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COVER St. Kevin Gulch, a mountain stream near Leadville, Colorado, which receives acidic, metal-enriched drainage from an abandoned mine. Hydrous iron oxides impart the bright orange color to the stream; photoreduction of these oxides and dissolved ferric iron causes large increases in dissolved ferrous iron, Fe^{2+}, during the day. See page 637. [Kenneth E. Bencala, U.S. Geological Survey, Menlo Park, CA]

Book Reviews

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This Week in
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Contaminants and atmospheric dynamics

LIKE the knee bone that's connected to the shin bone, greenhouse gases and anthropogenic contaminants are connected to changes in stratospheric temperatures and ozone concentrations, which, in turn, are connected to changes in radiative absorption and air flow patterns (page 634). In their detailed model of the earth's atmosphere, Brasseur and Hitchman map ozone and temperature changes in the atmosphere in two dimensions—from pole to pole and from the earth's surface to 85 kilometers into the stratosphere. Interactions of three factors were considered—the chemical reactions that can occur among various gases and ions, the dynamic wave motions that move air laterally and vertically in the atmosphere, and the absorption and emission of various kinds of electromagnetic radiation by atmospheric chemicals. With continuing atmospheric contamination, at current or accelerated rates, additional local and global stratospheric perturbations will be induced and will further reduce the stratosphere's effectiveness as the shield that protects the earth from the sun's electromagnetic radiation.

Sun and stream

SAINT Kevin Gulch is a Rocky Mountain stream (cover) that picks up the drainage from a mine that was worked some 80 years ago (page 637). In the stream, hydrous iron oxides are abundant and there is little dissolved organic matter; this is a common profile for the acidic mountain streams in Colorado. The reduction rate of iron in the stream has been shown to vary in response to sunlight: during daytime, the ferric form of iron in both dissolved and colloidal compounds is photoreduced to ferrous iron. Throughout each 24-hour period, some ferrous iron is continuously oxidized back to ferric iron, but the daytime chemical conversion rate may be four times as great as the night rate. McKnight *et al.* suggest that the daily light-related fluctuations in iron species have been overlooked in earlier field studies of acidic streams and lakes; this oversight may account for the wide variations in concentrations of iron, copper, and other metals reported for such streams and lakes.

