

SCIENCE

8 March 1974

Vol. 183, No. 4128

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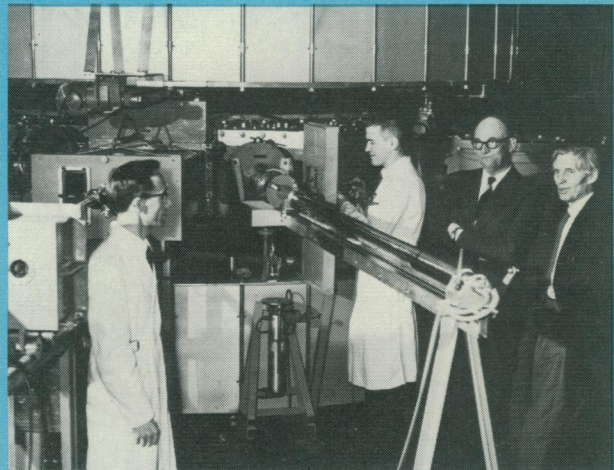
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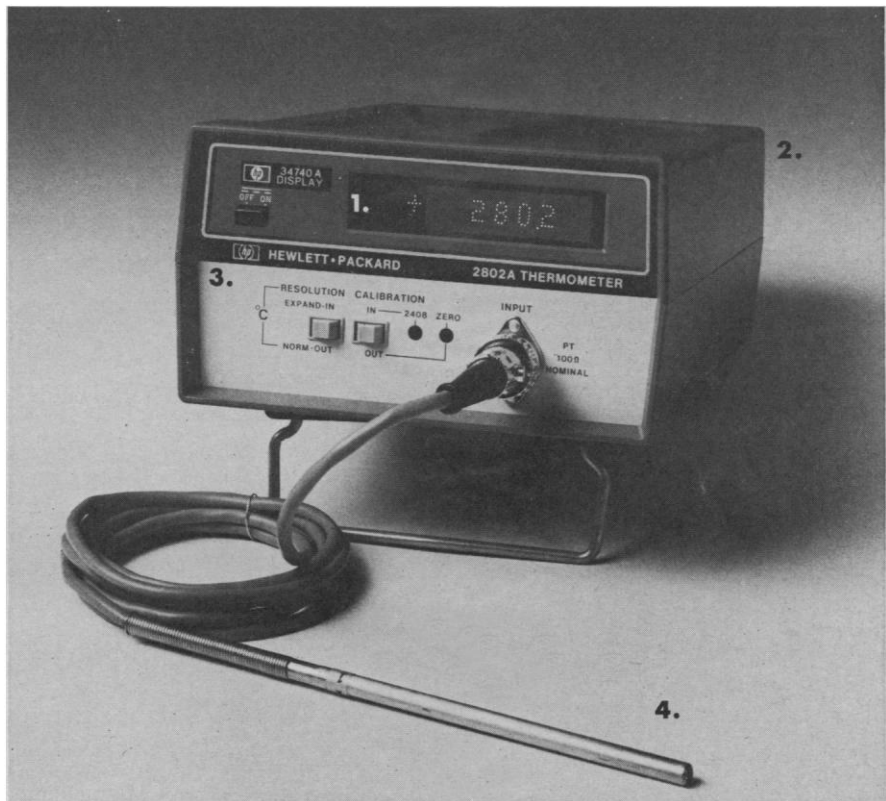
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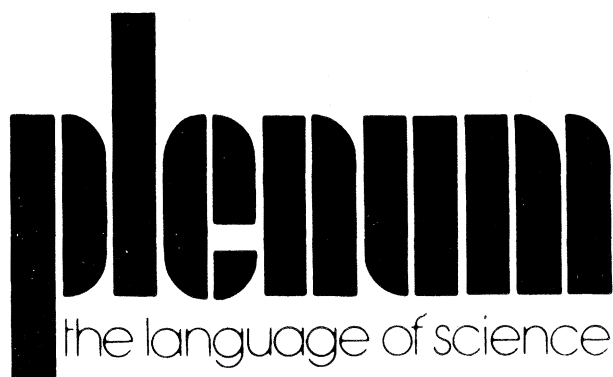
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Simultaneous photographs of the east coast of North America and Greenland taken about 7:30 p.m. local time, 15 November 1972. City lights, the aurora borealis, and moonlight reflected from clouds and terrain are seen in the visible light photograph on the left. An infrared temperature image, which ranges from 210 K (white) to 310 K (black), appears on the right. See page 951. [U.S. Air Force Weather Service Satellite]

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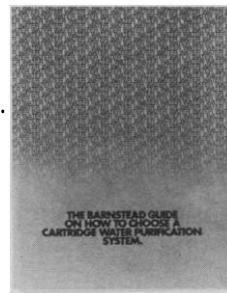
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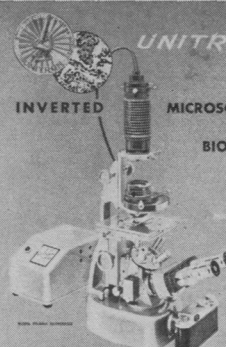
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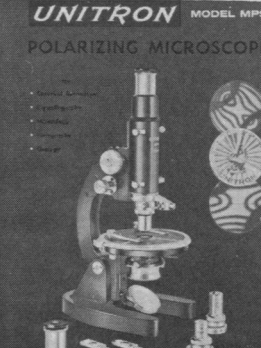
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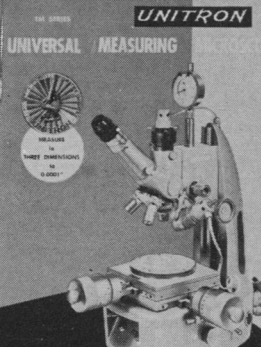
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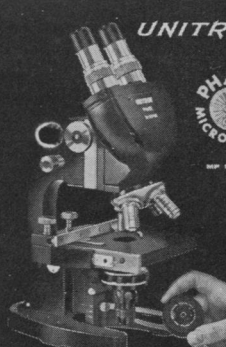


