

American Association for the Advancement of Science

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Publisher: Philip H. Abelson, *Acting*

Editor: Daniel E. Koshland, Jr.

Deputy Editor: John I. Brauman (*Physical Sciences*)

EDITORIAL STAFF

Managing Editor: Patricia A. Morgan

Assistant Managing Editor: Nancy J. Hartnagel

Senior Editor: Eleanore Butz

Associate Editors: Keith W. Brocklehurst, Martha Coleman, R. Brooks Hanson, Barbara Jasny, Katrina L. Kelner, Edith Meyers, Linda J. Miller, Phillip D. Szurmi, David F. Voss

Letters Editor: Christine Gilbert

Book Reviews: Katherine Livingston, *editor*

This Week in Science: Ruth Levy Guyer

Contributing Editor: Lawrence I. Grossman

Chief Production Editor: Ellen E. Murphy

Editing Department: Lois Schmitt, *head*; Mary McDaniel, Patricia L. Moe, Barbara E. Patterson

Copy Desk: Joi S. Granger, Jane Hurd, MaryBeth Shartle, Beverly Shields

Production Manager: Karen Schools Colson

Assistant Production Manager: James Landry

Graphics and Production: Holly Bishop, James J. Olivari, Yolanda M. Rook

Covers Editor: Grayce Finger

Manuscript Systems Analyst: William Carter

NEWS STAFF

News Editor: Barbara J. Culliton

Deputy News Editors: Roger Lewin, Colin Norman

News and Comment/Research News: William Booth, Gregory Byrne, Mark H. Crawford, Constance Holden, Richard A. Kerr, Eliot Marshall, Jean L. Marx, Robert Pool, Leslie Roberts, Marjorie Sun, M. Mitchell Waldrop

European Correspondent: David Dickson

Contributing Writer: John Walsh

BUSINESS STAFF

Circulation Director: John G. Colson

Fulfillment Manager: Ann Ragland

Business Staff Manager: Deborah Rivera-Wienhold

Classified Advertising Supervisor: Karen Morgenstern

Guide to Biotechnology Products and Instruments: Shauna S. Roberts

ADVERTISING REPRESENTATIVES

Director: Earl J. Scherago

Traffic Manager: Donna Rivera

Traffic Manager (Recruitment): Gwen Canter

Advertising Sales Manager: Richard L. Charles

Marketing Manager: Herbert L. Burkland

Employment Sales Manager: Edward C. Keller

Sales: New York, NY 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); Scotch Plains, NJ 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); Chicago, IL 60914: Jack Ryan, 525 W. Higgins Rd. (312-885-8675); San Jose, CA 95112: Bob Brindley, 310 S. 16th St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 11318 Kings Valley Dr. (301-972-9270); U.K., Europe: Nick Jones, +44(0647)52918; Telex 42513; FAX (0647) 52053.

Information for contributors appears on page XI of the 23 December 1988 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500.

Advertising correspondence should be sent to Tenth Floor, 1515 Broadway, New York, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO, or FAX 212-382-3725.

Fax

Facsimile transmission of letters and documents by the telephone system has already become an important mode of local and global communication. Activity and sales of equipment are expanding rapidly, with no end to the expansion in sight. Until recently use of telefax machines was largely confined to big business. But their use has spread dramatically to small business and individuals. In the not distant future most scientists will either have a fax or have access to one nearby. They will find it helpful in quick interaction with other scientists in this country and in much of the world. The typical simple machine that an individual might acquire sells for \$2000 or less. Competition among about 50 different manufacturers is keen. Prices have been falling. Additional features, including electronic memory, are being built into the devices.

Personal experience with fax has made me an enthusiast for it. Often I need quick local delivery of a short document. The mails in Washington, D.C., are erratic. Messenger service costing \$5 to \$10 is better than mail but usually requires several hours. Fax takes care of the matter for the cost of paper and a local telephone call. The deed is done in a minute or two. A related situation prevails in communications with places elsewhere in the country. Fax is cheaper and faster than overnight express. Big business has found that by dispatching documents across the country at times when telephone rates are minimal, fax can be cheaper than first-class mail. Already on some campuses use of fax is speeding internal communication. Scientists engaged in international collaboration with others halfway around the world have found fax a substitute for telephoning at inconvenient hours. Chemists and others wishing to transfer detailed structural formulas find fax a convenient tool. Engineering drawings and spread sheets are also being transmitted.

As might be expected, some of the uses are mundane, such as company employees sending their lunch orders to a local deli. Concerns have also been expressed about advertisers using fax for junk mail. But if the problem of unwelcome messages becomes substantial, electronic safeguards can be included as part of the equipment.

As a user of fax, the United States was relatively an underdeveloped country until a year or two ago. But in 1988 sales of 910,000 units had quadrupled from those in 1986. Total inventory at the end of 1988 was about 1.8 million. By the end of 1989 that number will be about 3 million. An International Facsimile Directory published last October provides an indication of the relative number of fax machines elsewhere at the time the directory was compiled, probably in early 1988. The directory provides approximately 700,000 numbers. Most of them are for companies; very few are for academic establishments. Virtually every country in the world is represented. A notable exception is the Soviet Union.

Per unit population, many countries had a greater number of listings than the United States. Switzerland had 15 times as many; Norway, 12, and the United Kingdom, 8. In the summer of 1988, when the postal workers in Britain went on strike, there was practically no outcry. In many other countries of the world the local postal service is slow and unreliable, and fax is a welcome substitute. For the Japanese, fax has been especially beneficial. A page of material consisting of kanji script is as easily transmitted as Roman script. Correspondingly, more than 2.5 million fax machines are in use in Japan. Half of the telephone traffic between Japan and the United States is devoted to fax. In addition, the Japanese are practically the sole manufacturers of telefax machines. As with many other high technology devices, the original modern models were invented and built in the United States. But from about 1980 on, the Japanese took over.

With a global and expanding market that in 1989 is likely to be about \$5 billion in magnitude, competitors are avidly seeking to add new features to the equipment. The inexpensive machine that an individual might buy today uses thermal paper. Resolution is adequate but not excellent. Ultimately, laser printing on plain paper will become widespread. Further along will come transmission of color with high resolution. The more expensive models already employ memory storage of information and computer capabilities. We are only in the beginning phases of a revolution in local and global communication that will have substantial impact on how business is conducted and on collaboration in science.

—PHILIP H. ABELSON