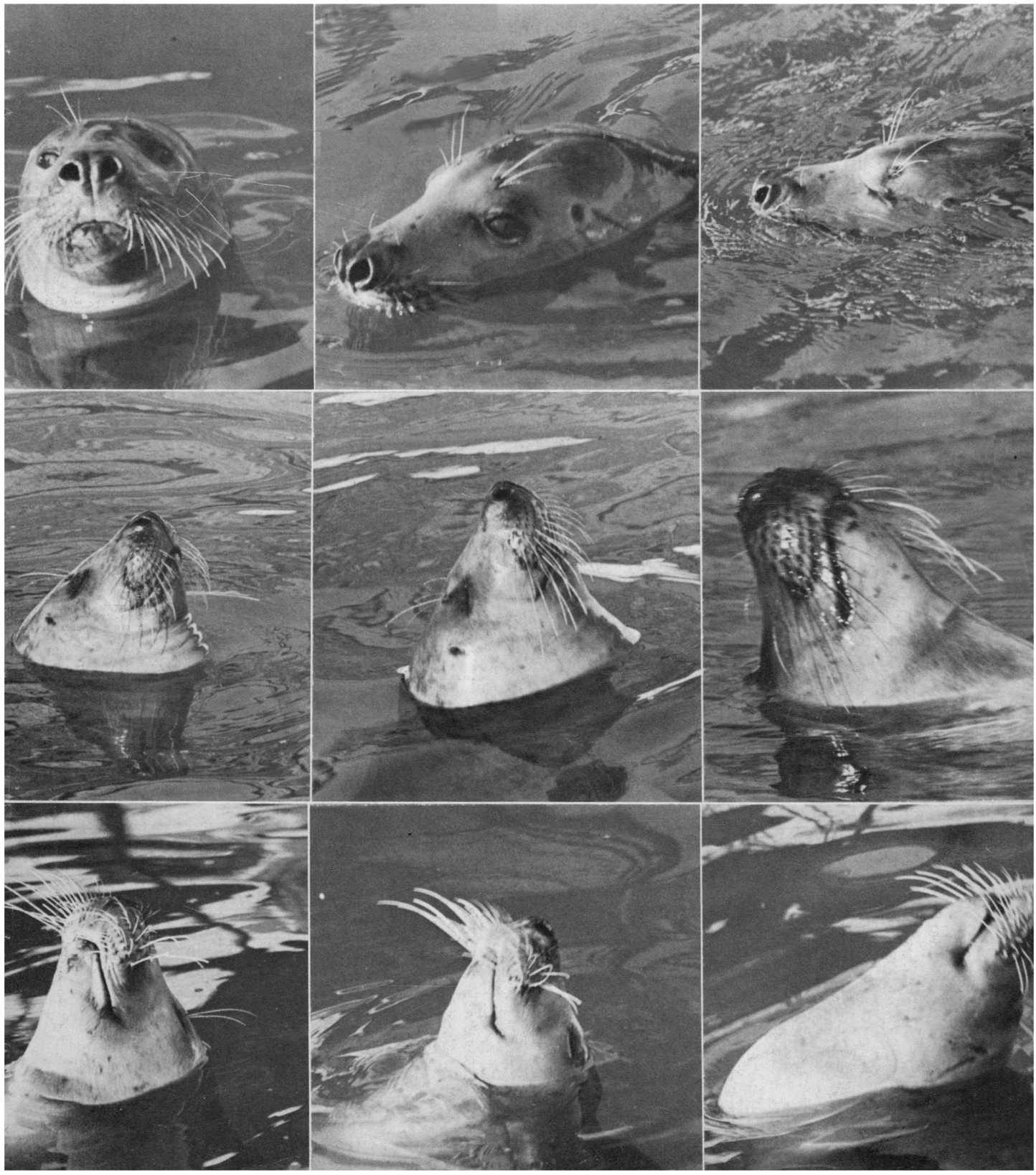
SCIENCE

14 February 1975

Vol. 187, No. 4176

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



ANALYZE 16 PROTEINS IN 2 HOURS

Analytical electrofocusing is a simple and straightforward method, with the new LKB Multiphor. You can analyze as many as 16 different protein mixtures simultaneously—under identical conditions. Comparisons are far more accurate.

It is easy to optimize and standardize. You can select the pH range you need from the wide choice of LKB Ampholine® carrier ampholytes. There are 10 different ranges, both broad and narrow, covering pH 2.5 to 11.

High resolution is a unique feature of electrofocusing. Zones become focused and concentrated as the separation proceeds. And with the Multiphor the complete separation is finished in less than 2 hours. For more information, contact LKB, the leaders in this field for many years.

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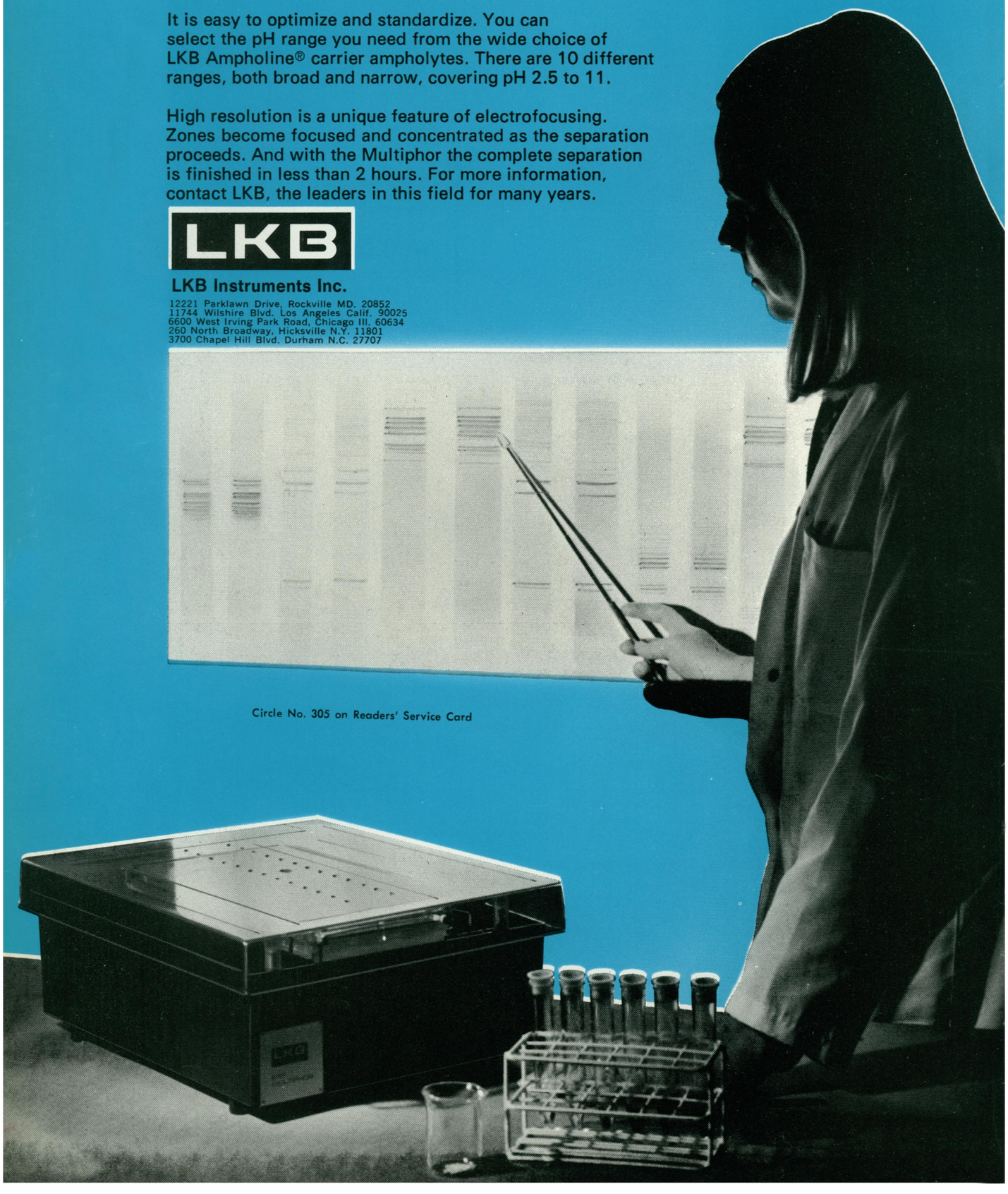
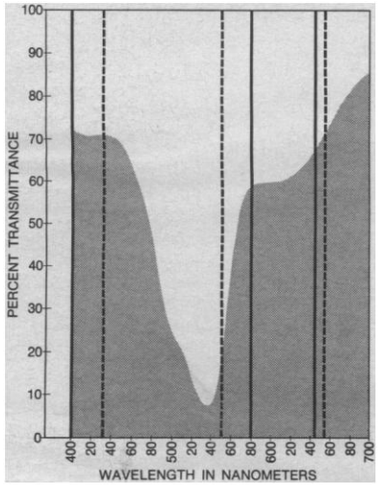