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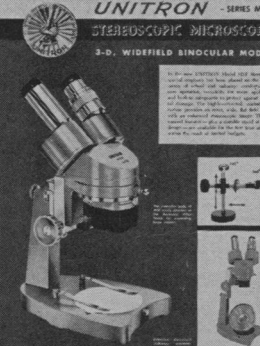
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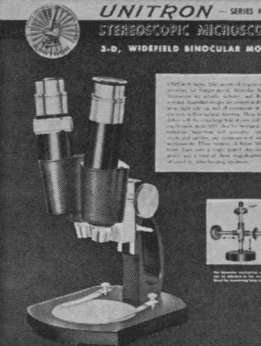
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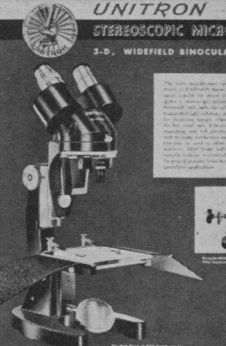
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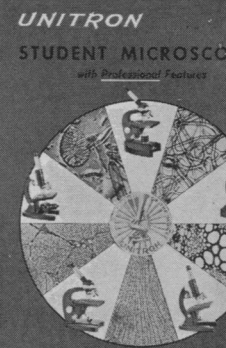
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
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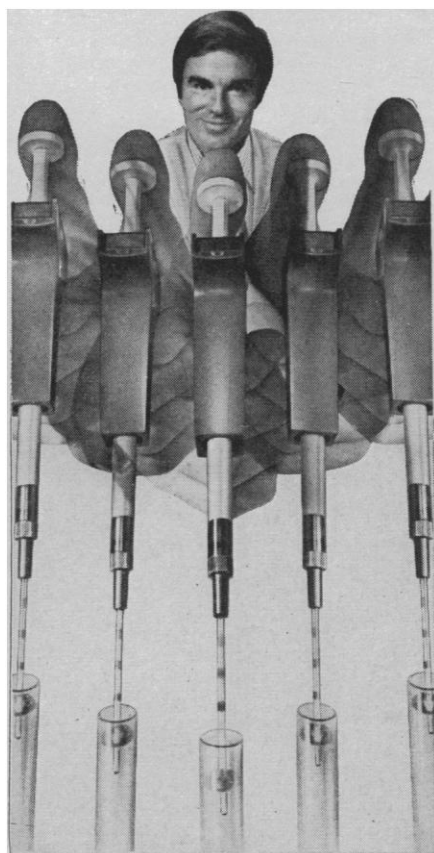
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of imparting information, inspiring, guiding, and tutoring, he need not do any of these. He is supposed to serve students, but anyone who has been to college classrooms knows that the service can be minimal. Not a single person from the department or administration comes to visit any teacher. The only indication of the quality of his work can be found in offhand remarks by students. Political officeholders also continue in their employment without much discipline. Only a change in administration affects them.

If a student protests any aspect of faculty service and decides to go through channels, he generally wastes his time; stone walls are met almost everywhere. The department chairman protects his charges unless adverse criticism is plentiful and the chairman feels the heat; the dean supports the chairman, and the president supports the dean. Faculty and administration have learned to form a united front through the incessant practice of politics.

College faculty at almost every school are forever concerned with reducing what they call their "load." The word is well chosen, but the term simply means the number of hours per week of classroom instruction. Administrators, too, seek reduced working hours and strive for long vacations, short days, and many assistants. Political action is used by both groups to attain their end. Faculty load reduction is awarded to the politically powerful—the researchers and writers. Those who are voted the best teachers by students or peers are awarded a plaque or a few dollars.

As in all legislative bodies, faculty committees are subject to pressures, and each of their deliberations is a result of compromise. Such important affairs as votes of confidence for administrators and revision of the curriculum are decided politically. An energetic faculty member can collect all others with real or imagined grievances and form a formidable group to oppose an administrator. The latter, on the other hand, must not only choose the proper time for his assessment by the faculty, but also must pay his respects to the political powers among the teachers. The curriculum is molded in a similar way, rather than in response to the needs of students. In some schools, a gentleman's agreement exists whereby departments approve each other's offerings without question.

In any event, departmental sovereignty is always very strong.

The establishment of the curriculum is a simple and political process. Whatever its origin—student, faculty member, or department chairman—a course is described in vague terms to a curriculum committee where hardly anyone, except the sponsor, is interested. The entire faculty then votes its approval. Occasionally a question or two may be asked by the faculty troublemakers, but little attention is paid to the boat rockers unless morale is low.

Faculty members who needle and prod are not the ones who are catapulted into administration posts. When newspapers announce that Professor X is appointed president of Y college, it is almost certain that Professor X has shown great political skill in faculty committees. Either he works out compromises between the opposing positions exceptionally well or he has acquired a coterie of supporters by virtue of his personal magnetism. He does not have to show any characteristic of a university president to be chosen; all he must do is show his acumen in academic politics. It is a realm replete with railroading, logrolling, pork-barreling, and sandbagging.

Political science and sociology departments have veritably neglected the study of academic maneuverings for individual and departmental power. More important, students have been barred from observing the process or participating in it. Academic politics could serve as a laboratory for developing future Woodrow Wilsons. Why not offer the course for credit?

MORRIS GORAN

*Roosevelt University,
Chicago, Illinois 60605*

I deeply appreciate the many letters that I have received personally in response to my article. Most of these included extensive ideas or were accompanied by published materials that have substantially amplified my own perceptions.

The letter from Stokes provides an encouraging report of his own experiences, but I must take exception to his last paragraph simply because the alleged exaggerations to which he refers imply a position that I don't recognize in my own writing.