HTLV-I in the blood supply

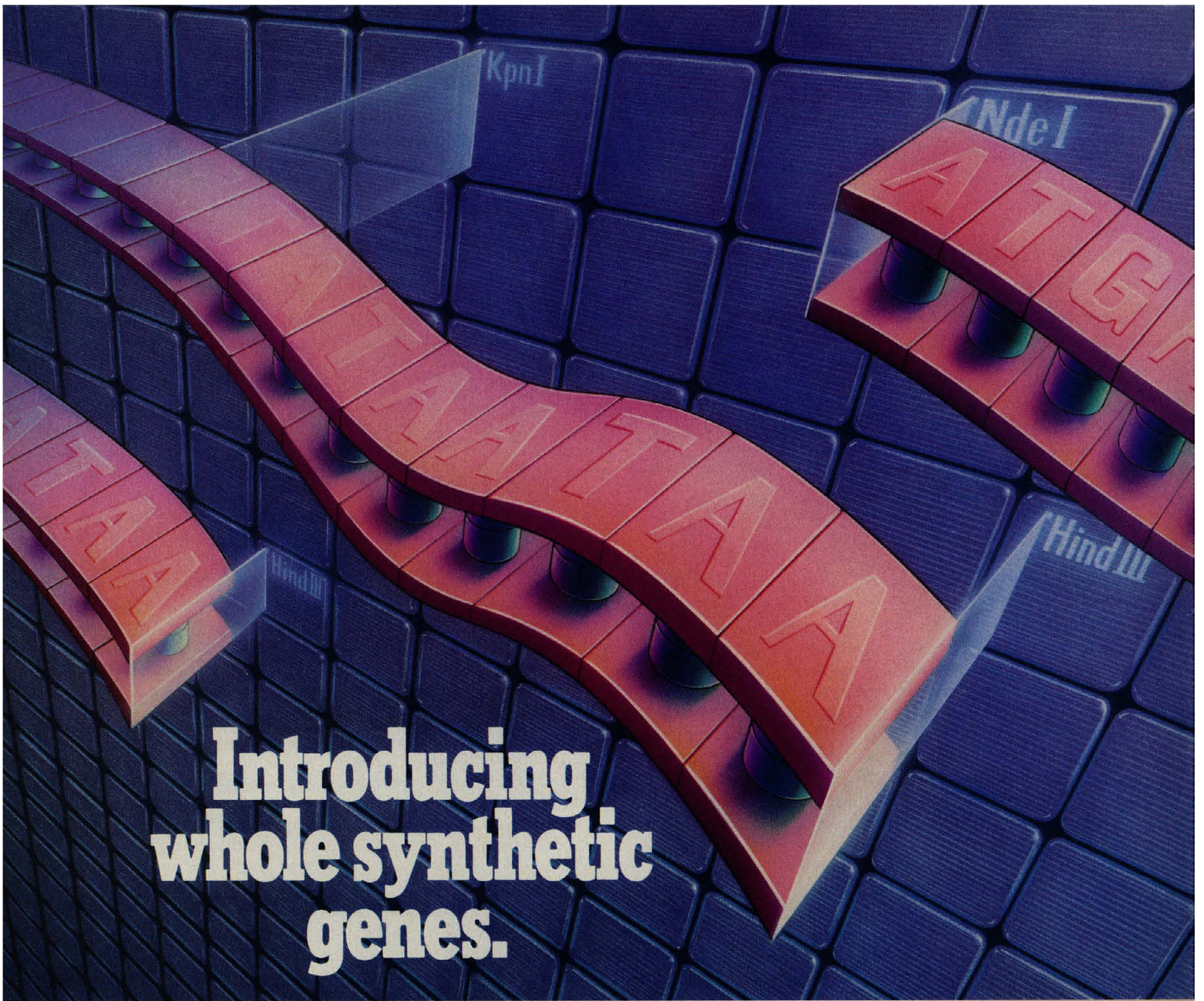
IN order to prevent the transmission of diseases to blood transfusion recipients, banked blood in the United States is routinely tested for the infectious agents or serologic indicators of hepatitis, syphilis, and AIDS (page 643). The prevalence of antibodies to another agent, the human T-lymphotropic virus type I (HTLV-I), has now been determined in blood samples from 39,898 donors in eight U.S. regional blood collection centers. HTLV-I has been associated with adult T cell leukemia and lymphoma and two neurologic diseases (tropical spastic paraparesis and one form of myelopathy). Although these diseases are currently rare outside Japan, Africa, and the Caribbean, infection with HTLV-I has been observed among intravenous drug users in the United States. Among the tested donors, ten infected (but disease-free) individuals were found and their epidemiologic characteristics evaluated and profiled. Williams *et al.* recommend routine testing of the blood supply for HTLV-I, for, without it, they estimate that about 2800 blood recipients each year could acquire HTLV-I infections from transfused blood.

Whooping cough vaccine development

WHOOPING cough is caused by *Bordetella pertussis*, a bacterium that produces a potent toxin (page 656). Of five polypeptides that make up the toxin, one, called S1, has figured both in the organism's pathogenicity and in its ability to induce a protective immune response in an infected host. Studies with mutant S1 molecules now show that it is difficult to completely uncouple the toxin's virulence from its protection-inducing effects. Bacteria that produced intact but enzymatically inactive S1 molecules (S1 is an adenosine diphosphate ribosytransferase and it can inactivate many of the proteins involved in normal cellular metabolism) were not virulent, but they also had somewhat diminished immunogenicity; however, with larger doses of the material, protection could be induced. Black *et al.* conclude that the enzymatic activity of S1 (and not just its antigenicity) is crucial to both virulence and protection and, therefore, that development of an effective whooping cough vaccine—one that protects without causing harmful sequelae—will not be simple even with the tools of genetic engineering at hand.