Make better color photomicrographs with film that fits the job

Making photomicrographs is not like making pictures of landscapes or people. Different films are needed.

Conventional films are designed for pleasing the average "eye." But film which does well in rendering grass, sky, and flesh tones may not perform so admirably with the hues of hematoxylin and eosin. As the chart indicates, the green sensitivity of KODAK Photomicrography Color Film 2483 is a good match for the peak transmittance of the common H & E stain.



A comparison of film sensitivities with the spectral transmittance of H & E stain. Vertical lines are peak-wavelength sensitivities of KODACHROME II Professional Film (Type A [solid lines]) and KODAK Photomicrography Color Film 2483 (dashed lines). The spectral-absorption curve is from hematoxylin and eosin stain on a 5-micrometer section of adult guinea pig liver, read on a General Electric Recording Spectrophotometer.

The contrast of ordinary color films is not really adequate for faintly stained or low-contrast subjects. In short, films excellent for routine photography may have serious shortcomings in the specialized world of photomicrography. But KODAK Photomicrography Color Film 2483 is a film fit for the job.

It has very high resolving power (200 lines per mm); extremely fine grain; green sensitivity which fits biological stains, as shown in the chart; and high contrast and color saturation.

Combined, these features make 2483 Film capable of producing sharp, brilliant, beautiful photomicrographs. It brings out fine detail and faint color with excellent clarity.

Of course, all high-contrast materials demand precise exposure. For best results with 2483 Film, uniform illumination of the field is essential, and bracketing exposures is recommended.

To try the film yourself, go to your usual source of Kodak products and ask for KODAK Photomicrography Color Film 2483. It comes in 36-exposure 135 magazines, 35 mm x 125-foot rolls, and 4 x 5-inch sheets. If your dealer doesn't have it on his shelf, he can order it.

He probably *will* have chemical kits for Process E-4, so you can process the film yourself in about an hour. Or you can have it done by any commercial processing laboratory that processes KODAK Ektachrome Films.

Or for prepaid processing, choose Kodak mailer PK36, and send the film to us.

More information? Just fill in and mail the coupon.

A better b/w film, too.
Excellent though color photomicrographs may be, there are times when black-and-white is preferable. The use of black-and-white may provide optimum visualization of detail via contrast control and color filtration. Or it may simply reflect the economics of reproduction in journals and monographs.

In such cases, the film of choice may well be KODAK Photomicrography Monochrome Film SO-410. To find out more, use the coupon.

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14 February 1975

Volume 187, No. 4176

SCIENCE

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The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.
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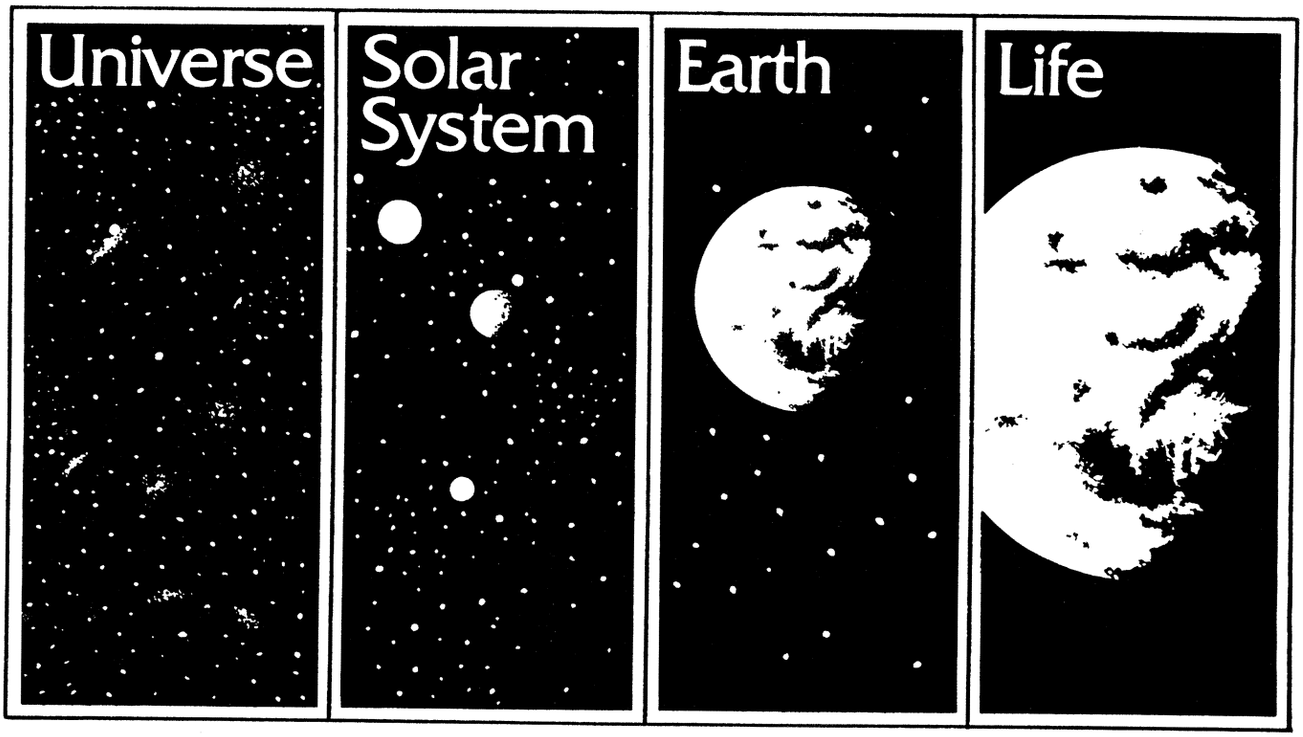
COVER

