500 FM. To publish a descriptive catalogue of all known maps and landscape drawings of Shaker villages in New England, Ohio, and Kentucky. *RP*

Walker State Technical College, Sumiton, AL; Carolyn Johnson: $10,316. To hire a consultant to assist the college in determining how to introduce the humanities into its curriculum. *EM*

Walters Art Gallery, Baltimore, MD; Gary Vikan: $10,000 OR; $1,297 FM. To conduct an international conference on ecclesiastical silver plate in early Byzantium. *RX*

Washington State U., Pullman; Thomas L. Kennedy: $200,000. To develop a two-term course in world civilization, implement a communications requirement, and review the institution's general distribution requirements. *EM*

Jurisprudence

U. of Florida, Gainesville; Michael D. Bayles: $9,841. To conduct a conference on the concept of "due process" in the American Constitution, its amendments, origins, and interpretations. *RX*

U. of Pennsylvania, Philadelphia; Ludo Rocher: $65,000 OR; $10,000 FM. To prepare an edition and translation of the 12th-century Law of Inheritance in Bengal, a code followed through Anglo-Indian times and still cited today. *RL*

Language & Linguistics

Stuart H. Blackburn: $35,725. To translate from the Tamil a folk version of the classic epic, Ramayana and the oral commentary that accompanies its 21-day performance in the temples of South India. *RL*

Brown U., Providence, RI; Eugene D. Cruz-Uribe: $10,000 OR; $4,000 FM. To catalogue a collection of Egyptian demotic papyri. *RC*

Ranjini D.E. Obeyesekere: $40,000. To translate the Saddharmaratnavaliya (Gems of the True Doctrine), a collection of stories about murderers, saints, demons, and folk cult heroes written by a 13th-century Sri Lankan monk to popularize Buddhist doctrines and ethics. *RL*

U. of Arizona, Tucson; Gregory L. McNamee: $5,000. To publish a sociolinguistic study of the Mexicano speech community of central Mexico. *RP*

U. of Pennsylvania, Philadelphia; Gillian E. Sankoff: $8,396. To conduct an international conference on contemporary Creole languages. *RX*

U. of Texas, Austin; Frances E. Karttunen: $12,617. To translate a 17th-century Nahuatl guide to the social and courtly etiquette of the Aztec nobility. *RL*

U. of Wisconsin, Milwaukee; Andreas Huyssen: $9,995. To conduct a conference which will reexamine German and Austrian modernism in light of recent scholarship and to compare the literary texts with the lived experience of the modern. *RX*

Literature

American Jewish Archives, Cincinnati, OH; Roy M. Lekus: $19,540. To plan a feature-length film for television on the major fiction and autobiography of the American-Jewish author Ludwig Lewisohn (1882–1955), examining these works as literature and for the light they shed on key American issues: ethnicity and assimilation, marriage and family. *GN*

Bay Area Radio Drama, Berkeley, CA; Erik Bauersfeld: $20,000. To plan 20 radio programs of Eugene O'Neill's works: five 60-minute programs of his short plays, and 15 programs of his longer works. *GN*

Bibliographical Society of America, Cambridge, MA; Michael B. Winship: $12,444. To prepare volume eight of the *Bibliography of American Literature*, a comprehensive descriptive bibliography of the works of 281 significant American literary authors. *RC*

John W. Bierhorst: $18,000 OR; $3,000 FM. To prepare the critical edition and translation of two Nahuatl texts, the Anales de Cuauhtitlan (Annals of the Aztec City-state, Cuauhtitlan) and the Leyenda de los Soles (Legends of the Suns), native pre-Columbian histories and sacred myths of the Aztecs preserved in a 16th-century transliteration. *RL*

Brown U., Providence, RI; Anthony Oldcorn: $25,000. To translate from the Italian Goldoni's dramatic trilogy Villeggiatura (A Month in the Country), first performed in Paris in 1761. *RL*

Champaign Public Library & Information Center, IL; Beverly J. Pinkston: $81,672. To produce an exhibition, public symposium, and lectures on H.G. Wells. Aids to viewing the exhibition will include a catalogue, lectures, an audio guide, a bibliography, a reader's theater, and film presentations. *GL*