High-lysine corn

CORN is one of the cereals that is deficient in the essential amino acid lysine, and, for some time, a goal of agricultural research has been to improve its food value by introducing lysine into corn proteins (page 662). Although some success has been achieved in increasing the lysine content of zeins (the storage proteins in corn) by genetic selection and breeding experiments, the yields from these experiments have generally been low and those seeds that are produced are usually soft and do not hold up well during storage. Wallace *et al.* have now used genetic engineering techniques to alter DNA in such a way that the zeins that are made contain lysine residues. The zeins assemble properly into dense "protein bodies" despite the addition of the highly charged amino acids (thus providing not a kernel of evidence that a charged zein will necessarily be dysfunctional). The altered zeins were produced in an artificial system, but the work illustrates that by genetic engineering functional lysine-rich zeins can be produced. This is a step toward production, eventually by transgenic plants, of nutritionally complete corn.



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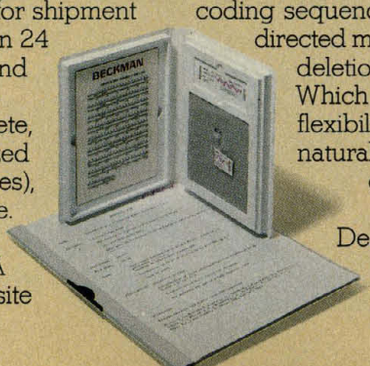

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Science, Journalism, and Whistle-Blowing

Discussion of fraud in science is becoming a cottage industry in need of an environmental impact report. Fraud is devastating to science; it undermines the basic respect for the literature on which the rapidity of scientific advance depends. It must be rooted out wherever and whenever it is discovered. That makes it all the more imperative that charges of fraud be made responsibly and that the performance record of whistle-blowers be scrutinized as well as those of the scientists they criticize. In recent times we have been exposed to excesses in whistle-blowing and journalism that come close to the evils they wish to eradicate. We see, for example, the charge that there is widespread fraud, followed by a text defining fraud as a broad concept including "misconduct." Misconduct is then interpreted to include such items as poor proofreading or incomplete references. In a recent congressional hearing, misconduct was further broadened to include a difference in interpretation of complex data. Crying wolf tends to lose effectiveness when the wolf is redefined as a vicious mouse and then it is further conceded that the viciousness is a matter of opinion.

The slowness of institutions in conducting investigations is viewed by some as evidence of an "old boy" conspiracy. But there are good reasons to be slow to accuse a colleague. A student works in close cooperation with a professor for months or years and finally solves a problem. A statement by the professor that "we can't publish until the result is checked" might eliminate a few cases of fraud, but it would forever damage the relation between student and professor. Institutions that are quick to accuse distinguished faculty members of misconduct or worse on the basis of gossip or flimsy data will not long have a distinguished faculty. The fate of whistle-blowers who have lost their jobs or failed to continue in science is often recounted as evidence of retaliation, but the quality of the whistle-blowers' work is relevant to this conclusion. The idea that scientists may cut corners to achieve fame, but whistle-blowers never do, is nonsense. Past track records are not always a guide to future conduct—some distinguished scientists err, some erratic whistle-blowers are right on occasion—but scientists, like ordinary citizens, are innocent until proven guilty. Investigation of their integrity should require substance. It is not a cover-up for an institution to refuse to initiate an inquiry if the only evidence is the accusation by an unreliable source.

The scientific apparatus cannot afford to disregard accusations of fraud, and competent whistle-blowers help science. Investigations should be pursued meticulously, but the final report should strongly state the outcome: If the accusation is correct the miscreant should be punished and the whistle-blower commended. If, however, the accusation is incorrect, in addition to the usual bland announcement of exoneration there should be a denunciation of the false charges and a documentation of the time, anguish, and delay that has been occasioned. Science cannot tolerate fraud, but it should not be at the mercy of headline-happy journalists or incompetent whistle-blowers.