ROBERT STRAUS

*Department of Behavioral Science,
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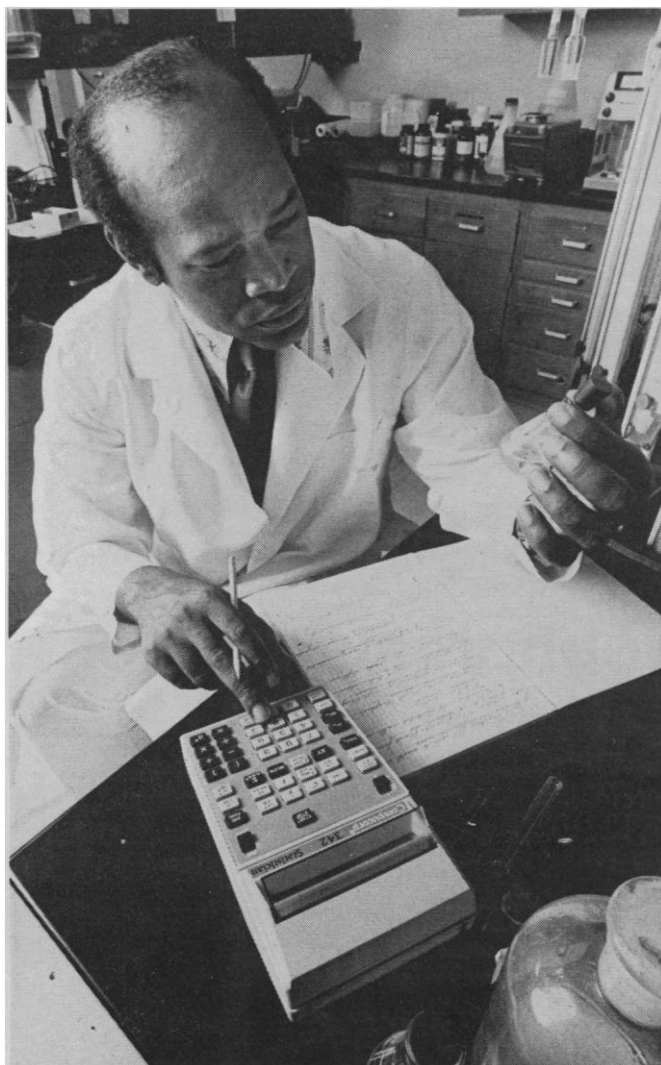
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Ignorance as the Driving Force

In the sense of unaware and as yet unlearned, our ignorance and our recognition of that ignorance may be the best motivation both for problem-solving and for creative activity. Instead of patting ourselves on the back for our firm grasp of nature, while at the same time condemning ourselves for being too smart for our own good, we ought to recognize what we do not know. We have heard the paeans for the great capabilities we have developed and we have heard the criticisms for these same capabilities at the same time.

"Information explosion" is a well-recognized phrase, but what should be at least as noticeable is that it is accompanied by an information compression. The latter stems from numerous imaginative hypotheses and well-developed theories and models that could only have resulted from continually clearer insights. The compression permits previously scattered facts and observations to be retained, not as a great number of individual items but as part of a larger picture capable of acceptance of additional facts and observations. But all viable theories have led to other shadowy or dark areas of understanding—in fact, to an ignorance explosion.

Why not inventory the gaps in our factual knowledge and general understanding in every field susceptible to such a listing? This would permit a more rational basis for debate of such things as the true nature of our current energy problem, or the indistinctness of the basis for criminal behavior, or the vagaries of market indicators of economic health. Perhaps the mere acknowledgement of the still-pervasive ignorance in all human activities would make progress more likely than does shouting about our vast knowledge.

Further, it would be therapeutic to recognize that there is ignorance beyond that which is identifiable—that is, "pure" ignorance, the ignorance of which we are not yet even aware. This is nibbled at by those who have the gift of being able to perceive and hazily define the vast stockpile of the not-known. These gifts are equivalent, whether they result in literature, art, music, or fuller understanding of the physical world or of human behavior. They can be lumped under the heading of creativity. This is a vital if not critical force in society. If it is not a critical force, that is only because of the time scale of usability. Creative activity (research) involves a stochastic approach to the totally unknown, and this comes from individual interest in a way not too susceptible to management.

It seems likely that our ignorance is as great as it ever was, to judge by the number of questions that can still be asked. Maybe ignorance should be treated as a constant of nature. Or maybe it appears to be constant and continuous up to some critical point beyond which everything starts over. In any event, ignorance seems to be the driving force impelling us to refine truth constantly.

It may be noted that this approach to truth seems to be of concern to some people, and it may be one basis for anti-intellectual stirring. For those to whom truth is an invariant, that is, something engraved in stone, it must be unsettling to be told that even long-standing natural "laws" are subject to alteration in light of fuller understanding. This must be especially unsettling when the same proposition is applied to human "truths."

Thus, for the reasons stated and probably for others not recognized here, it might be helpful to remind ourselves regularly of the sizable incompleteness of our understanding, not only of ourselves as individuals and as a group, but also of nature and the world around us.—NORMAN HACKERMAN, *President, Rice University, Houston, Texas 77001*

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ments in a nonhomogeneous flow cell"; C. Y. Cha, "Mathematical model of in situ oil shale retorting"; M. Prats, "Flow regimes in thermal recovery processes"; C. S. Land, L. C. Marchant and C. J. Cupp, "Application of reverse combustion to in situ oil recovery from tar sands"; H. J. Ramey, "Unique flow problems in geothermal reservoirs"; R. J. Blackwell, "Isothermal displacement processes"; L. E. Scriven, "Dynamic interfacial phenomena during immiscible displacement processes"; C. Jacquin, "Representation of a two dimensional network of fractures by a probabilistic model"; J. Burger, "Spontaneous ignition in an oil reservoir."

Textiles: Fiber Science

Colby College—New Hampshire

John P. Knudsen, chairman; H. Dieter Weigmann, vice chairman.