Dartmouth College, Hanover, NH; Barry P. Scherr: $10,000. To conduct an international conference on critical theories of versification in Russian poetry. *RX*

Educational Film Center, Annandale, VA; Ruth Pollak: $72,850. To write a dramatic script based on Saul Bellow's short story, "A Silver Dish." *GN*

Georgetown U., Washington, DC; Alison Hilton: $10,000 OR; $10,795 FM. To conduct an international conference on Emile Zola's role as creative artist and critic in the art world of his time, and his influence on the impressionist movement. *RX*

Globe Radio Repertory, Seattle, WA; Irina S. Thompson: $48,339. To write and produce a radio dramatization of Nikolai Gogol's Dead Souls in nine 30-minute episodes. *GN*

Harvard U., Cambridge, MA; Ali S. Asani: $7,000. To prepare a finding aid and microfilm for a collection of manuscript and printed religious works from the Shiite Islamic community on the Indian subcontinent. *RC*

Thomas H. Hoisington: $12,000. To translate the first Polish novel, Mikolaja Doswiaczynskiego Przypadki (The Adventures of Nicholas Wisdomseeker, 1776), a picaresque satire of 18th-century Polish manners and mores. *RL*

Jefferson State Junior College, Birmingham, AL; Jo G. Marshall: $12,970. To plan a series of local library programs on southern literature for rural and inner-city people. *GL*

Learning in Focus, Inc., NYC; Robert Geller: $800,000 OR; $200,000 FM. To produce a feature-length television film adapted from Kate Chopin's novel *The Awakening* (1899). *GN*

Louisiana State U., Baton Rouge; Beverly Jarrett: $3,918. To publish a biography of the Harlem renaissance writer, Jean Toomer, author of *Cane*. *RP*

New York Center for Visual History, NYC; Lawrence Pitkethly: $300,000 OR; $50,000 FM. To produce one 60-minute film on Wallace Stevens, as part of a 13-part series for PBS on the world and work of American poets. *GN*

Northern Illinois U. Press, DeKalb; Mary L. Lincoln: $4,973. To publish a study of the moral issues raised in six classic works of Russian literature. *RP*

Occidental College, Los Angeles, CA; Tyrus G. Harmsen: $32,246. To create exhibitions, a series of lectures, and a symposium on the life and works of Robinson Jeffers to coincide with the centennial of his birth in 1987. A catalogue of the exhibition, a booklet of Jeffers' poetry, and a smaller, traveling exhibit will be prepared. *GL*

Rutgers U. Press, New Brunswick, NJ; Leslie C. Mitchner: $3,475. To publish a detailed and comprehensive study of the influence of the visual arts on W.B. Yeats's poetry and dramatic works. *RP*

Southern Connecticut Library Council, Hamden; Susan E. Davidson: $111,084. To conduct a series of book discussion programs in 20 Connecticut libraries using a critical, comparative, and historical approach to the reading and analysis of detective fiction. Books by Poe, Doyle, Christie, Stout, Chesterton, and Sayers have been selected for the project. *GL*

Southern Illinois U., Carbondale; Kenney Withers: $4,000. To publish a comprehensive study of the life and works of the 17th-century dramatist John Webster in the context of Renaissance, Caroline, and Restoration drama. *RP*

Stanford U., CA; Ian H. Levy: $50,000 OR; $5,000 FM. To translate and annotate, with introduction, the third volume of the earliest anthology of Japanese classical poetry from the 7th to the 8th century A.D. *RL*

Richard E. Strassberg: $36,682. To translate, with extensive critical apparatus, a selection of Chinese travel literature from the 5th to the 19th century which shows its relationship with Chinese landscape painting. *RL*

Tucson Public Library, AZ; Rolly Kent: $206,605. To conduct a series of reading and discussion programs using works in the Library of America series and other selected American literature as the central texts. *GL*