Journalists must distinguish between fraud, sloppiness, and differences of opinion. When an accusation of fraud is made, if the evidence appears weak or the charge exaggerated a careful journalist should be alerted to probe more deeply. Opinions of noninvolved experts on the likelihood of error and the track record of the accuser should be documented early on, even in the initial story. The original story may have to state the facts of an accusation before all the background is obtained, but in most cases the story can be delayed, and in all cases pertinent doubts should be expressed. The final outcome should be publicized appropriately. Finally, the setting in which a story is reported must be considered by a journalist. A story involving a prominent scientist in an inquiry on fraud is bound to make headlines, even if the story is only a question of judgment. The late Senator Joseph McCarthy was particularly clever at manipulating journalists in this way; the techniques should be familiar by now.

Scientists respect integrity, scholarship, and good judgment as much as they abhor fraud, sloppiness, and poor judgment, but these are very different phenomena. Those who mix them together in uncritical ways may decrease our chances of eliminating true fraud, may damage reputations unfairly, and may diminish enthusiasm for healthy differences of opinion at the cutting edge of science.—DANIEL E. KOSHLAND, JR.

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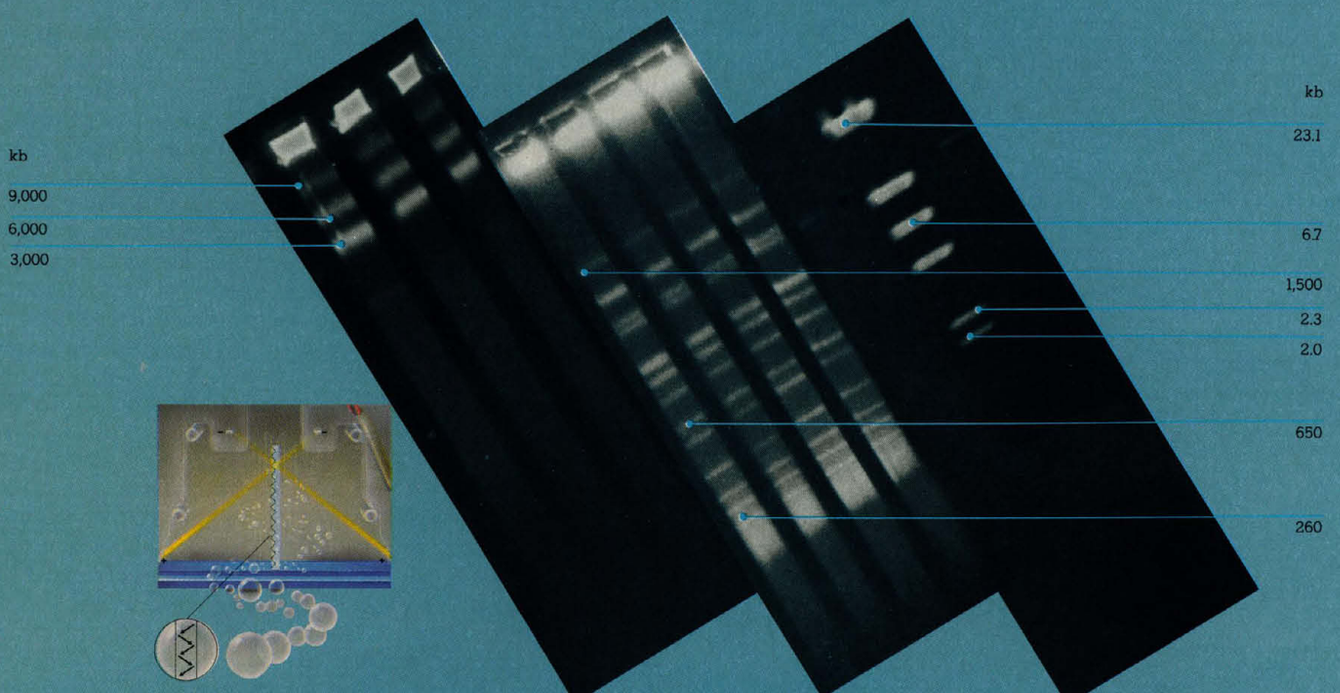

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death is pronounced, not the time that artificial support measures are stopped or organs are removed.