Gray seal (*Halichoerus grypus*) spends most of its life in the sea and can sleep on the surface, underwater, and on land. The seal proceeds from active waking (upper left) to quiescent waking (upper center) to rapid eye movement sleep (upper right) to slow-wave sleep (lower six views). See page 553. [S. H. Ridgway and P. L. Romano, U.S. Navy, San Diego, California]

Origins:

Speculations and facts on the sources of planets, Earth, and life by Robert Jastrow, Philip Morrison, Cyril Ponnamperuma, George Wald.



What is man's deepest mystery? Perhaps it is his own origin and that of his world. How did life begin? Where? . . . How did primitive life evolve into man? . . . How did the earth form? . . . How was the universe created? . . . What of the genesis, life, and death of stars? . . . What do pulsars and quasars signify? How were elements created?

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Cyril Ponnamperuma, University of Maryland

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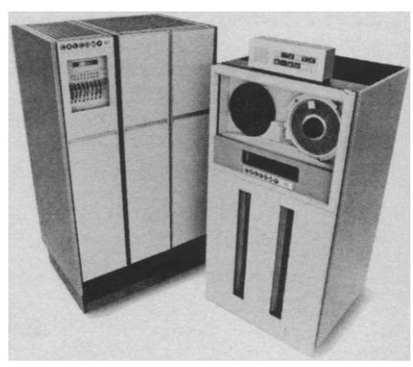

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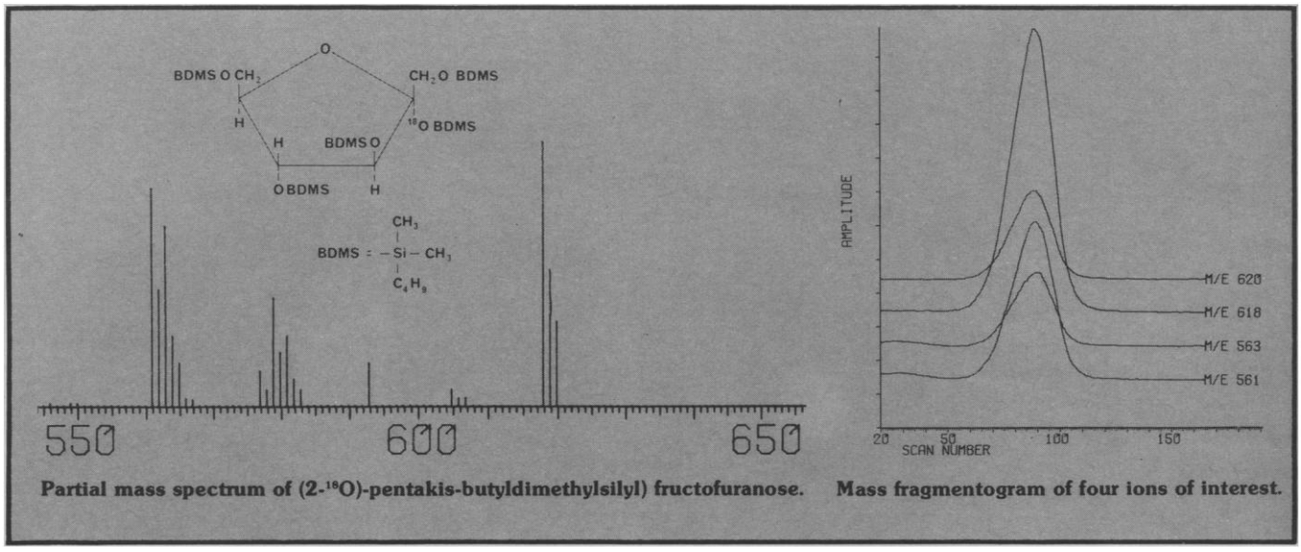

Partial mass spectrum of (2-^{18}O)-pentakis-butyldimethylsilyl) fructofuranose. **Mass fragmentogram of four ions of interest.**

Stable isotope labeling is entering an era of even greater usefulness because Finnigan GC/MS systems have made precise isotope measurements a practical tool. The technique of mass fragmentography provides sensitivity, specificity, and quantitation at levels never before achieved. Measurements of labeled compounds in biological fluids and tissues can be made at levels of 10^{-9} to 10^{-12}g, even if relatively impure samples are isolated. This cannot be easily accomplished by any other technique.

An Example

The (2-^{18}O)-pentakis-(butyldimethylsilyl) fructofuranose is being used in isotope labeling studies of intact cells. This analysis was performed to verify the position of the ^{18}O isotope and to measure its enrichment at that position. The isotope ratios were obtained by comparing the integrated areas of the specific ion chromatograms of the (2-^{18}O) fructose. These specific mass ions are chosen because they are the diagnostic ions of the (2-^{18}O) fructose. The ion at m/e 561 (M^+-189) contains 31.3 atom % excess ^{18}O measured at 0.36% precision. Combustion techniques were used to show that this was the total amount of ^{18}O in the (2-^{18}O) fructose. Thus, the ion at m/e 561 contains all of the C-2 oxygen atom and measurement of the m/e 563/561 ratio can be used to calculate the ^{18}O enrichment in this oxygen atom. This provides meaningful data in the metabolism studies of fructose in intact cells. The 0.36% figure is typical of the precision and accuracy obtainable by mass fragmentography.

The New vs The Old

Up to now the life scientist has been faced by a choice of two extremes—the combustion technique provided necessary precision but no structural information; the conventional GC/MS technique provided a wealth of structural information but poor precision. Mass fragmentography bridges the gap between the two.

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Rapid switching, especially between ions of widely different masses, poses a real challenge to the stability of the mass spectrometer electronics. Mass-set voltages must be maintained within 0.01% (i.e., better than 0.1 amu precision), even when switching between widely different masses. The RF-to-DC voltage ratio must also be maintained to 1 ppm in order to maintain 0.5% ion peak height stability. Only Finnigan GC/MS systems have demonstrated this level of performance in *users* laboratories.