U. of Georgia Press, Athens; Elizabeth M. Makowski: $4,200. To publish a study of the rise and decline of William Faulkner's literary vocation in the larger context of the predicament faced by a serious writer in the American South. *RP*

U. of Michigan, Ann Arbor; Piotr A. Michalowski: $50,000. To prepare the edition and translation of The Royal Correspondence of Ur, a collection of royal letters inscribed on clay tablets in Sumerian cuneiform script and used as school texts in Old Babylonian Mesopotamia (1700–1600 B.C.). *RL*

U. of North Carolina Press, Chapel Hill; Iris T. Hill: $3,027. To publish a comprehensive study of the pastoral in English Romantic poetry. *RP*

U. of North Carolina Press, Chapel Hill; Iris T. Hill: $2,066. To publish a new interpretation of the *Canterbury Tales* that argues that each tale is an expression of a special kind of poetry, and that the whole is not a dramatic contrast of different pilgrims but an unresolved debate among different poets. *RP*

U. of Pennsylvania, Philadelphia; Zachary W. Simpson: $4,300. To publish a history of the development and growth of the teaching and study of American literature in United States colleges and universities from the early 20th century to the present. *RP*

U. of Texas, Austin; Merlin H. Forster: $75,000. To complete an annotated guide to primary and secondary resources on experimental Latin American literary movements of the 20th century. *RC*

U. of Texas, Austin; Bernth Olof Lindfors: $36,458. To prepare an international bibliography of criticism of black African literature in English. The work will cover criticism published in 1982–86 and supplement two earlier volumes covering 1936–81. *RC*

Philosophy

Bowling Green State U., OH; Thomas W. Attig: $9,660. To conduct a conference exploring issues related to the restraint of liberty. *RX*

Columbia U. Press, NYC; Vincent Duggan: $3,800. To publish a translation of the K'un-Chih Chi, a 16th-century Chinese Neoconfucian philosophical text. *RP*

Inst. for Research in Classical Philo. & Sci., Pittsburgh, PA; Alan C. Bowen: $9,626. To conduct an international conference on the interaction of science and philosophy in Greece in the 5th and 4th centuries B.C. *RX*

Massachusetts Institute of Technology Cambridge; Robert M. Wallace: $11,880 OR; $7,890 FM. To translate Die Lesbarkeit der Welt (The Legibility of the World), a discussion of irreducible book and reading metaphors in the history of Western thought, by the contemporary German philosopher Hans Blumenberg. *RL*

Saint Bonaventure U., St. Bonaventure, NY; Conrad L. Harkins: $10,000. To publish volume one of the Lectura Secunda of Adam de Wodeham, the 14th-century philosopher and interpreter of Duns Scotus and William of Ockham. *RP*

Richard T. Taft: $20,575 OR; $2,000 FM. To translate, with critical apparatus, Martin Heidegger's Kant und das Problem der Metaphysik (Kant and the Problem of Metaphysics), 1929. *RL*

U. of Delaware, Newark; Robert F. Brown: $40,000 OR; $5,000 FM. To prepare the edition and translation of Hegel's Lectures on the History of Philosophy (1825–26) in four volumes, to appear as part of the ten-volume series that will include all of the lectures given by Hegel during his academic tenure. *RL*

U. of Massachusetts, Amherst; Leonard M. Ehrlich: $22,615 OR; $2,000 FM. To prepare an edition and translation of volume three of The Great Philosophers by Karl Jaspers (1882–1969). *RL*

U. of Virginia, Charlottesville; Paul W. Humphreys: $7,187. To conduct a conference on the issue of philosophy as a separate discipline in contrast to the recent tendency for it to proliferate into other disciplines (e.g., philosophy of language, philosophy of biology). *RX*

Religion

Robert Doran: $31,000. To translate from the Greek and Syriac, the biographies of Saint Simeon the Stylite, the fifth-century holy man whose teachings and asceticism dominated late eastern Roman society. *RL*

August J. Kling: $22,000 OR; $5,000 FM. To translate the Book of Prophecies compiled by Christopher Columbus from biblical and medieval texts and the 2,000 postils (notes) he wrote in the margins. *RL*

