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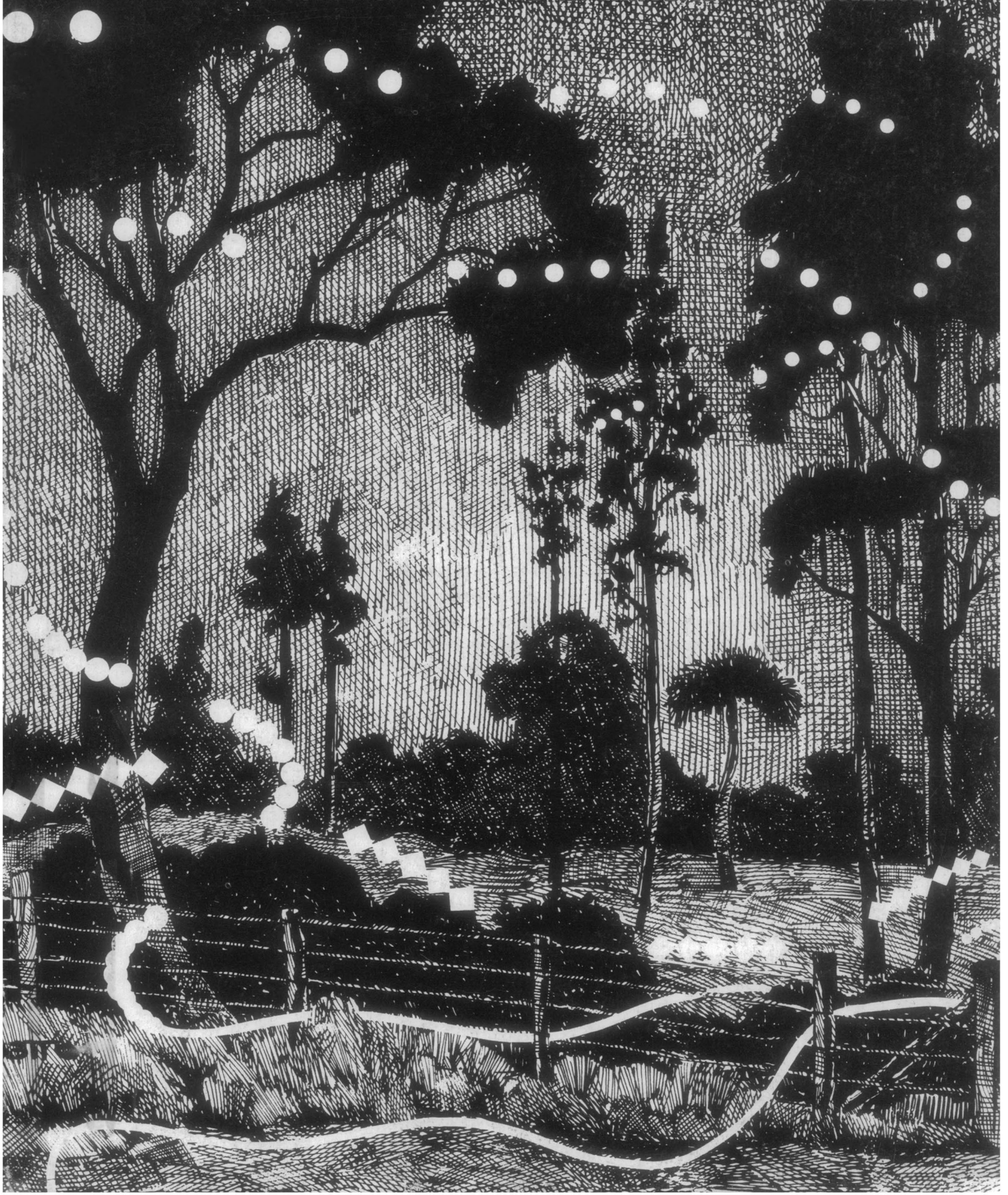