Ions in a particular isotope series may be collected for widely different amounts of time, depending on their relative abundances. This provides for equalizing the S/N ratio for each ion, no matter how greatly the relative ion intensities differ.

Any ions in the spectrum, no matter their mass difference, may be measured in a particular analysis. They need not lie within a restricted percentage of the mass range, as with the conventional magnetic sector type mass spectrometer.

To make quantitative mass fragmentography even easier, the Finnigan data system automatically calculates the peak areas or peak heights, allowing for subtraction of background signal, and reports the isotope ratios of any selected isotopes.

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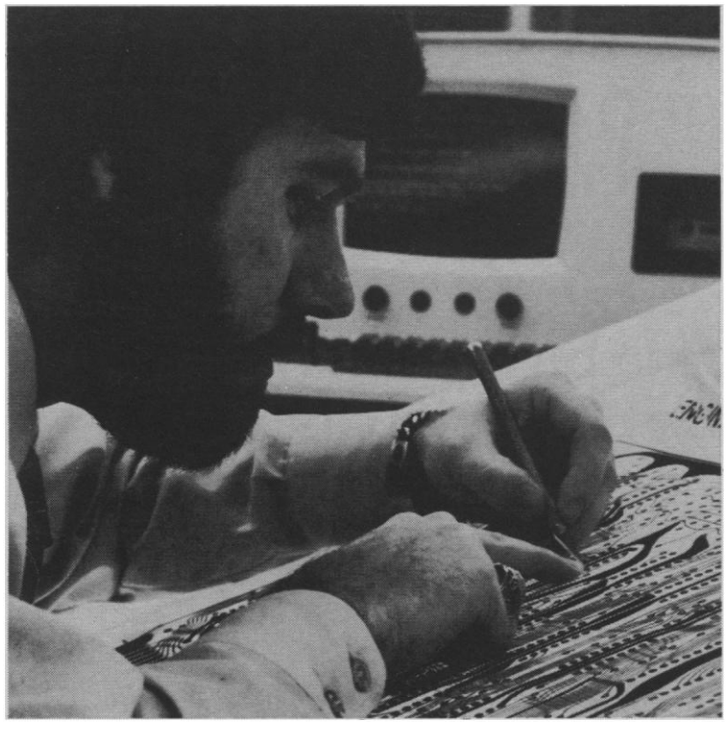

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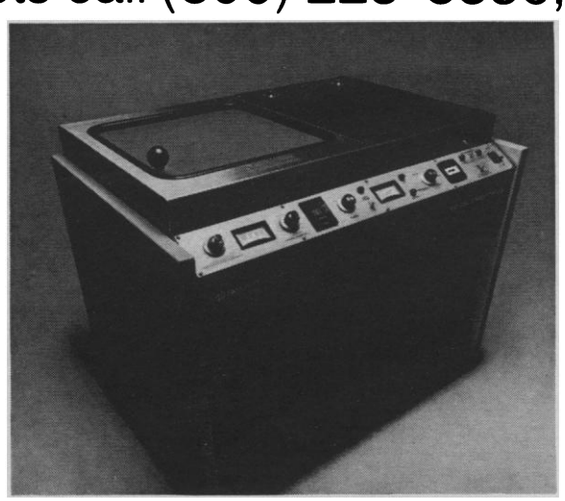

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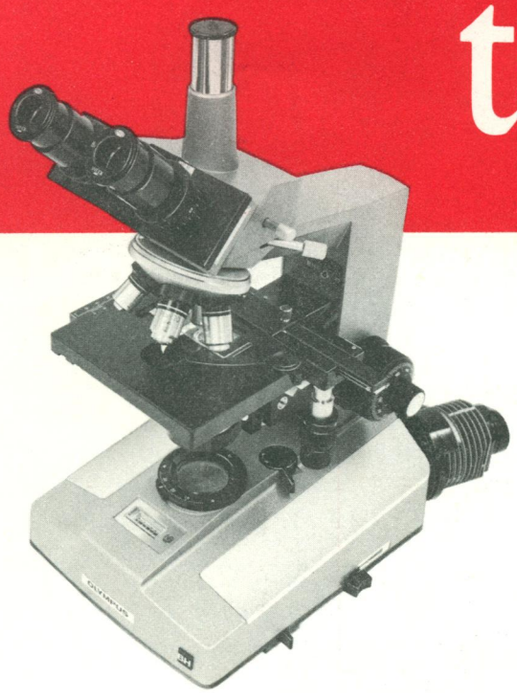

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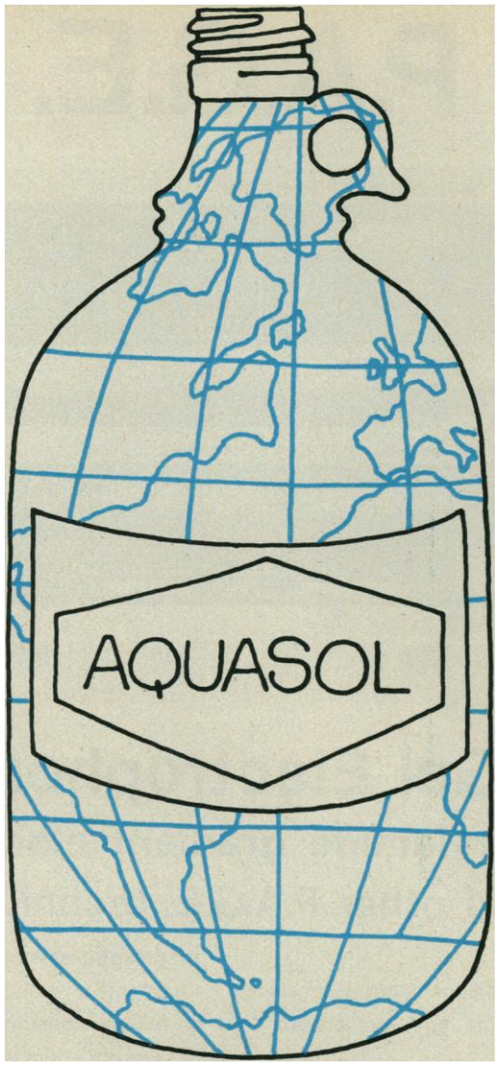