8 July. J. E. Spruiell and J. L. White, "Structure development in polyolefin fibers during melt spinning and drawing"; J. A. Cuculo, "Flow induced crystallization of poly(ethylene terephthalate) melts in the extrusion process."

9 July. R. E. Cunningham, "A novel technique for preparing inorganic filaments from inviscid melts"; R. W. Work, "Some relationships between the conditions of formation and the physical properties of spider ampullate silk fibers."

10 July. S. K. Batra, "Analysis of bicomponent fiber crimp: a critical review; a generalized model"; J. H. Saunders, "Biconstituent fibers from segmented polyurethanes and nylon 6."

11 July. B. Miller, "Autoignition of textile systems"; S. Schulman, "An instrumented mannikin to determine burn damage."

12 July. J. Skelton, "Changes in inter-fiber forces during wetting and drying."

Toxicology and Safety Evaluations

Kimball Union Academy

Harold M. Peck, chairman; Ralph C. Wands, vice chairman.

5 August. (J. F. Borzelleca, discussion leader): M. F. Cranmer, "The mission and capabilities of the NCTR"; H. J. Schumacher, "The NCTR approach to developing new teratology methodology." (E. S. Feenstra, discussion leader): W. E. Jaques, "Early histopathologic studies on chemical carcinogenesis."

6 August. (R. J. Weir, discussion

leader): P. J. Gehring, "Use of pharmacokinetics in assessing the environmental hazards of chemicals"; H. M. Hanson, "Techniques for assessing the behavioral effects of chemicals." (H. N. MacFarland, discussion leader): E. D. Palmes, "Influence of particle dynamics on inhalation toxicology."

7 August. The role of diet in studies of chemical carcinogenesis and toxicology (H. C. Grice, discussion leader): P. M. Newberne, "Toxicologic response to diet"; A. E. Rogers, "Carcinogenic response to diet." (R. M. Hehir, discussion leader): G. E. Davies, "Evaluation of sensitizing potential."

8 August. (J. F. Finklea, discussion leader): R. C. Wands, "Intergovernmental agency communications on toxicology." Panel: (J. F. Finklea, moderator): M. F. Cranmer, H. J. Schumacher, W. E. Jaques, P. J. Gehring, H. M. Hanson, E. D. Palmes, P. M. Newberne, A. E. Rogers, G. E. Davies, R. C. Wands. (H. M. Peck, discussion leader): M. Eisler, "Toxicology, optimism, pessimism and reality."

9 August. (R. C. Wands, discussion leader): A. Furst, "Metal carcinogenesis."

Water and Aqueous Solutions

Holderness School

George J. Safford, chairman; Frank H. Stillinger, vice chairman.

Physics and Chemistry of Aqueous Solutions

5 August. (G. S. Kell, session chairman): J. H. Gibbs, "What melting and boiling tell us about liquid water"; H. C. Anderson, "Cluster expansions for water"; L. Blum, "Invariant expansions." (R. Lumry, session chairman): (R. Franks, "A reexamination of hydrophobic effects in very dilute aqueous solutions"; G. A. Jeffrey, "The effects of hydration on the conformation of carbohydrates as observed in the crystalline state"; J. H. Freed, "ESR studies of anisotropic rotational tumbling in liquid and frozen media and radical diffusion in aqueous solvents."

6 August. (H. G. Hertz, session chairman): A. Sugget, "Time-domain dielectric studies of nonelectrolyte aqueous solutions"; F. J. Millero, "The high pressure PVT properties of water and D₂O"; C. Hansch, "The role of hydrophobic forces in the interaction of drugs with macromolecular systems." (H. S. Frank, session chairman): C. A. Angell, "The weirdness of supercooled

water"; H. Yasuda, "Diffusive transport of salt and water in semipermeable membranes"; J. Wenzel, "Neutron scattering of amorphous ice."

7 August. (S. Lindenbaum, session chairman): W. Kauzmann, "Hydrophobic bonding"; I. Wadso, "Calorimetric studies of biopolymer solutions and model compounds"; U. P. Strauss, "Hydrophobic interactions in polyelectrolytes." (G. E. Walrafen, session chairman): M. J. Colles, "Stimulated Raman scattering in water"; P. Rentzepis, "Picosecond pulse spectroscopy of the hydrating electron"; A. R. Davis, "Pressure effect on ionic equilibria"; J. Muentert, "H₂O dimer."

8 August. (A. Ben-Naim, session chairman): J. White, "Neutron inelastic scattering from water and ionic solutions"; H. L. Friedman, "NMR relaxation studies of ionic pair distribution functions"; A. H. Narten, "X-ray and neutron diffraction from water and aqueous solutions." (R. L. Kay, session chairman): H. S. Frank, "Reflections on progress in the science of water"; L. Onsager, "Interpretation of kinetic properties of water."

9 Aug. (F. St. Lillinger, session chairman): E. Clementi, "Quantum mechanical calculations of potential energy surfaces and their applications to structural determinations for liquid"; H. A. Scheraga, "Semi-empirical potential functions for water"; A. Rahman, "Molecular dynamics—progress report."

X-Ray Photoelectron Spectroscopy

Brewster Academy

David M. Hercules, chairman; T. Carlson, vice chairman.

15–19 July. Correlations with other techniques: G. Andermann, "X-ray photon spectroscopy." Correlations with calculations: M. Schwartz, "Quantum calculations"; W. Jolly, "Empirical calculations." Surface reactions and catalysis: R. Brundle, S. Ikeda, N. Delgas. Satellite bands: M. Krause, "Shake-off and shake-up"; C. Fadley, "Multiplet structure." Band structure of solids: D. Eastman. Gas-phase core measurements: T. Thomas. Application to inorganic chemistry: C. Jorgensen, J. Van Wazer. Application to organic chemistry: W. Riggs. Application to analytical chemistry: W. Schwartz. Instrumentation: G. Schweitzer. The future of ESCA and other bothersome problems (panel discussion) (T. Carlson, moderator). Cross section calculations: S. Manson. Relaxation effects: D. Shirley.