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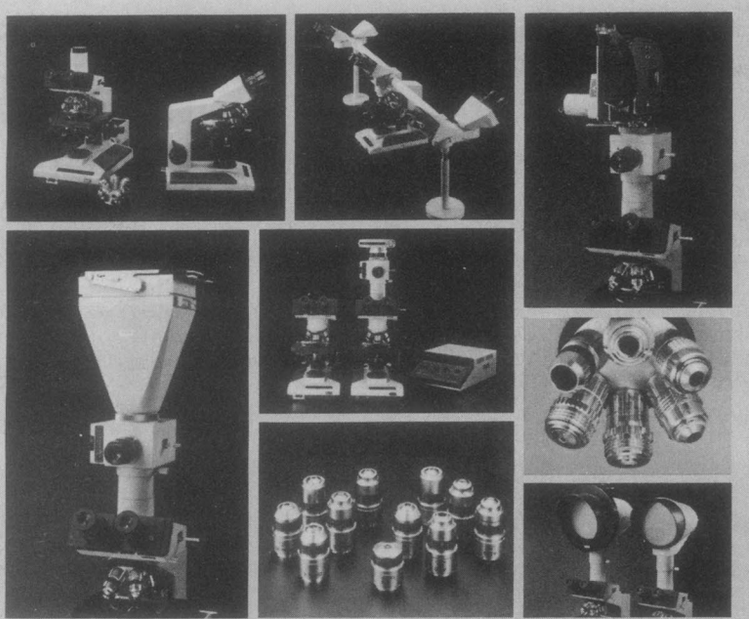

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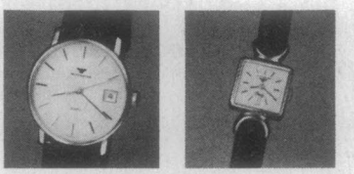

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COVER

Firefly habitat in northwestern peninsular Florida in March. Pulsing *Photuris* males descend from tall pines to fly, flicker, and glow, like males of unrelated species. Males are probably in quest of their females which are, in turn, hunting the foreign males by aggressive signal mimicry. See page 669. [Dan Otte, Academy of Natural Sciences, Philadelphia, Pennsylvania]

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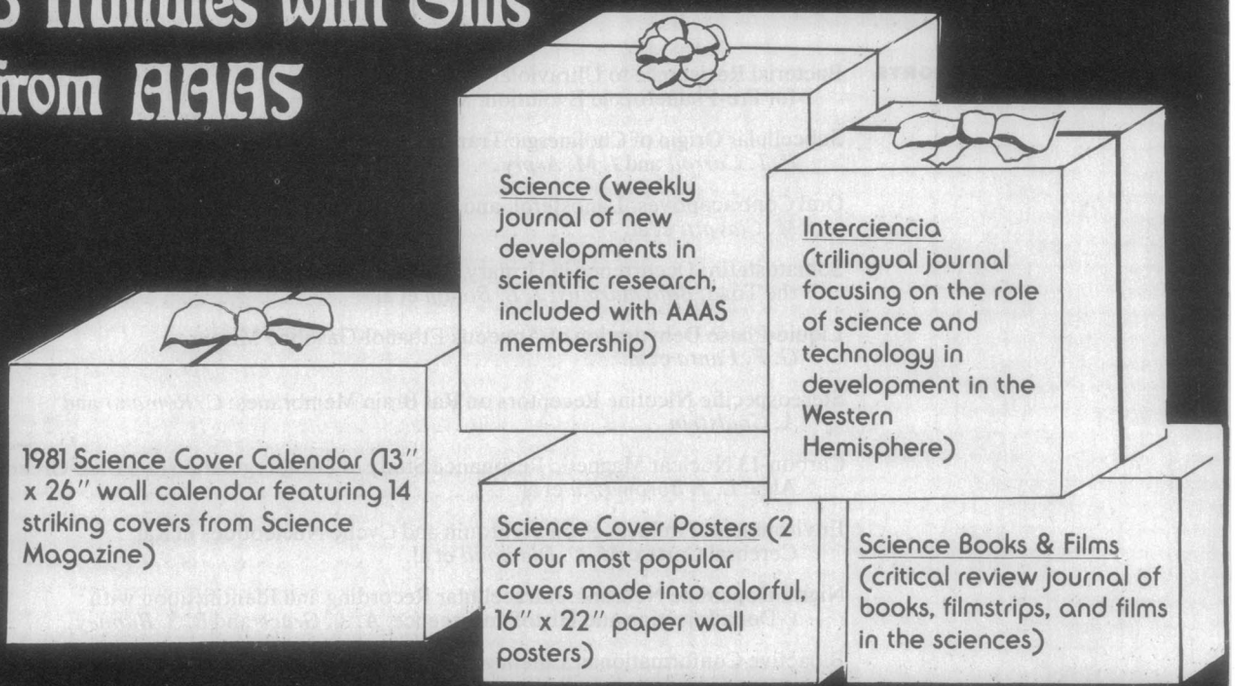