Public Television Playhouse, Inc., Los Angeles, CA; Joyce Keener: $100,000. To produce a 90-minute dramatic program for *American Playhouse* in which a young man in

a Pennsylvania Mennonite community in the 1930s comes to grips with conflicts arising from commitments to his family, to his religious community, and to his own conscience. *GN*

Southern Methodist U., Dallas, TX; Victor P. Furnish: $10,000 OR; $16,969 FM. To conduct an international conference on interpretations of the Apostle Paul and his letters, especially the ways in which they influenced and were influenced by the broader cultural and intellectual movements of the first five centuries of the Christian era. *RX*

U. of Texas, Austin; Irving J. Mandelbaum: $35,000. To translate, with introduction and notes, the Yerushalmi Kilayim ("Each According to Its Kind"), the tractate of the Palestinian Talmud (third to fifth centuries C.E.) on an agricultural section of the Mishnah, the earliest rabbinic document (200 C.E.), which the Babylonian Talmud neglects. *RL*

Social Science

Metropolitan Pittsburgh Public Broadcasting, PA; Danforth P. Fales: $700,000. To produce two 60-minute documentary programs, part of a nine part series on the U.S. Constitution. *GN*

Nevada State Division of Archives and Records, Carson City; Guy Louis Rocha: $43,596. To arrange and describe official records documenting the history of territorial Nevada and Utah and the state of Nevada in the period 1855 to 1945. *RC*

Rochester Institute of Technology, NY; David D. Murdoch: $62,836. To conduct a faculty seminar and various public events related to the teaching of a required senior seminar on the U.S. Constitution. *EL*

Rutgers U. Press, New Brunswick, NJ; Marlie P. Wasserman: $2,810. To translate Le Marche de la Peinture en France 1945–1967 (The Market for Painting in France) by the French sociologist Raymonde Moulin. *RL*

U. of Baltimore, MD; Carol M. Peirce: $17,406. To plan workshops in which faculty members will work with consultants to refine syllabi for four new core courses and to prepare to teach the courses. *EK*

U. of Michigan, Ann Arbor; R. Anne Okey: $20,591. To support completion of a project to improve access to a collection of manuscripts and ephemeral literature produced by 20th-century radical protest and reform movements. *RC*

Capital letters following each grant amount have the following meanings: *FM* Federal Match; *OR* Outright Funds. Capital letters following each grant show the division and the program through which the grant was made.

Division of Education Programs
- *EB* Central Disciplines in Undergraduate Education
- *EK* Improving Introductory Courses
- *EL* Promoting Excellence in a Field
- *EM* Fostering Coherence Throughout an Institution
- *ES* Humanities Instruction in Elementary and Secondary Schools
- *EH* Exemplary Projects in Undergraduate and Graduate Education
- *EG* Humanities Programs for Nontraditional Learners

Division of General Programs
- *GN* Humanities Projects in Media
- *GM* Humanities Projects in Museums and Historical Organizations
- *GP* Humanities Programs for Adults
- *GL* Humanities Programs in Libraries

Division of Research Programs
- *RO* Interpretive Research Projects
- *RX* Conferences
- *RH* Humanities, Science and Technology
- *RP* Publication Subvention
- *RA* Centers for Advanced Study
- *RI* Regrants for International Research
- *RT* Tools
- *RE* Editions
- *RL* Translations
- *RC* Access

Office of Preservation
- *PS* Preservation
- *PS* U.S. Newspaper Program

HUMANITIES, SCIENCE AND TECHNOLOGY

(continued from page 40)

of the work within a discipline, and panelists who are often concerned more with the broader significance of the research for the humanities. For a project investigating the role of technology in architecture, for example, the reviewers were unanimous in their high estimation of the abilities of the principal investigators and considered the study to be of great value to architectural history. Most of the reviewers also noted the investigators' work in creating a new synthesis of the primary role of structural technology in the creation of works of building art. Panelists, on the other hand, discussed the extent to which the project focuses on values in the humanities. The panelists did reach the consensus that the issues raised by the study are of importance to the humanities and that the investigators are extremely competent scholars, who are knowledgeable of the relationships between engineering and aesthetics.