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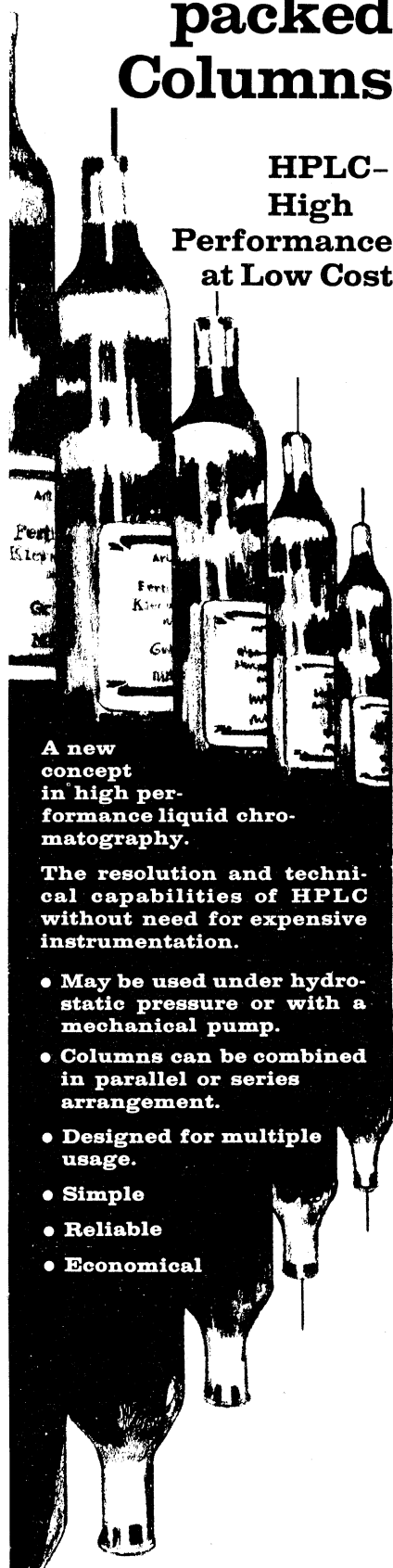
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Computational Physics. David Potter. Wiley-Interscience, New York, 1973. xii, 304 pp., illus. \$19.95.

Computer Approaches to Mathematical Problems. Jurg Nievergelt, J. Craig Farrar, and Edward M. Reingold. Prentice-Hall, Englewood Cliffs, N.J., 1974. xiv, 258 pp., illus. \$8.95.

Concepts and Methods in Discrete Event Digital Simulation. George S. Fishman. Wiley-Interscience, New York, 1973. xiv, 386 pp., illus. \$17.50.

Conjoint Marital Therapy. R. V. Fitzgerald. Aronson, New York, 1973. iv, 248 pp. \$10.

Convex Functions. A. Wayne Roberts and Dale E. Varberg. Academic Press, New York, 1973. xx, 300 pp., illus. \$19.50. Pure and Applied Mathematics, vol. 57.

The Correspondence of Henry Oldenburg. Vol. 9, 1672–1673. Edited and translated by A. Rupert Hall and Marie Boas Hall. University of Wisconsin Press, Madison, 1973. xxx, 706 pp., illus. \$20.

The Cosmic Connection. An Extraterrestrial Perspective. Carl Sagan. Doubleday, New York, 1973. xiv, 274 pp., illus. \$7.95.

Crisis Intervention. Proceedings of a symposium, College Park, Md., Mar. 1972. Gerald A. Specter and William L. Claiborn, Eds. Behavioral Publications, New York, 1973. x, 210 pp. Cloth, \$9.95; paper, \$4.95. Topical Series in Community-Clinical Psychology, vol. 2.

Critique of the Psycho-Physical Identity Theory. A Refutation of Scientific Materialism and an Establishment of Mind-Matter Dualism by Means of Philosophy and Scientific Method. Eric P. Polten. Mouton, The Hague, 1973. xviii, 290 pp. Dfl. 34. Studies in the Social Sciences 14.

Current Topics in Comparative Pathobiology. Vol. 2. Thomas C. Cheng, Ed. Academic Press, New York, 1973. xvii, 334 pp., illus. \$24.

Darwin and the Modern World View. John C. Greene. Louisiana State University Press, Baton Rouge, 1973. x, 142 pp. Paper, \$1.95. Reprint of the 1961 edition.

The Death of a Wombat. Ivan Smith. Drawings by Clifton Pugh. Scribner, New York, 1973. 62 pp. \$5.95.

A Dictionary of Zoology. A. W. Leftwich. Constable, London, ed. 3, 1973 (U.S. distributor, Crane, Russak, New York). x, 478 pp., \$13.50.

Disturbed and Troubled Children. Maurice F. Freehill, Ed. Spectrum Publications, Flushing, N.Y., 1973 (distributor, Halsted [Wiley], New York). 224 pp., illus. \$12.50.

Diversity and Homogeneity in World Societies. Erika Bourguignon and Lenora S. Greenbaum. HRAF Press, New Haven, Conn., 1973. xiv, 190 pp., illus. Cloth, \$8; paper, \$5.

DNA Synthesis in Vitro. Proceedings of a symposium, Madison, Wis., July 1972. R. D. Wells and R. B. Inman, Eds. University Park Press, Baltimore, 1973. xxviii, 476 pp., illus. \$24.50.

Don't Push Me, I'm No Computer. How Pressures to "Achieve" Harm Pre-School

Children. Helen L. Beck. McGraw-Hill, New York, 1973. xiv, 174 pp. \$5.95.

Ego Functions in Schizophrenics, Neurotics, and Normals. A Systematic Study of Conceptual, Diagnostic, and Therapeutic Aspects. Leopold Bellak, Marvin Hurvich, and Helen K. Gediman. Wiley-Interscience, New York, 1973. xiv, 572 pp., illus. \$19.95. Wiley Series on Personality Processes.