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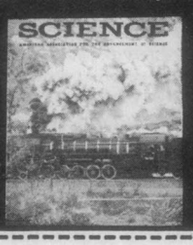

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Electronic Data Bases

Profound changes are occurring in the creation, processing, storage, retrieval, and transmission of scientific numerical data. The power and convenience of electronic instrumentation has led to its wide use in laboratories. Digitized data from such equipment can readily be stored and processed. They can be retrieved and transmitted to other equipment both here and abroad through telecommunication networks. In many areas of science and technology large electronic data bases are being created that can also be tapped through the networks. Improvements in very large scale integrated circuits and memory devices, together with development of additional software, guarantee a great expansion of the role of electronic data.

New electronic devices have made possible experiments and observations not previously attainable and the accumulation of data at unprecedented rates. This is true throughout the natural sciences. The exploration of Jupiter by the Voyager spacecraft was completely dependent on electronic sensing devices, communication of signals to the earth, storage of the data in memories, and subsequent machine processing. The Geosynchronous Environmental Operational Satellite measures visible and infrared spectra of the earth's disk every 30 minutes and produces 2×10^{11} bits of data every day.

Many processes in nature occur in very short times. An important research frontier today is picosecond chemistry. Through the use of lasers and electronic sensing devices, much information is now being gathered about excited states of atoms and molecules. Details of the mechanisms of photosynthesis are being studied. When light falls on a plant, excited states are produced, electrons are transferred, spectral changes take place. These phenomena occur in time spans of microseconds or less.

New instrumentation has had profound effects on analytical chemistry. The most striking one has been to create the capability of identifying and measuring very tiny amounts of substances. By employing a combination of gas-liquid chromatography and mass spectrometry, biochemists have been able to isolate and measure 0.1 picogram of a hormone. With other equipment, analyses can be made much more rapidly than heretofore. A new spectrophotometer produces an entire spectrum from 200 to 800 micrometers in only 1 second.

A major hazard in hospitals is errors of transcription, which sometimes run as high as 5 percent or more. Modern hospitals try to avoid such errors in clinical laboratories by using electronic devices and storing results in a computer. A similar situation exists in pharmaceutical laboratories, which must maintain records of exemplary quality. Every measurement possible, such as weighing, is conducted with equipment that ties into the computer.

Electronic storage of digital data is the only feasible means of dealing with information in areas of science where it is produced at such a great rate that placing it on paper would be impractical. In addition, once the massive amounts of data are in machine-retrievable form, they can be processed and analyzed quickly and with a thoroughness beyond human capability.

Computers can communicate with each other, and this is being facilitated by public and private networks. Traffic is increasing rapidly. In large part this is due to the establishment of commercially available data bases, which are expanding in scope and numbers. The data bases will be helpful in pure science; they are already proving very valuable in applied research, and industrial organizations are willing to pay well for tapping them. In fields such as chemistry, solid state physics, and metallurgy, international competition is arising among compilers and vendors. We are in the early phase of important changes in electronic data handling. The federal government has been moderately helpful in furthering these developments, but expansion of its support is in order.—PHILIP H. ABELSON

Adapted from a talk given at the CODATA Conference in Kyoto, Japan, 8 October 1980. Proceedings of the conference are to be published by Pergamon Press.

