large cluster of public buildings that may have been a temple complex, as well as a pebbled street running through the settlement." The houses and the street are arranged exactly the same way in 10 successive layers of occupation, yet most of the vegetative remains and all of the animal remains were wild. In short, the occupants of this fairly large and highly stable settlement subsisted mostly on hunting and gathering. That "goes against every paradigm we have ever had," Guillermo Algaze of the University of California, San Diego, points out.

A further assault on the Neolithic Revolution has come from researchers using new techniques involving tiny plant fossils to study early agriculture, Pringle says. Their work has pushed back the dates of both plant domestication and animal husbandry around the world. While some villages in the Near East came into existence before agriculture, settlements in many other regions came thousands of years after crops. Either way, the strong causal link between farming and settled village life that archaeologists have long imagined seems to have snapped.

In Search of Objectivity

"Objective Visions" by Bruce Bower, in *Science News* (Dec. 5, 1998), 1719 N St., N.W., Washington, D.C. 20036.

Objectivity is a fighting word in the current "science wars." Postmodernist sociologists and philosophers claim that it's only a socially constructed idea masking scientists' shared assumptions and self-interested drives for power and prestige. Scientists themselves insist that it is a scientific lodestar. What both sides tend to ignore, maintains *Science News* writer Bower, is the history of objectivity in science.

A drawing from Bernhard Albinus's 1747 Tabulae Sceleti et Musculorum Corporis Humani. *Albinus felt the elaborate backgrounds gave his engravings a three-dimensional effect.*

In assuming that objectivity has one fixed meaning, many on both sides of the science wars are making a mistake, historians tell him. "Objectivity has had and continues to have different meanings," says Lorraine Daston, director of the Max Planck Institute for the History of Science in Berlin. Among its modern ones: empirical reliability, procedural correctness, emotional detachment, and absolute truth.

The term *objectivity* "did not acquire its current cachet in science until the 19th century," Bower points out. Eighteenth-century scientists relied more on imagination, especially the informed imaginations of acknowledged geniuses such as Dutch anatomist Bernhard Albinus. His 1747 atlas of the human body portrayed not the skeletons he had carefully reassembled but an "improved" depiction based on his insights.

Between about 1830 and 1920,

according to Peter L. Galison, a historian of science at Harvard University, that sort of approach declined, as scientists sought to remove overt signs of imagination—now the province of poets and artists—from their work. They were pushed by both the collapse of major theories (e.g., the Newtonian theory of light) built the old way and the availability of new devices, such as the camera. In this new era of "mechanical objectivity," it was thought better to illustrate atlases, for example, with a blurred photograph of a distant star or a fragment of a fossil than to present an imaginative reconstruction.

Scientists busied themselves standardizing their instruments, clarifying their basic concepts, and adopting an impersonal style of writing—all to make it easier for other scientists to understand their work. Facts were no longer "malleable observations but . . . unbreakable nuggets of reality," writes Bower.

In the medical and natural sciences, however, another shift occurred by about 1920, as a door opened to trained imagination and informed judgment.

Today, rigid standards of quantitative rigor tend to be most strongly valued in embattled and divided disciplines such as experimental psychology, contends Theodore M. Porter, a historian of science at the University of California, Los Angeles. Scientists in more secure disciplines, such as in the small community of experimental high-energy physics, operate, in contrast, much more informally. With only a few particle accelerators available, and experimenters continually adjusting their equipment, independent replication of experimental results is difficult. As a result, influential physicists often assess the skills and trustworthiness of the experimenters themselves in order to reach a collective judgment on whether particular findings merit acceptance.

"Scientists employ techniques and ways of thinking which are powerful and effective, but which are often hard to articulate," Porter says. "In science, as in political and administrative affairs, objectivity has more to do with the exclusion of personal judgment and the struggle against subjectivity than with truth to nature."

Superfund Waste

"How Costly Is 'Clean'? An Analysis of the Benefits and Costs of Superfund Site Remediations" by James T. Hamilton and W. Kip Viscusi, in *Journal of Policy Analysis and Management* (Winter 1999), Univ. of Pennsylvania, The Wharton School, 3620 Locust Walk, Ste. 3100, Philadelphia, Pa. 19104–6372.

It's no secret that cleaning up a Superfund hazardous waste site is a very expensive proposition. Is it worth it? Hamilton, a professor of public policy at Duke University, and Viscusi, a professor of law and economics at Harvard Law School, add their voices to those who say that in many cases the answer is no.

Examining a representative sample of 150 out of the 1,388 Superfund sites, and using Environmental Protection Agency (EPA) risk assessments and 1990 census data about the populations in the surrounding areas, the two researchers calculate that at most of the sites, the number of expected cancer cases resulting from contamination is relatively low. Overall, at the 150 sites, $2.2 billion is being spent to avert 731 cancer cases—an average of $3 million per case. But even that figure is misleading, say the authors. At half the locations, the risk amounts to less than one-tenth of a cancer case per site. And at 101 of the 145 sites with any averted cancer cases, the cleanup costs would be more than $100 million per averted case.

Why are the cleanups so inefficient? In part, say the authors, because the EPA has focused on the cancer risk to an individual who becomes contaminated at the site (even though there were residents on only 14 of the 150 sites), rather than on the number of cancer cases expected to arise in the area's population. The inefficiency also is due, Hamilton and Viscusi say, to the fact that Congress, wanting to prevent the Reagan administration from favoring polluters, as it allegedly had been doing, directed the EPA in 1986 legislation to require permanent cleanups, not mere containment of hazardous wastes.