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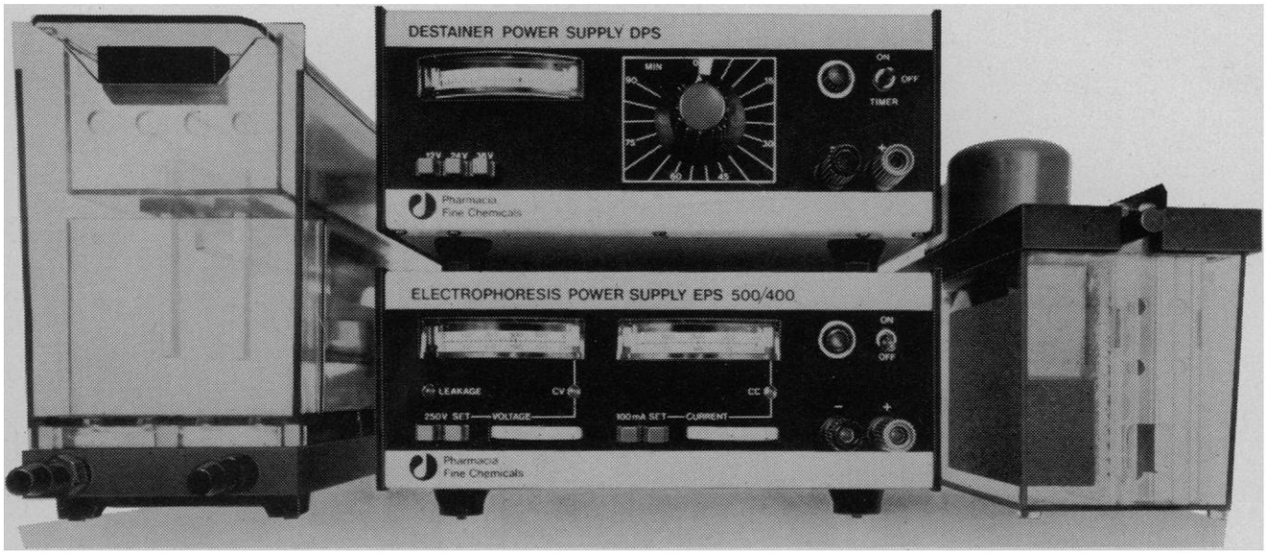

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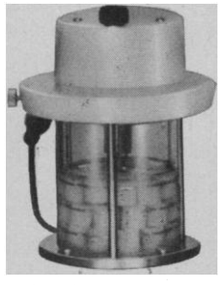

Reichert EM Tissue Processor.

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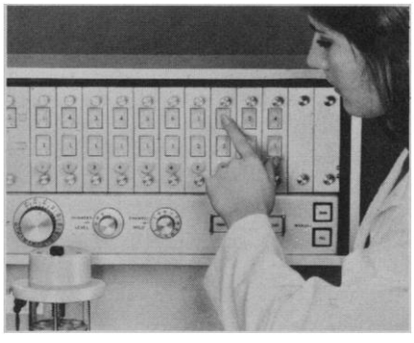

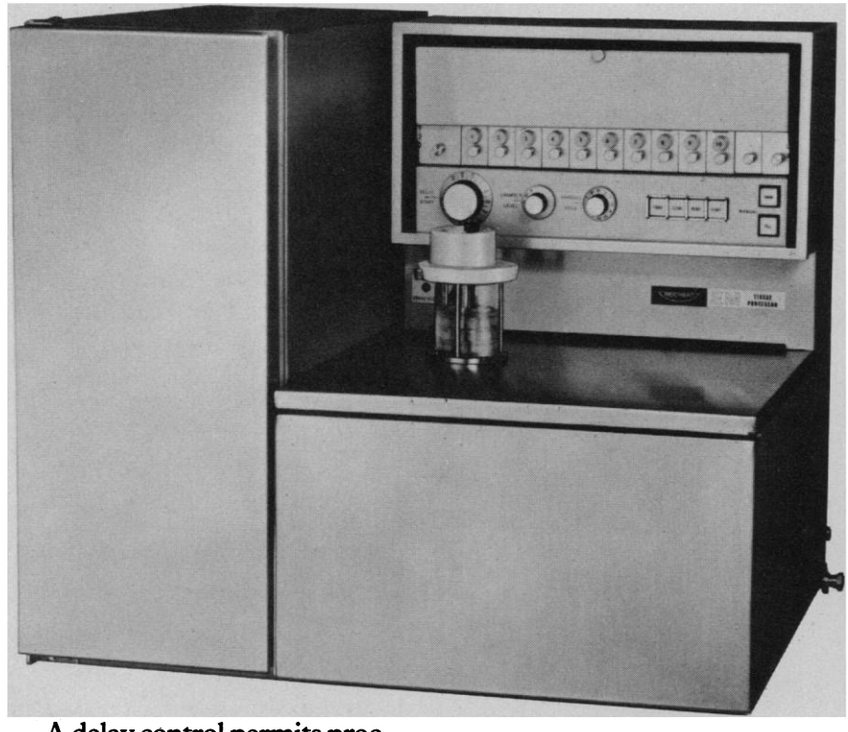

A delay control permits processing to start at a predetermined time, to continue through programmed procedures, and be completed at a specified time, automatically. Processing can thus be run during the night or over a weekend, completely unattended.

The Reichert EMbedder instrument is used to follow-up specimen processing. Gentle vibration provides complete infiltration of the embedding medium into the specimen and "settles" the specimen in the capsule base. Two-stage controlled heat cures the embedding

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For additional information on the Reichert EM Tissue Processor and EMbedder instrument, write

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LETTERS

NIH Management

Barbara J. Culliton has reported perceptively on some of the problems at the National Institutes of Health (NIH). I believe, however, that the impressions she gained (News and Comment, 10 Jan., p. 47) from the press conference held by the Federation of American Scientists (FAS), which included the director of the FAS and five leading scientists from the NIH, do not represent a majority view of NIH scientists.

I know of no sizable movement for an independent NIH or of strong feelings that NIH scientists should be "left . . . alone to do their thing." The *Washington Post*, in an editorial published on 27 December 1974, correctly concluded (from some of the same scientists that Culliton talked to) that "scientists agree that they cannot live in splendid isolation . . .[b]ut they consider themselves qualified to participate in the decisions about the . . . methods . . . their science ought to pursue in order to obtain the most promising results."

That is the nub of the problem. What scientists inside and outside the NIH object to is "targeted" research selected by managers and legislators who are politically motivated and seek advice from scientific entrepreneurs who have power and are articulate, to the exclusion of advice from working scientists. This is partly the fault of the scientists who, as Culliton says, "have a knack for putting [arguments] in ways that sound self-serving." But it is also the fault of managers, legislators, and some reporters who do not make the effort to separate what some scientists say some of the time from what the majority of scientists mean.

Let's continue to have targeted goals, programs, and managers. But let working scientists into the programming and managing processes at the highest levels, appoint managers that have an understanding of how scientific research works, keep the system flexible enough so that serendipitous discoveries and flashes of genius are not suppressed, and above all do not sacrifice scientific quality for perceived program needs.

Finally, don't make the NIH an independent agency. There may be an argument for a separate Department of Health including the NIH, but biomedical research needs the support of disease-oriented programs. If the raison d'être for biomedical research is only intellectual curiosity, it can expect a level of support equivalent, say, to archeology.