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66. J. A. Huberman and A. D. Riggs, *J. Mol. Biol.* **32**, 327 (1968).
67. R. L. P. Adams, *Biochim. Biophys. Acta* **254**, 205 (1971); H. H. Evans, T. E. Evans, S. Littman, *J. Mol. Biol.* **74**, 563 (1973).
68. M. G. Marinus and N. R. Morris, *J. Bacteriol.* **114**, 1143 (1973).
69. S. Lacks and B. Greenberg, *ibid.*, p. 153.
70. M. G. Marinus and N. R. Morris, *Mutat. Res.* **28**, 15 (1975).
71. B. Glickman, P. Van den Elsen, M. Radman, *Mol. Gen. Genet.* **163**, 307 (1978).
72. C. Coulondre, J. H. Miller, P. J. Farabough, W. Gilbert, *Nature (London)* **274**, 775 (1978).
73. T. W. Sneider, *J. Mol. Biol.* **79**, 731 (1973).
74. W. A. Salser, I. Cummings, A. Liu, J. Strommer, J. Padayatty, P. Clarke, in *Cellular and Molecular Switching*, G. Stamatoyannopoulos and A. W. Nienhius, Eds. (Grune & Stratton, New York, 1979), p. 621.
75. A. P. Bird, *Nucleic Acids Res.* **8**, 149 (1980).
76. T. W. Sneider, J. Kaput, D. Neiman, B. Westmoreland, in *Transmethylation*, E. Usdin, R. T. Borchardt, C. R. Creveling, Eds. (Elsevier/North-Holland, New York, 1979), p. 473; J. Kaput and T. W. Sneider, *Nucleic Acids Res.* **7**, 2303 (1979).
77. D. E. Comings and A. D. Riggs, *Nature (London)* **233**, 48 (1971).
78. C. Shen and T. Mariatis, *Proc. Natl. Acad. Sci. U.S.A.* **77**, 1787 (1980).
79. J. C. Cohen, *Cell* **19**, 653 (1980).
80. J. Mullins, personal communication.
81. A. Pellicer *et al.*, *Science* **209**, 1414 (1980).
82. H. Weintraub and M. Groudine, *ibid.* **193**, 848 (1976).
83. M. T. Kuo, J. L. Mandel, P. Chambon, *Nucleic Acids Res.* **7**, 2105 (1979).
84. J. K. Christman, P. Price, L. Pedriman, G. Acs, *Eur. J. Biochem.* **81**, 53 (1977).
85. S. M. Taylor and P. A. Jones, *Cell* **17**, 771 (1979).
86. P. A. Jones and A. M. Taylor, *ibid.* **20**, 85 (1980).
87. C. B. Olson, *Speculations Sci. Technol.* **2**, 365 (1979).
88. H. Holtzer, *Q. Rev. Biophys.* **8**, 523 (1975).
89. D. G. Dickinson and R. F. Baker, *Science* **205**, 816 (1979).
90. E. W. Jones, G. H. Goodwin, J. M. Walker, C. Sanclus, *Ciba Found. Symp.* **28**, 95 (1975); S. Weisbad and H. Weintraub, *Proc. Natl. Acad. Sci. U.S.A.* **76**, 630 (1979); B. Gazit, A. Panet, H. Cedar, *ibid.*, in press.
91. J. R. Davie, E. Peter, M. Candido, *Proc. Natl. Acad. Sci. U.S.A.* **75**, 3574 (1978).
92. P. M. M. Rae and R. E. Steele, *Nucleic Acids Res.* **6**, 2987 (1979). There is preliminary evidence that *Drosophila* may utilize 6-methyladenine for DNA modification (J. Mullins, personal communication).
93. Supported by NIH grants GM20483 and GM25825.