Electrochemistry. Vol. 3. A Review of the Literature Published during 1971. G. J. Hills, senior reporter. Chemical Society, London, 1973. x, 250 pp., illus. £8. Specialist Periodical Reports.

Elements of Biological Science. William T. Keeton. Illustrated by Paula Di Santo Bensadoun. Norton, New York, 1973. xvi, 584 pp. + plates. \$9.95. Shortened version of *Biological Science*, ed. 2.

Encyclopedia of Library and Information Science. Vol. 10, Ghana to Hong Kong. Allen Kent, Harold Lancour, Jay E. Daily, and William Z. Nasri, Eds. Dekker, New York, 1973. x, 498 pp., illus. \$50; by subscription, \$40.

Energy in the World of the Future. Hal Hellman. Evans, New York, 1973 (distributor, Lippincott, Philadelphia). 240 pp., illus. \$5.95. World of the Future Series.

Energy under the Oceans. A Technology Assessment of Outer Continental Shelf Oil and Gas Operations. University of Oklahoma Press, Norman, 1973. xxii, 378 pp., illus. Cloth, \$20; paper, \$4.50.

Environment and Society. A Book of Readings on Environmental Policy, Attitudes, and Values. Robert T. Roelofs, Joseph N. Crowley, and Donald L. Hardesty, Eds. Prentice-Hall, Englewood Cliffs, N.J., 1974. x, 374 pp., illus. Cloth, \$11.95; paper, \$5.95.

Environmental Geomorphology and Landscape Conservation. Vol. 3, Non-Urban Regions. Donald R. Coates, Ed. Dowden, Hutchinson and Ross, Stroudsburg, Pa., 1973. xii, 484 pp., illus. \$23. Benchmark Papers in Geology, vol. 8.

The Enzymes. Vol. 9, Group Transfer. Part B, Phosphoryl Transfer, One-Carbon Group Transfer, Glycosyl Transfer, Amino Group Transfer, Other Transferases. Paul D. Boyer, Ed. Academic Press, New York, ed. 3, 1973. xxii, 586 pp., illus. \$35.

Exercise Testing and Exercise Training in Coronary Heart Disease. John Naughton, Herman K. Hellerstein, and Irvin C. Mohler, Eds. Academic Press, New York, 1973. xx, 474 pp., illus. \$16.

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Fields and Particles. An Introduction to Electromagnetic Wave Phenomena and Quantum Physics. Francis Bitter and Heinrich A. Medicus. Elsevier, New York, 1973. xiv, 690 pp., illus. \$17.95. Revision of *Currents, Fields, and Particles*, 1956.

Fine Structure of Cells and Tissues. Keith R. Porter and Mary A. Bonneville. Lea and Febiger, Philadelphia, ed. 4, 1973. viii, 204 pp., illus. \$11.

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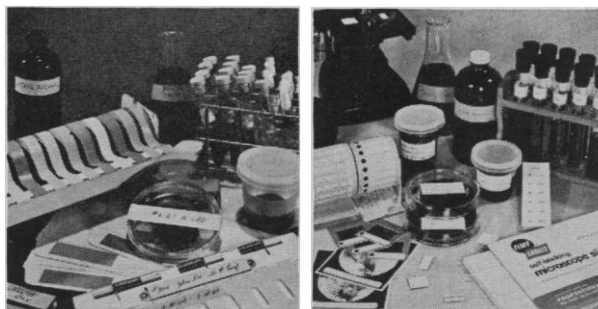
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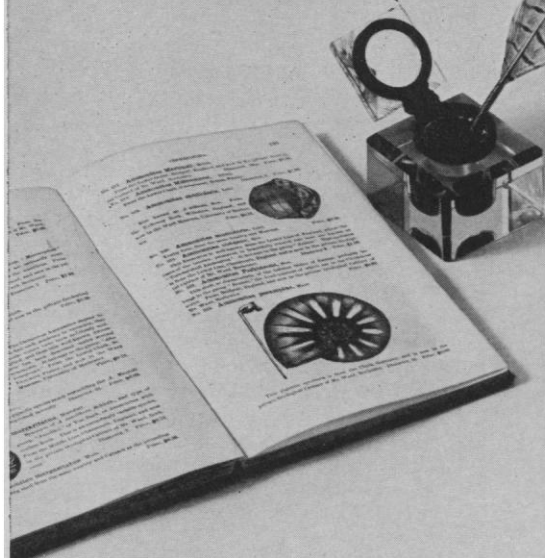
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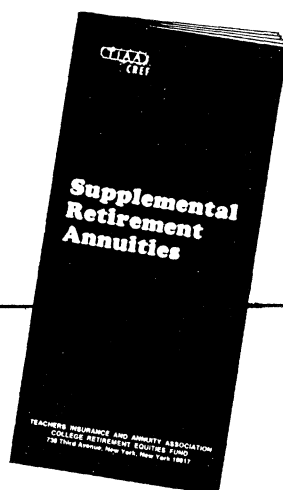
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Friedel-Crafts Chemistry. George A. Olah. Wiley-Interscience, New York, 1973. viii, 582 pp., illus. \$19.50. Interscience Monographs on Organic Chemistry.

Functions of One Complex Variable. John B. Conway. Springer-Verlag, New York, 1973. xiv, 314 pp., illus. Paper, \$15.20. Graduate Texts in Mathematics, vol. 11.

Genetic Fix. Amitai Etzioni. Macmillan, New York, 1973. 276 pp. \$7.95.

Golden Shadows, Flying Hooves. George B. Schaller. Knopf, New York, 1973. xxvi, 290 pp., illus. + plates. \$8.95.