Prospective applicants should consider carefully whether their proposals respond to the questions listed on page 21 of the Division of Research Programs brochure of guidelines. These questions are sent to reviewers along with the proposals that they evaluate and are often used by them as guides for evaluation.

How does the Endowment determine appropriate dollar amounts for each component or phase of a proposed project?

Proposals are evaluated primarily on the merit of the ideas, the ability of the project staff, and the significance of the project to scholarship in the humanities. Once these criteria have been met, NEH staff examine the proposed budgets to determine whether the costs are reasonable and necessary to carry out the work and have been justified in the description of the project.

After the program staff have determined that costs are reasonable and necessary, the NEH Grants Office staff make sure that costs are allowable according to federal regulations. This determination is made after the project has been recommended for funding.

How soon after the deadline for proposal submissions can I expect to receive a decision on my application?

Approximately eight months after the deadline for receipt of applications. Once a formal application has been received at a deadline, the staff will not comment on the status of that application except with respect to questions of completeness or eligibility.

If I am not sure that my project idea adequately integrates the humanities with science and technology to receive Endowment support, is there a way that I can determine this, short of applying for support?

After reading the guidelines, applicants should draft a brief description of the project and mail it to the HST program officer, Daniel Jones, who will assess its eligibility and completeness. Experience has shown that those applications that have benefited from preliminary staff advice have a significantly higher success rate in the review process. Applicants are urged to begin preparation of their proposals early so that sufficient time remains for preliminary discussions with the staff.

DEADLINES · DEADLINES · DEADLINES · DEADLINES

Area code for all telephone numbers is 202	**Deadlines in boldface**	For projects beginning after
Division of Education Programs—*Pamela Glenn Menke, Director 786-0373*		
Central Disciplines in Undergraduate Education—*Lyn Maxwell White 786-0380*	**April 1, 1987**	October 1987
Improving Introductory Courses—*Lyn Maxwell White 786-0380*	**April 1, 1987**	October 1987
Promoting Excellence in a Field—*Lyn Maxwell White 786-0380*	**April 1, 1987**	October 1987
Fostering Coherence Throughout an Institution—*Lyn Maxwell White 786-0380*	**April 1, 1987**	October 1987
Humanities Programs for Nontraditional Learners—*Sara S. Chapman 786-0384*	**April 1, 1987**	October 1987
Exemplary Projects in Undergraduate and Graduate Education—*Sara S. Chapman, Paul Peterson 786-0384*	**December 1, 1986** **May 1, 1987**	July 1, 1987 January 1, 1988
Humanities Instruction in Elementary and Secondary Schools—*Carolynn Reid-Wallace, Stephanie Quinn Katz, Jayme A. Sokolow, Thomas Gregory Ward 786-0377*	**January 8, 1987** **May 15, 1987**	July 1987 January 1988
High School Humanities Institutes at Historically Black Colleges and Universities—*Jayme A. Sokolow 786-0377*	**March 15, 1987**	September 1987
Summer Humanities Program for High School and College Teachers—*Jayme A. Sokolow 786-0377*	**March 15, 1987**	September 1987
Improving the Preparation of Teachers in the Humanities—*Pamela Glenn Menke 786-0373*		
Division of Fellowships and Seminars—*Guinevere L. Griest, Director 786-0458*		
Fellowships for College Teachers and Independent Scholars—*Karen Fuglie 786-0466*	**June 1, 1987**	January 1, 1988
Fellowships for University Teachers—*Maben D. Herring 786-0466*	**June 1, 1987**	January 1, 1988
Constitutional Fellowships—*Joseph Phelan 786-033, Maben D. Herring, Karen Fuglie 786-0466*	**June 1, 1987**	January 1, 1988
Summer Stipends—*Joseph B. Neville 786-0466*	**October 1, 1987**	May 1, 1988
Travel to Collections—*Leon Bramson 786-0463*	**January 15, 1987**	June 1, 1987
Faculty Graduate Study Program for Historically Black Colleges and Universities—*Beatrice Stith Clark, Maben D. Herring 786-0466*	**March 15, 1987**	September 1, 1988
Younger Scholars—*Leon Bramson 786-0463*	**November 1, 1986**	May 1, 1987
Summer Seminars for College Teachers—*Kenneth Kolson 786-0463*		
Participants	**March 1, 1987**	Summer 1987
Directors	**March 1, 1987**	Summer 1988
Summer Seminars for Secondary School Teachers—*Steven S. Tigner 786-0463*		
Participants	**March 1, 1987**	Summer 1987
Directors	**April 1, 1987**	Summer 1988