KARL A. PIEZ
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Vigorous Vitamins

Reports that vitamin A may be endowed with Antitumor activities (Research News, 27 Dec. 1974, p. 1198) follow the announcement that vitamin E promotes Eternal youth (Research News, 20 Dec. 1974, p. 1105) and the already notorious claim that vitamin C prevents Colds. It is to be expected that new activities for some of the other vitamins will be discovered shortly. Thus vitamin B might cure Baldness (or Botulism), vitamin D could work miraculously against Dengue, and vitamin K is very possibly an excellent agent for Kleptomania.

Has anybody got a few milligrams of vitamin S (for Skeptics)?

JAN T. VILČEK
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Thomas H. Maugh's report on vitamin A and its relation to carcinogens presents several provocative points, the most significant of which is the observation that the primary thrust of cancer therapy has been toward treatment *after* the development of malignancy.

The *Ten-State Nutrition Survey* (*1*) brought to light the marked incidence of vitamin A deficiency in this country. Further, Jennings (*2*) has reviewed at length the interrelation of vitamin A metabolism and various endocrine abnormalities. For instance, it has been noted in humans with diabetes or hypothyroidism that conversion of dietary sources of carotene to vitamin A is almost completely blocked. Diabetes has long been noted as a disease in which neoplasm incidence is excessive. Further, mild depletion of vitamin A has been shown to inhibit synthesis of deoxycorticosterone to corticosterone. Severe depletion of vitamin A has been demonstrated to inhibit glucocorticoid synthesis, which amounts to "chemical

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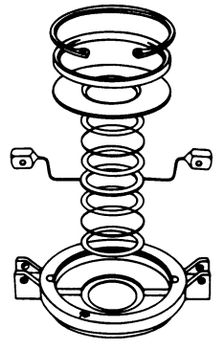

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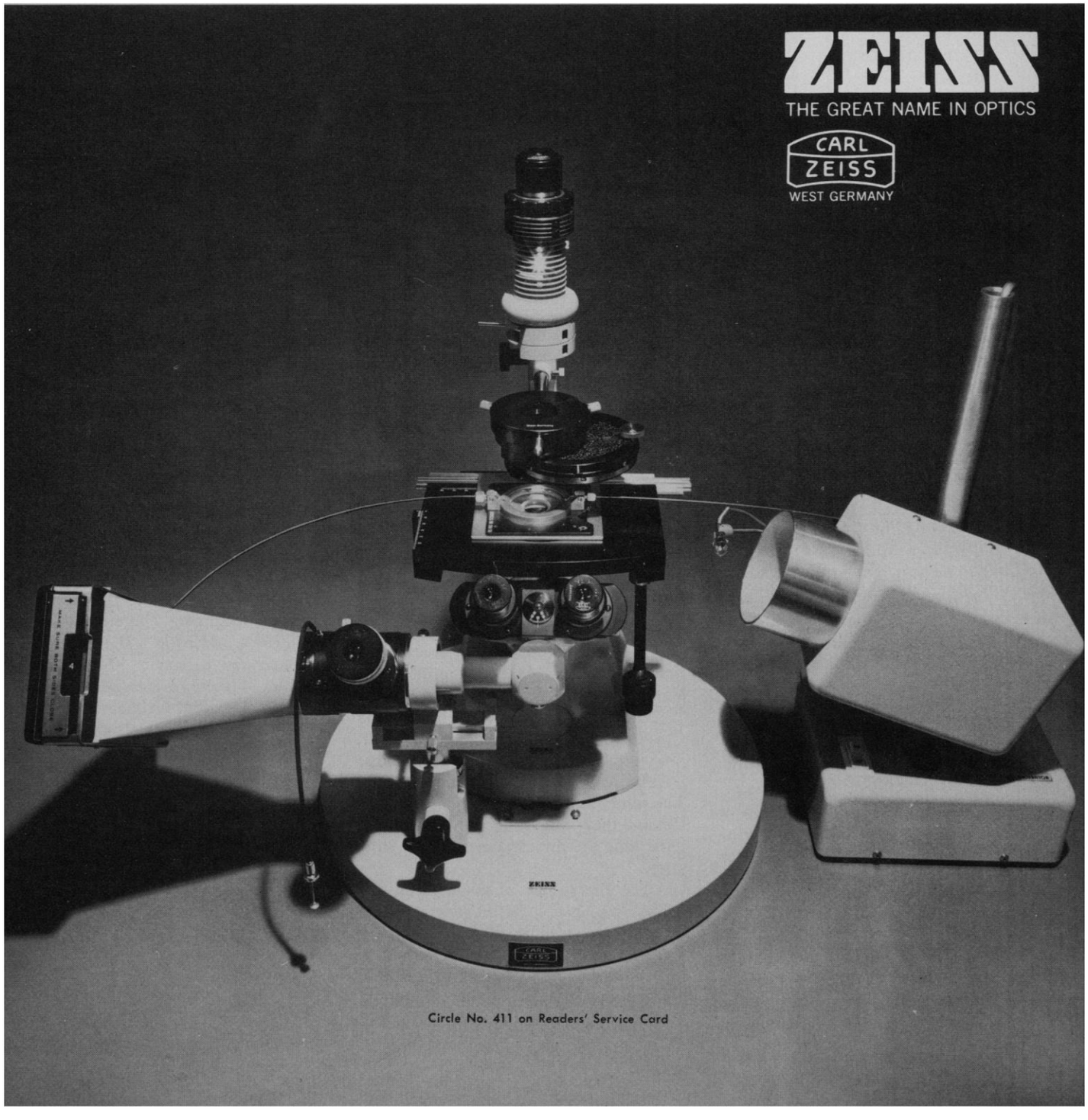

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adrenalectomy" (*3*). Defective adrenal cortical hormone synthesis has been demonstrated to have a carcinogenic effect.

Preventive programs might well embrace investigation of the relation between dietary deficiency and endocrine abnormalities of subtle or gross natures. Studies thus far indicate that such an interrelation creates fertile circumstances for the development of neoplasms.

Maugh comments that there is a distressing potential for a faddist approach in this entire matter. This approach could be averted if the usefulness and protectiveness of dietary sources of all nutrients, including sources of vitamin A, were to be outlined in public educational programs. Inappropriate medication with large amounts of vitamin A in capsule form is not suggested. Rather, attention to diet with consideration of existing endocrine defects is the reasonable approach based on the findings thus far.

MARILYN HAMILTON LIGHT
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Particle Physics Race

Never before have I seen the absurd competition in high energy physics made so clear as in William D. Metz's articles (Research News, 6 Dec. 1974, pp. 909 and 910) about the discovery of the new particles.

Goldhaber retreated to write the paper announcing the Stanford result when there were only three data points. Only in the second draft could parameters of the resonance be included because they were not fully known at the time the first draft was being written.