The legal status of the brain-dead, but heart-beating, cadaver may need further clarification, but there is an ethical framework in which to proceed. My view is that the cadaver donor is still entitled to the protections and safeguards due a hospitalized patient until the body is released to the morgue or funeral home and becomes a "traditional" corpse. Hospitals currently have extensive review processes to ensure proper declaration of brain death and proper procedures leading to organ donation. Informed consent of the donor family is essential. Any experimental protocol for "organ maintenance" would require approval by institutional review boards and consent of the deceased's family. Additional safeguards exist as a result of the "required request" procedure for organ donation, which provides for the identification and documentation of brain-dead individuals and provides data that would disclose questionable practices.

The transplant community has worked hard for years to establish public trust in order to have access to donor organs. Every effort is made to ensure accountability for actions related to donation and to exclude conflict of interest between the care of the patient and the obtaining of donor organs. It is essential to maintain this trust, which may well require further clarification of the donor status. It also requires careful use of the terms defining patient status.

FRANCIS H. WRIGHT
Department of Surgery, Division of Organ Transplantation, University of Iowa Hospitals and Clinics, Iowa City, IA 52242

Macho Work Week

I strongly disagree with the letter from Alina C. Lopo (18 Mar., p. 1362) implying that no professional can make a worthwhile contribution to his or her field without putting in a 60- to 80-hour week. Counterexamples in science include Newton, Einstein, and Ben Franklin, all of whom did science on the side. The country is in dire straits if productive professionals are excused from contributing to family, community, and political activities because they are too busy with their jobs. In addition, experience gained in the outside world can be valuable in professional situations.

Both quality and quantity of work are issues. Careful, quality work can be done at least as well in a 40-hour work week as in the first half of an 80-hour week. Furthermore, a tired professional is likely to produce lower quality work than a rested one. Hence the current controversy concerning decisions made by doctors on duty for 30 hours at a time. Quantity of work will decrease with hours spent, but not linearly, because the marginal extra hours may be less productive. Many difficult problems require intense concentration that cannot be sustained for an extended period or can lead to dead ends. In such cases, taking a break and starting fresh can be much more productive than beating one's head against a wall.

The argument is for flexibility and freedom of choice. If a professional chooses to work a macho week, he should be rewarded for whatever is accomplished by so doing. Likewise, the high-quality work done by people who choose to keep normal hours or work part time should be acknowledged for its value.