DLINES · DEADLINES · DEA
· DEADLINES · DEADLINES

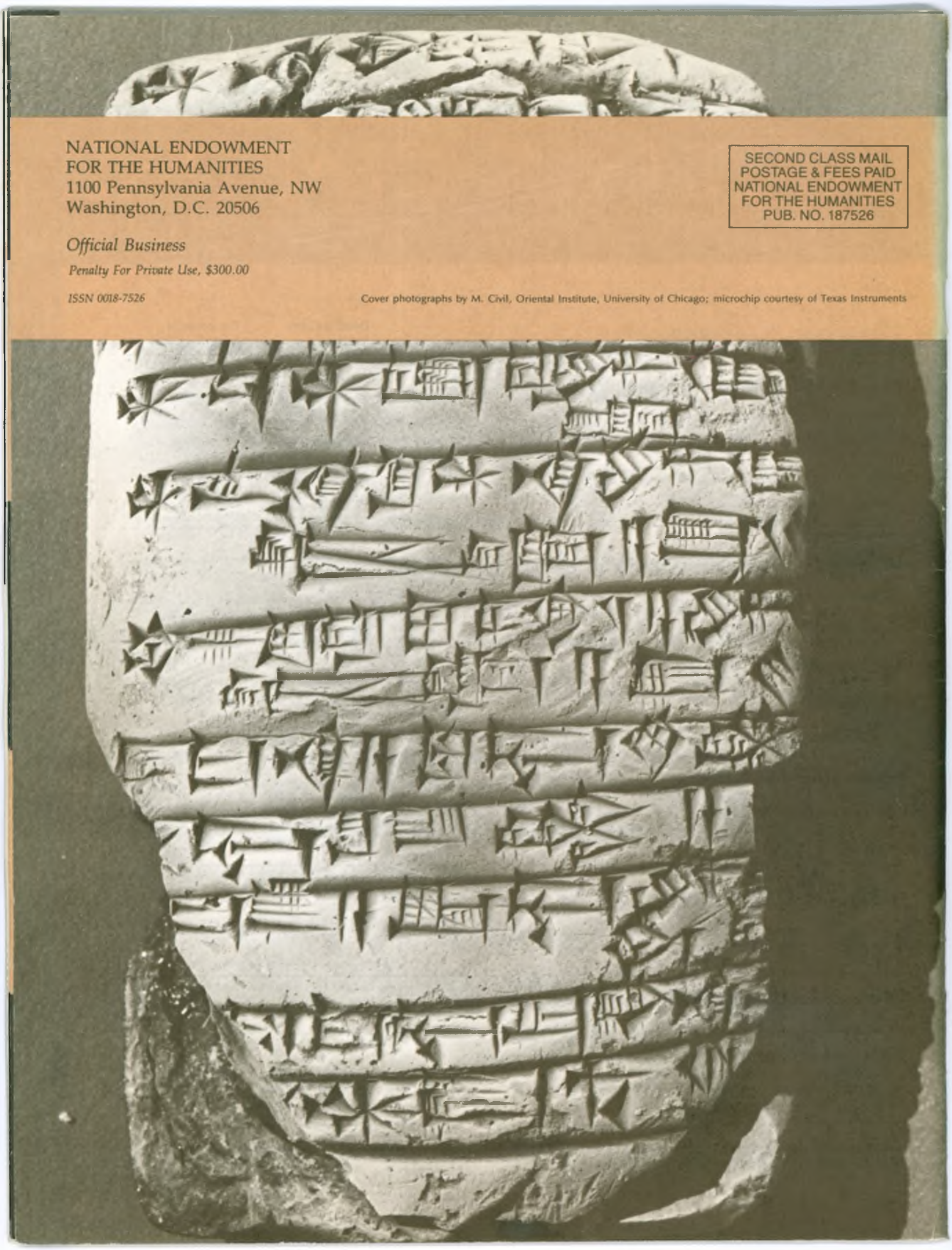
Area code for all telephone numbers is 202	**Deadlines in boldface**	For projects beginning after
Division of General Programs—*Donald Gibson, Director 786-0267*		
Humanities Projects in Media—*James Dougherty 786-0278*	**March 20, 1987**	October 1, 1987
Humanities Projects in Museums and Historical Organizations—*Dudley Varner 786-0284*	**December 12, 1986**	July 1, 1987
Public Humanities Projects—*Malcolm Richardson 786-0271*	**March 20, 1987**	October 1, 1987
Humanities Projects in Libraries—*Thomas Phelps 786-0271*	**March 20, 1987**	October 1, 1987
Division of Research Programs—*Richard Ekman, Director, 786-0200*		
Texts—*Margot Backas 786-0207*		
Editions—*Charles Meyers, Kathy Fuller, Dennis Romano 786-0207*	**June 1, 1987**	April 1, 1988
Translations—*Martha Chomiak, Sharon Cohen 786-0207*	**June 1, 1987**	April 1, 1988
Publication Subvention—*Margot Backas, Kathy Fuller 786-0207*	**April 1, 1987**	October 1, 1987
Reference Materials—*John Williams 786-0358*		
Tools—*Helen Aguera 786-0358*	**November 1, 1986**	July 1, 1987
Access—*Patricia Shadle, Patrick Nolan 786-0358*	**November 1, 1986**	July 1, 1987
Interpretive Research—*Dorothy Wartenberg 786-0210*		
Projects—*David Wise, Dennis Romano, Kenneth Garcia 786-0210*	**October 1, 1987**	July 1, 1988
Humanities, Science and Technology—*Daniel Jones, Elizabeth Arndt 786-0210*	**October 1, 1987**	July 1, 1988