The almost-hero of this comedy was Ting, who had sufficient judgment and caution to wonder if his data were correct or even spurious. As a result, he and his colleagues working at Brookhaven engaged in several months of reflection and experimental checking. Yet, when the threat of a scoop appeared, he too rushed to publish.

I wonder if these scientists also run to the cashier's window the moment the horses in a race leave the starting gate.

EDWARD M. DICKSON
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Organic Cations

The admirable hypothesis of D. McMahon (20 Sept. 1974, p. 1021) that differentiation of embryonic cells is determined by their content of inorganic ions and cyclic nucleotides leads me to consider the possibility that not only are inorganic cations of considerable importance in this connection, but that organic cations, such as putrescine, spermidine, and others, found in all nucleated mammalian cells, could also be of importance. These have been found to substitute and synergistically promote enzymatic activities stimulated by inorganic cations (*1*). Polyamine biosynthesis can also be stimulated by cyclic nucleotides (*2*). Furthermore, in addition to having ionic properties, these diamines, being derivatives of aliphatic hydrocarbons, have the ability of conformational adjustment into specific binding sites of macromolecules such as DNA and RNA (*3*). Because they are subject to enzymatic synthesis and catabolism, their biological activities could also be modulated by endogenic processes causing variation in concentrations of these compounds and resulting in a variety of other metabolites, as for instance conversion of putrescine by diaminooxidase (histaminase) to γ-aminobutyraldehyde and then to Δ^1-pyrroline and polymers.

With all these events occurring in the cell, I could imagine that they contribute to the mechanisms considered by McMahon.

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Photocopying and Purchasing Practices of Libraries

In his reply (10 May 1974, p. 610) to letters from Vernon E. Palmour, W. Kenneth Lowry, and Robert D. Patton regarding library photocopying, Curtis G. Benjamin of McGraw-Hill, Inc., refers to a study of mine (*1*) and states that I "found that books and periodicals of all kinds were copied in almost equal proportion." This is true. He then says, "My own unscientific but painfully educated guess is that, of all the photocopying done today *at* (not *by*) all college and university libraries, about 65 percent is of books and 35 percent is of periodicals and technical reports." This is a misleading statement, besides being unscientific. It should be examined in the light of my findings, as follows.

Type of material copied	Number of copies	Percent
Book	33,000	21.5
Periodical	34,409	22.4
Government document	6,579	4.3
Thesis	4,713	3.1
Other published material	5,073	3.3
Miscellaneous	69,683	45.4
Total	153,457	100.0

The sample of 153,457 copies was taken at 37 university and college libraries, from both staff-operated and coin-operated machines, so the results take into account copying both *at* and *by* university and college libraries. It represents more than 1 percent of the annual total of photocopying at and by these libraries, sufficient to guarantee statistical validity. Although all the libraries were located in Canada, I believe that student and faculty requirements are sufficiently similar in our two countries that, if such a study were conducted in the United States, it would yield comparable results.

The category "Other published material" included newspapers, music, and such odds and ends as broadsides and advertisements. The miscellaneous category included for the most part student notes and library reproduction of business forms, catalog cards, and correspondence. On the basis of this evidence, it would be more accurate to say that about a fifth of *all* copying done *at* and *by* college and university libraries is of books.

I was also able to analyze 31,649 book exposures in terms of the imprint date.

Date of publication	Number of exposures
Pre-1899	3,308
1900–1949	3,581
1950–1959	4,746
1960–1964	5,376
1965–1969	10,941
1970–1971	3,697

It is impossible to say how many of the books from which copies were taken were in print. But to be generous, let us assume that every book published before 1960 is now out of print and all thereafter are in print. Then 63 percent of books copied would still be in print. Yet, although book copying is concentrated in the last decade of publishing, this amounted to about 20,000 exposures out of a total of more than 150,000, or about 13 percent.

In the case of Canadian books, I studied the number of pages copied per individual book, by date of imprint. This showed that the copying of long passages and whole books was an exception, unless the books were published before the turn of the century.

Date of publication	Average number of pages copied per book
Pre-1899	55.9
1900–1949	8.3
1950–1959	6.3
1960–1964	10.4
1965–1969	6.6
1970–1971	7.0

Benjamin's argument is that copying of books leads to a decline of sales. Clearly, where libraries are concerned, the copying of up to a dozen pages would be no substitute for the purchase of the whole book. Benjamin says that he does not claim "to have absolute proof" of his thesis, but that he knows "for sure that many large library systems that used to order from two to five copies of a new monograph now order only one copy." He deduces "that the rapid growth of interlibrary loan services, coupled with readily available copying facilities, has been responsible for this change."

I would like to suggest that there are other more important reasons for the decline in the number of copies ordered by libraries. We are ordering fewer copies per title than we did just a few years ago, and the reasons have nothing to do with the copy machine. Our situation is not atypical. First, our enrollment dropped. Class sizes diminished, particularly those of large

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general courses. We needed fewer copies to meet student needs. Second, although our book budget has continued to increase every year, it has not increased enough to offset inflation, and our rate of accession has been virtually cut in half in 4 years. Third, our faculty members are distributing longer reading lists than they have in the recent past, so that student reading is no longer concentrated on a half-dozen texts which we had to buy in multiple copies.

I find it hard to believe that a college or university librarian would consciously purchase only a single copy of a work in the expectation that he would be able to borrow additional copies of the same work from other libraries when he needed them. Interlibrary loan is too slow a process to use for works in demand. Moreover, most libraries will not fill interlibrary loan requests on behalf of undergraduates, who are the principal users of multiple copies.

Benjamin also perceives a threat to the new monograph in the development of library consortia, which he thinks "will arrange to have one copy of a monograph serve the needs of the whole region." Cooperative purchasing has been taking place since the 19th century, and in recent years the decline of library budgets and the increase in costs of materials has lent some impetus to closer cooperation, with or without the fanfare surrounding the recent agreement among a number of eastern U.S. university and public libraries. But the concentration, as stated in Benjamin's quotation (*2*) from the director of the New York Public Library, will be on "expensive sets of volumes . . . or little-used journals." When a new monograph is published, is well reviewed, and is on a subject of interest, it will be in demand, and libraries will not be able to maintain standards of service unless they acquire those monographs. Our library is taking the same approach as many other research libraries in managing its collections budget, which is to stay current at all costs; what is getting cut out of our acquisitions programs is the rare, the expensive, the out-of-print. The publishers who should be concerned are those who flourished in the reprint business during the golden years of the 1960's, when new centers of learning were being founded across the continent and all were trying to catch up with Harvard. The golden years are over, and librarians are having to answer to cost-benefit-minded administrators who want to know why thousands of dollars must be spent on a set of some obscure journal which might be referred to once in 5 years by four scholars at three neighboring universities. I am sure Benjamin, as a businessman and taxpayer, would ask that kind of question too. But as a publisher of monographs of the quality and distinction one has come to expect from his firm, Benjamin's fears on behalf of his product are unrealistic, where photocopying and cooperative purchasing are concerned. But there is no question that the market is changing. Academic planners and demographers tell us to anticipate fewer students; zero population growth does not in the end lead to an ever-expanding educational enterprise.