LINDA GAINES
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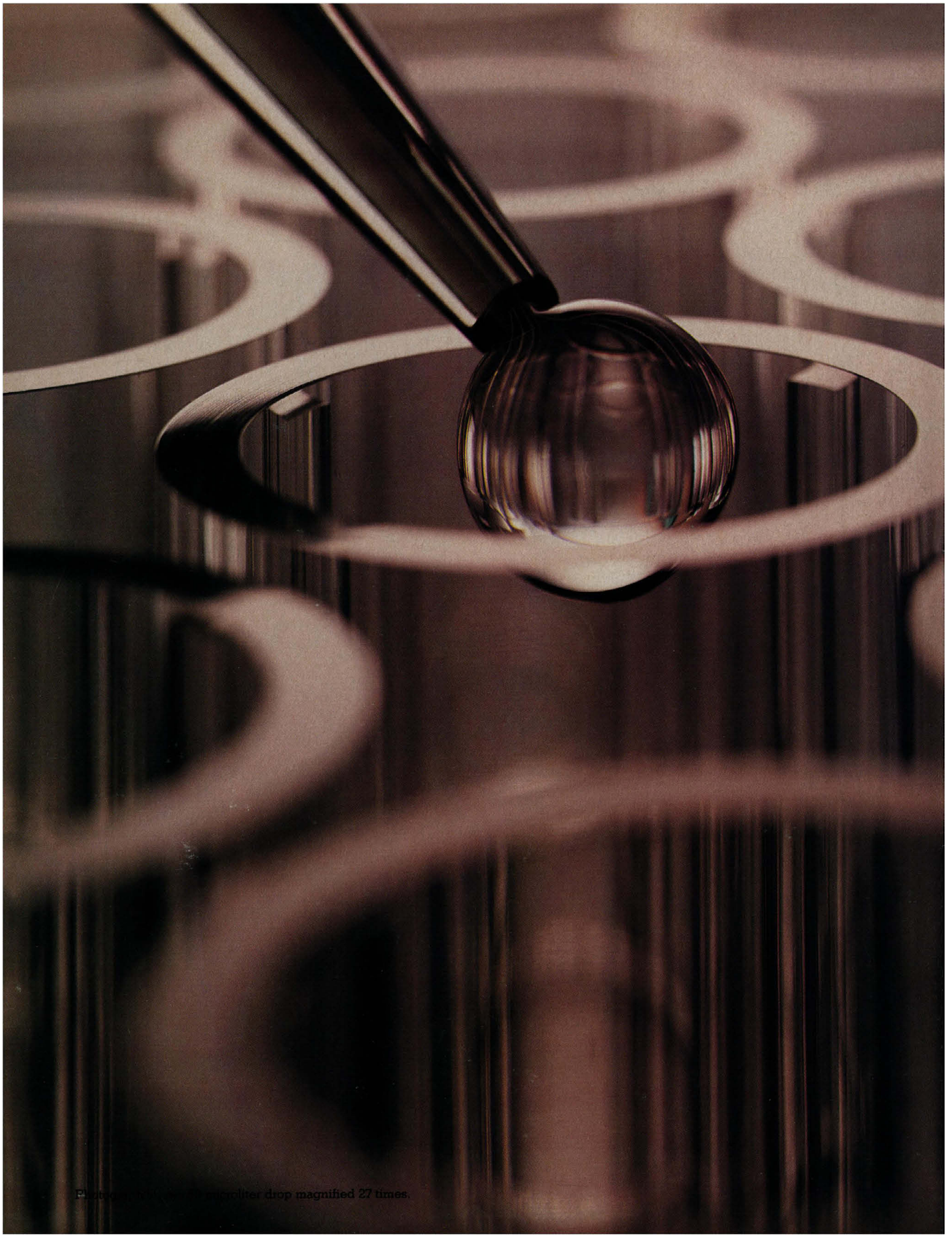

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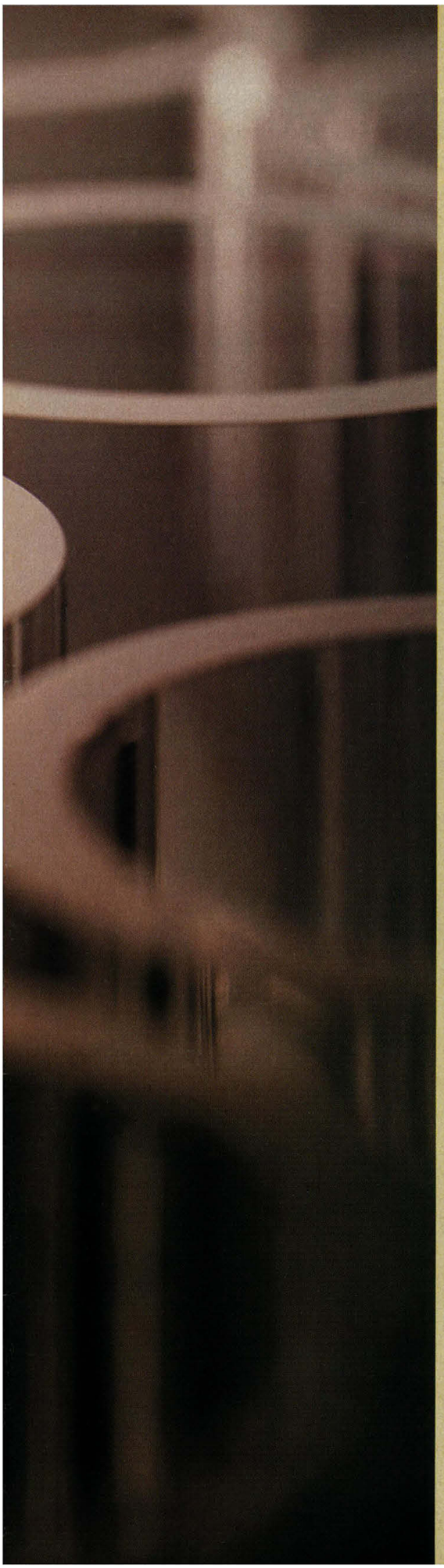