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Initial Reports of the Deep Sea Drilling Project. Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). Vol. 21, Nov.-Jan. 1971-72. Prepared for the National Science Foundation by the Scripps Institution of Oceanography, La Jolla, Calif., 1973 (available from the Superintendent of Documents, Washington, D.C.). xx, 932 pp., illus. + charts. \$15.45.

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Introductory Solid Mechanics. James McD. Baxter Brown. Wiley, New York, 1973. xiv, 434 pp., illus. \$18.50.

IR. Theory and Practice of Infrared Spectroscopy. Nelson L. Alpert, William E. Keiser, and Herman A. Szymanski. Plenum, New York, 1973. xiv, 380 pp., illus. + graphs. Paper, \$7.95. A Plenum/Rosetta Edition, Reprint of the 1970 edition.

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Isozymes and Enzyme Regulation in Cancer. Proceedings of a conference, San Diego, Calif., Mar. 1971. Sidney Weinhouse and Tetsuo Ono, Eds. University of Tokyo Press, Tokyo, 1972 (U.S. distributor, University Park Press, Baltimore). viii, 322 pp., illus. \$29.50. GANN Monograph on Cancer Research 13.

Laboratory Investigations in the Principles of Biology. Thomas R. Mertens and Alice S. Bennett. Burgess, Minneapolis, ed. 3, 1973. viii, 206 pp., illus. Spiral bound, \$6.50.

Laboratory Techniques in Rabies. Martin M. Kaplan and Hilary Koprowski, Eds. World Health Organization, Geneva, ed. 3, 1973. 368 pp., illus. + plates. Paper, \$14.40. World Health Organization Monograph Series, No. 23.

Lexicography in English. Proceedings of a conference, New York, June 1972. Raven I. McDavid, Jr., and Audrey R. Duckert, Eds. New York Academy of Sciences, New York, 1973. 342 pp., illus. Paper, \$24. *Annals of the New York Academy of Sciences*, vol. 211.

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Microbiology. Including Immunology and Molecular Genetics. Bernard D. Davis, Renato Dulbecco, Herman N. Eisen, Harold S. Ginsberg, and W. Barry Wood, Jr. Harper and Row Medical Department, Hagerstown, Md., ed. 2, 1973. xviii, 1562 pp., illus. \$27.50.

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Models of the Mind. A Psychoanalytic Theory. John E. Gedo and Arnold Goldberg. University of Chicago Press, Chicago, 1973. xvi, 220 pp., illus. \$9.50.

Modern Electrochemistry. An Introduction to an Interdisciplinary Area. John O'M. Bockris and Amulya K. N. Reddy. Plenum, New York, 1973. Two volumes, illus. Vol. 1. xxxiv + pp. 1-622 + index. Vol. 2. xxx + pp. 623-1432 + index. Paper. Each vol., \$8.95. A Plenum/Rosetta edition. Reprint of the 1970 edition.

Molecular Crystals and Molecules. A. I. Kitaigorodsky. Academic Press, New York, 1973. xiv, 554 pp., illus. \$44. Physical Chemistry, vol. 29.

Net Radiation Received by a Horizontal Surface at the Earth. B. de Jong. Delft University Press, Delft, 1973 (U.S. distributor, International Scholarly Book Services, Portland, Ore.). 52 pp. + maps. Paper, \$15.50.

A New Ecophysiological Approach to Forest-Water Relationships in Arid Climates. I. Gindel. Junk, The Hague, 1973. vi, 142 pp., illus. Dfl. 40.

Organic Electronic Spectral Data. Vol. 9, 1967. John P. Phillips, Henry Feuer, and B. S. Thyagarajan, Eds. Interscience (Wiley), New York, 1973. xvi, 960 pp. \$40.

Organic Quantum Chemistry Problems. Rudolf Zahradnik and Petr Cársky. Plenum, New York, 1973. x, 222 pp., illus. Paper, \$5.95. A Plenum/Rosetta Edition.

Partially Ionized Gases. M. Mitchner and Charles H. Kruger, Jr. Wiley-Interscience, New York, 1973. x, 518 pp., illus. \$24.95. Wiley Series in Plasma Physics.

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Practical Liquid Chromatography. S. G. Perry, R. Amos, and P. I. Brewer. Plenum, New York, 1973. xiv, 230 pp., illus. Paper. \$7.95. A Plenum/Rosetta Edition.

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Psychological Processes in Pattern Recognition. Stephen K. Reed. Academic Press, New York, 1973. xvi, 244 pp., illus. \$13.95. Academic Press Series in Cognition and Perception.

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Public Health in the People's Republic of China. Proceedings of a conference, Ann Arbor, Mich., May 1972. Myron E. Wegman, Tsung-Yi Lin, and Elizabeth F. Purcell, Eds. Josiah Macy, Jr., Foundation, New York, 1973. x, 354 pp., illus. Paper, \$7.50. Macy Foundation Series on Medicine and Public Health in China.

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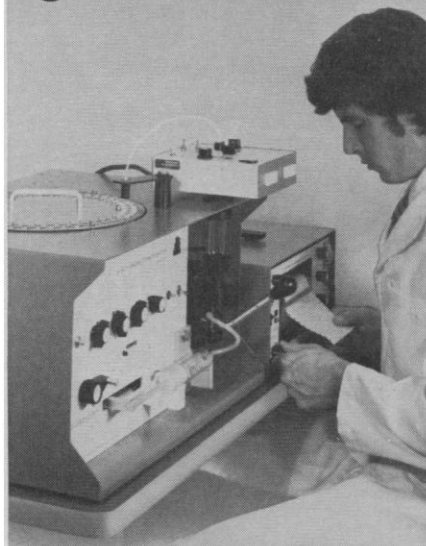
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Spectral Theory of Operators in Hilbert Space. K. O. Friedrich. Springer-Verlag, New York, 1973. x, 244 pp. Paper, \$6.50. Applied Mathematical Sciences, 9.