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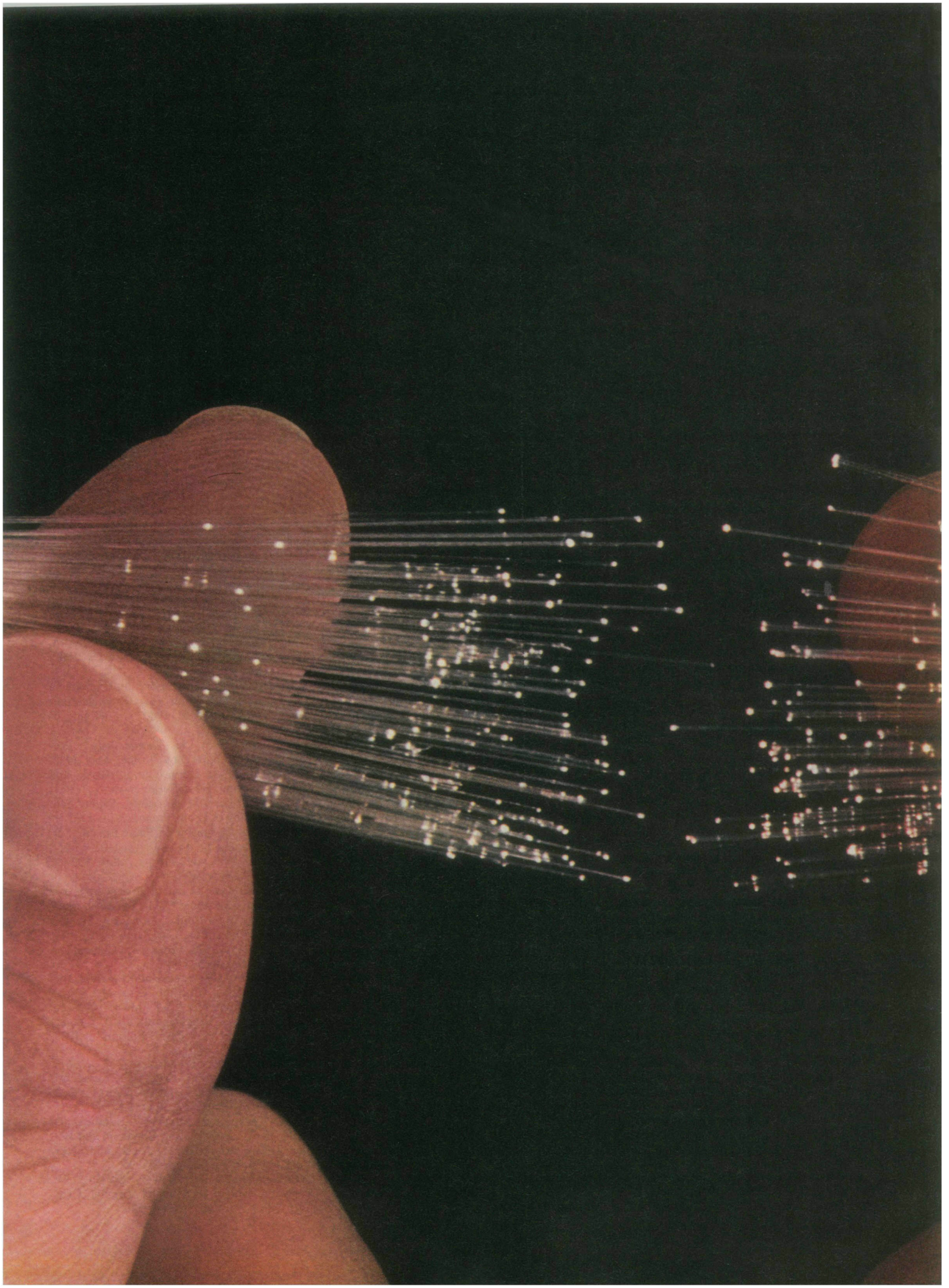

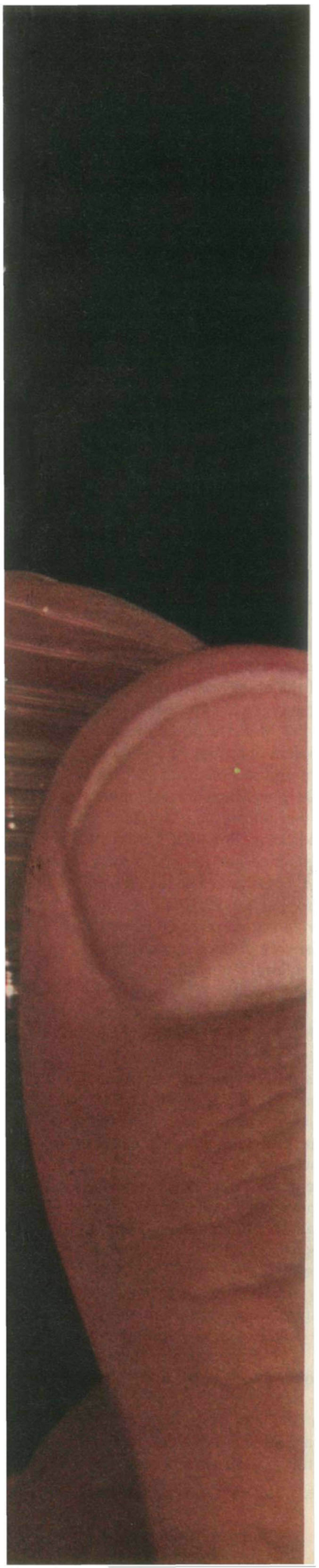

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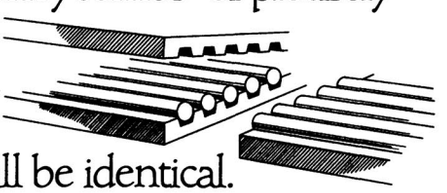

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