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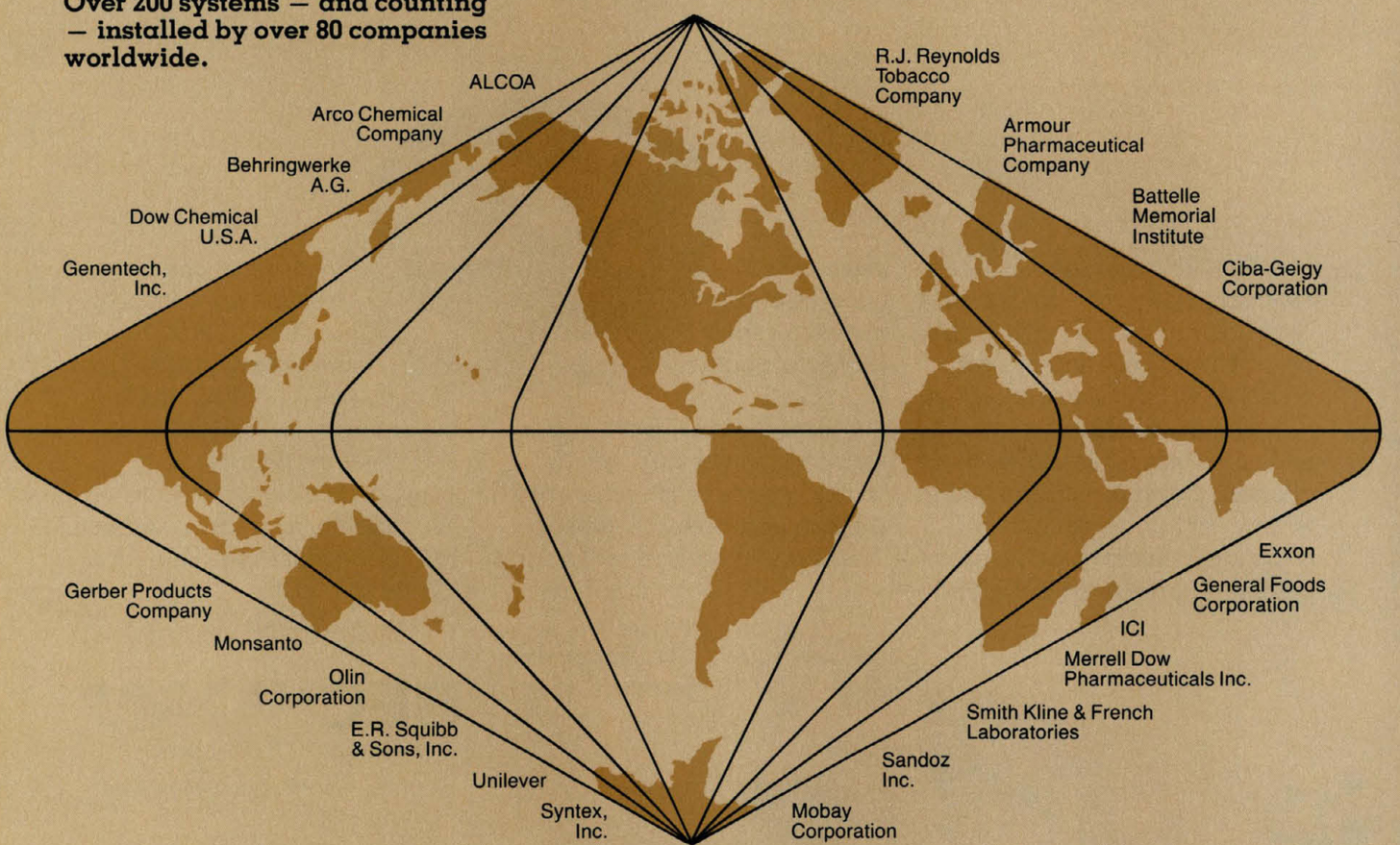