Speech Synthesis. James L. Flanagan and Lawrence R. Rabiner, Eds. Dowden, Hutchinson and Ross, Stroudsburg, Pa., 1973. xvi, 512 pp., illus. \$22. Benchmark Papers in Acoustics.

Stochastic Processes and Applications in Biology and Medicine. M. Iosifescu and P. Tautu. Editura Academiei, Bucharest, and Springer-Verlag, New York, 1973. Two volumes. Vol. 1. 332 pp. \$21.80. Vol. 2. 338 pp. \$21.80. Biomathematics, vols. 3 and 4.

Strong Rigidity of Locally Symmetric Spaces. G. D. Mostow. Princeton University Press, Princeton, N.J., and University of Tokyo Press, Tokyo, 1973. vi, 198 pp. Paper, \$7. Annals of Mathematics Studies, No. 78.

Studies in Human Geography. Michael Chisholm and Brian Rodgers, Eds. Heinemann Educational Books, London, 1973 (U.S. distributor, Crane, Russak, New York). x, 306 pp., illus. \$12.75.

The Study of Behavioral Development. Joachim F. Wohlwill. Academic Press, New York, 1973. xiv, 414 pp., illus. \$19.

Surgical Approaches in Psychiatry. Proceedings of a congress, Cambridge, England, Aug. 1972. Lauri V. Laitinen and Kenneth E. Livingston, Eds. University Park Press, Baltimore, 1973. xvi, 336 pp., illus. \$24.50.

Team Policing. Seven Case Studies. Lawrence W. Sherman, Catherine H. Milton, and Thomas V. Keily. Police Foundation, Washington, D.C., 1973. xviii, 108 pp. Paper.

Terpenoids and Steroids. Vol. 3. A Review of the Literature Published between September 1971 and August 1972. K. H. Overton, senior reporter. Chemical Society, London, 1973. x, 528 pp., illus. £12. Specialist Periodical Reports.

Theory and Therapy in Dynamic Psychiatry. Jules H. Masserman. Aronson, New York, 1973. 236 pp. \$10.

The Theory of Bernoulli Shifts. Paul Shields. University of Chicago Press, Chicago, 1973. x, 118 pp., illus. Cloth, \$6.50; paper, \$2.50. Chicago Lectures in Mathematics.

Theory of Unimolecular Reactions. Wendell Forst. Academic Press, New York, 1973. xvi, 448 pp., illus. \$29.50. Physical Chemistry, vol. 30.

Three Styles in the Study of Kinship. J. A. Barnes. University of California Press, Berkeley, 1973. xxiv, 318 pp., illus. Paper, \$3.85. Reprint of the 1971 edition.

Topics in Geophysics. Peter J. Smith. MIT Press, Cambridge, Mass., 1973. x, 246 pp., illus. \$10.95.

Towards a Theoretical Biology. Four essays. Proceedings of a symposium, Bellagio, Italy. C. H. Waddington, Ed. Aldine-Atherton, Chicago, 1973. viii, 300 pp., illus. + plates. \$17.50.

Toxicology and Pharmacology of Venoms from Poisonous Snakes. John H. Brown. Thomas, Springfield, Ill., 1973. xiv, 184 pp. + plates. Cloth, \$13.75; paper, \$9.95.

Transition Metal Complexes of Phosphorus, Arsenic and Antimony Ligands. C. A. McAuliffe, Ed. Halsted (Wiley), New York, 1973. xx, 428 pp., illus. \$32.50.

Transport Phenomena Through Polymer Films. Proceedings of a symposium, New York, Aug. 1972. Charles A. Kumins, Ed. Interscience (Wiley), New York, 1973. vi, 176 pp., illus. Paper, \$10. *Journal of Polymer Science: Polymer Symposia* No. 41.

United States-Japan Seminar on Polymer Processing and Rheology. Gatlinburg, Tenn., Aug. 1972. Donald C. Bogue, Misazo Yamamoto, and James L. White, Eds. Interscience (Wiley), New York, 1973. vi, 378 pp., illus. Paper, \$12.50. *Applied Polymer Symposia* No. 20.

Virus Research. Proceedings of a conference, Squaw Valley, Calif., Mar. 1973. C. Fred Fox and William S. Robinson, Eds. Academic Press, New York, 1973. xxviii, 600 pp., illus. \$19.50.

Water for a City. A History of New York City's Problem from the Beginning to the Delaware River System. Charles H. Weidner. Rutgers University Press, New Brunswick, N.J., 1974. xii, 340 pp. + plates. \$17.50.

Weather and Climate Modification. Problems and Progress. Committee on Atmospheric Sciences, National Research Council. National Academy of Sciences, Washington, D.C., 1973. xxii, 258 pp. Paper, \$6.25.

The Western Pacific. Island Arcs, Marginal Seas, Geochemistry. Proceedings of a congress, Canberra, Australia, Aug. 1971. Patrick J. Coleman, Ed. University of Western Australia Press, Nedlands, and Crane, Russak, New York, 1973. xviii, 676 pp., illus. \$44.

What Every Patient Should Know about His Health and His Doctor. A Guide to Symptoms, Common Diseases, Diagnostic Tests, Medications, and Treatments, Home Health Care and the Periods of Life. R. Douglas Collins. Exposition Press, Jericho, N.Y., 1973. xiv, 406 pp.

Work Is Dangerous to Your Health. A Handbook of Health Hazards in the Workplace and What You Can Do about Them. Jeanne M. Stellman and Susan M. Daum. Vintage, New York, 1973. xxiv, 450 pp., illus. Paper, \$1.95. Reprint of the 1971 edition.

Yearbook of Astronomy 1974. Patrick Moore, Ed. Sidgwick and Jackson, London and Norton, New York, 1973. 198 pp., illus. \$6.50.

The You-Don't-Need-A-Man-To-Fix-It Book. The Woman's Guide to Confident Home Repair. Jim Webb and Bart Houseman. Doubleday, New York, 1973. xvi, 248 pp., illus. \$7.95.