Regrants—*Eugene Sterud 786-0204*		
Conferences—*Crale Hopkins 786-0204*	**February 15, 1987**	October 1, 1987
Centers for Advanced Study—*David Coder 786-0204*	**December 1, 1986**	July 1, 1987
Regrants for International Research—*Eugene Sterud 786-0204*	**February 15, 1987**	October 1, 1987
Regrants in Selected Areas—*Eugene Sterud 786-0204*	**February 15, 1987**	October 1, 1987

Division of State Programs—*Marjorie Berlincourt, Director 786-0254*

Each state humanities council establishes its own grant guidelines and application deadlines. Addresses and telephone numbers of these state programs may be obtained from the division.

Office of Challenge Grants—*James Blessing, Director, 786-0361*	**May 1, 1987**	December 1, 1986
Office of Preservation—*Harold C. Cannon, Director 786-0570*		
Preservation—*Steven Mansbach 786-0570*	**December 1, 1986**	April 1, 1987
U.S. Newspaper Program—*Jeffrey Field 786-0570*	**December 1, 1986**	April 1, 1987
	June 1, 1987	

Guidelines are available from the Public Affairs Office (202/786-0438) two months in advance of the application deadline. Telecommunication Device for the Deaf: 786-0282



NATIONAL ENDOWMENT
FOR THE HUMANITIES
1100 Pennsylvania Avenue, NW
Washington, D.C. 20506

SECOND CLASS MAIL
POSTAGE & FEES PAID
NATIONAL ENDOWMENT
FOR THE HUMANITIES
PUB. NO. 187526

Official Business

Penalty For Private Use, $300.00

ISSN 0018-7526

Cover photographs by M. Civil, Oriental Institute, University of Chicago; microchip courtesy of Texas Instruments