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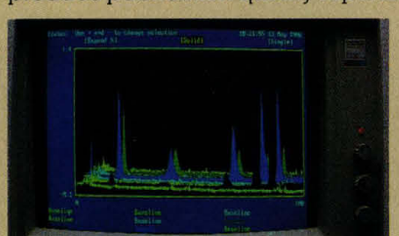

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Ramifications of Technology

Technology, the Economy, and Society. The American Experience. JOEL COLTON and STUART BRUCHEY, Eds. Columbia University Press, New York, 1987. xv i, 287 pp. $35.

During the first half of the 1980s the International Commission on the History of Social Movements and Social Structures sponsored interdisciplinary research into the ubiquitous impact of technology on life in the modern world. Joel Colton of Duke University and Stuart Bruchey of Columbia University directed the United States research team and were asked by the commission to publish the American essays as a separate book. The collection that has emerged from this process contains an instructive summary introduction by the editors and ten essays of very uneven quality.

Alfred D. Chandler, Jr., sets a rigorous standard of analysis early in the book with a discussion of the evolution of managerial structures and marketing practices engendered by the new transportation and communication systems of the late 19th century. Although Chandler identifies differences among nation states that have influenced the shape of business organization, he argues that the cause of reorganization per se is to be discerned by comparisons among industries rather than among countries. It was the need of capital-intensive industries to integrate mass production and mass distribution that produced the structures of modern management, whose evolution he attributes to functional adaptation.

The contributions of Harold G. Vatter, Geraldine J. Clifford, and Morton Rothstein are essentially summaries of the recent literature dealing with large topics. Vatter discusses the contours of American economic growth from 1870 to 1980, emphasizing a fundamental shift from the accumulation of "material capital goods to investment in human capital" (p. 41) over the course of the present century, which has consistently increased the importance of academic training. Clifford chronicles the development of formal education during the same period, but rather than wrestling with the implication of Vatter's point, she focuses on problems that confronted the educational system—problems that, she insists, are not essentially technical. Rothstein treats farmers' movements. Although he analyzes the economic roots of farmers' protest movements, he is more concerned with self-help movements, and especially with the roles of agricultural societies, county agents, and agricultural colleges as nurseries of technological innovation. Brief essays are also provided by Kenneth Jackson on patterns of urban life, David Hammack on forms of political mobilization made possible by the technology of the 1830s and the 1960s, and Martin E. Marty on questions posed for religious thought and practice by modern technology.

Three chapters deserve close attention: those by Harry N. Scheiber, Melvyn Dubofsky, and Derk Bruins. Scheiber deals with American law. In the 19th century, he argues, courts and state legislatures redefined older legal standards in such a way as to encourage the development of new technology and to relieve entrepreneurs of inhibitions to its use and responsibility for its social costs. During the first four decades of this century increasing priority was given to national needs, administrative law, and expert determination. After World War II had stimulated unprecedented levels of federal promotion of innovations, the assignment of responsibility for their social costs and perils not only gave the government a pervasive regulatory role but also unleashed in the courts "a fundamentally new 'litigative order' " (p. 107). Public interest lobbies and judicial decisions uncoupling liability from fault introduced a new variant of legal realism and, in response, the "originalist" doctrine with which recent controversies over Supreme Court nominations have made the reading public familiar. Scheiber's essay is present-oriented history in the best sense of the term.

Dubofsky draws upon the last 30 years' creative work in labor history to show how technological innovations have given new contours to industrial conflict, rather than eliminating it. Despite the assistance lent employers by new machinery and new styles of management in restraining or even eliminating craft unions before World War I, the new methods of production proved by the 1930s to have augmented the power of relatively small groups of workers to bring a factory to a halt and to have introduced new industrial unions with which management had to collaborate if shop floor militancy was to be curbed. Even where automation has given corporations the capacity to destroy unions today, as they did for example in the 1920s, Dubofsky thinks that few

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