There has been much speculation about the implications of interlibrary lending for publishing and bookselling, and the continuing debate between librarians and publishers has been plagued with hunches and unsubstantiated hypotheses. It is encouraging to note that one of the provisions of a copyright bill (S.3976) which passed Congress on 19 December calls for the establishment of a National Commission on New Technological Uses of Copyrighted Works. This commission is to be composed of thirteen members: four selected from users of copyrighted works, presumably including libraries; four nongovernmental members selected from the public generally, including at least one "expert in consumer protection affairs"; four selected from authors and other copyright owners, presumably including publishers; and the Librarian of Congress. One of the functions of the commission will be to study and compile data on the reproduction and use of copyrighted works. So, at long last, there is the possibility that there will be sound information which can be used in the framing of legislation and, one hopes, in bringing together those who create and those who disseminate knowledge.

BASIL STUART-STUBBS

Library,
University of British Columbia,
Vancouver, Canada V6T 1W5

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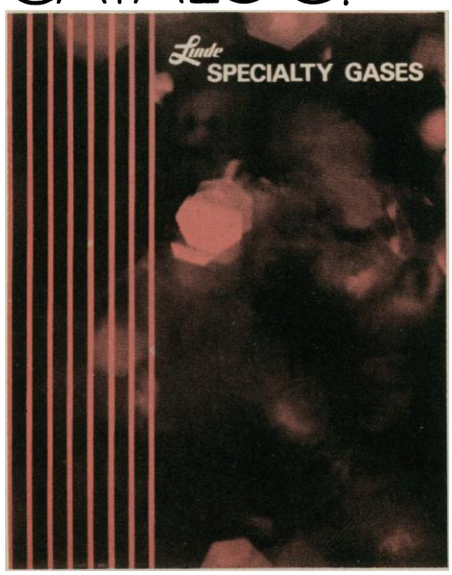

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14 February 1975, Volume 187, Number 4176 **SCIENCE**

Students, Careers, and the Recession

College and university faculties properly are concerned about their responsibilities to their students, to their disciplines and professions, and to the social, economic, and intellectual health of the larger society.

As part of those responsibilities, some faculty members feel they should restrict students from entering programs of study preparatory for careers where prevailing estimates indicate that potential job opportunities are limited and diminishing. Other faculty members feel they should provide students with the best advice available about potential employment opportunities and, having done so, should offer students maximum freedom of choice to pursue the various instructional programs in our institutions of higher education.

I join the latter group for two reasons. First, our record in predicting specialized manpower requirements has been too poor to justify using such prognostications as a basis for preventing men and women from entering careers of their choice. Second, and more importantly, in a free and open society it should not be a responsibility of colleges and universities to police the entry of individuals into various careers.

It should be the responsibility of colleges and universities to make higher education maximally available. That responsibility should include advising students about employment opportunities in different fields. But it should not include denial of the opportunity to pursue a student's chosen area of study. An important but different consideration is that there is an advantage to the broad society in having persons trained in one field work with persons trained in another, for that condition ameliorates the potential isolation of specialized elites.

Since there are practical limits to the number of persons our universities can instruct and the number of programs our universities can offer, restrictions on enrollments in programs are often necessary. Such restrictions should not be based on faculty estimates of future manpower needs. They should be based on the availability of qualified students and faculty, views of the missions of the institution, cost benefits of various programs, and other considerations related to academic affairs and their support.

These two contrasting points of view are not novel. I raise them at this time because the issue is exacerbated during a recession. At present, beyond demographic and other factors, the recession is contributing to (i) a reduction in job opportunities and (ii) a largely unanticipated increase in overall college and university enrollments. Hence the issue is thrown into bolder relief (more students and fewer jobs) and the dilemma will be more pressing each day the recession continues.

Under such conditions, persons of good will must feel it wrong to provide individuals with professional preparation for careers for which few openings are expected to occur. Yet other persons of good will must feel it wrong to deprive individuals of the chance to compete for those few openings by denying them the opportunity to acquire the necessary academic preparation.

In a democracy committed to educational opportunity for all, the balance must lie on the side of keeping the doors of higher education open as wide as possible, consistent with quality instruction. Our young people should have full access to the potential job opportunities, be they few or many. To close certain of those doors as a response to an estimated reduction in specific manpower needs would mean that our colleges and universities were assuming the roles of agents for a controlled society.—ARNOLD B. GROBMAN, *Special Assistant to the President, University of Illinois, Box 4348, Chicago 60680*

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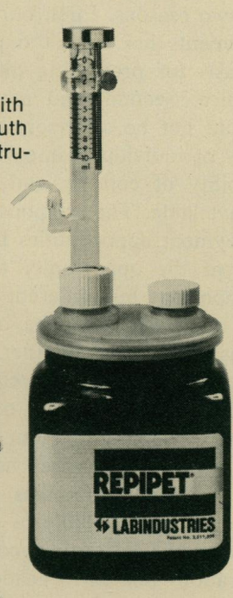

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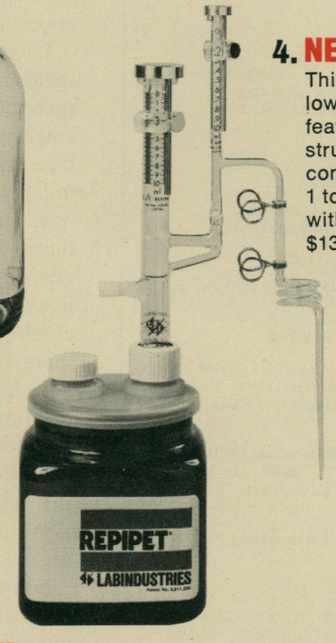

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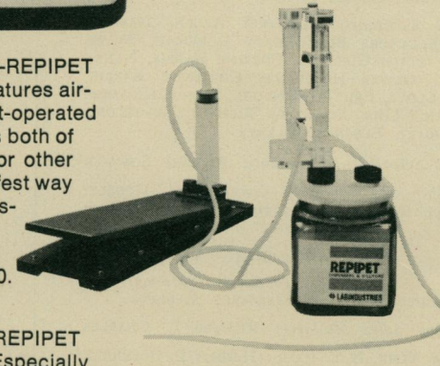

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Liquid Dispensers

Dispensors are now available in 13 new fixed-volume models from 0.1 to 10 milliliters. Adjustable volume models cover 0.04 to 0.8 milliliter, 0.2 to 3 milliliters, and 3 to 10 milliliters. The devices are easy to prime with small amounts of the liquid to be dispensed. The barrels and plungers are factory matched for each instrument. Oxford Laboratories Incorporated. Circle 813.

Incubator

The laboratory incubator is suitable for culturing coliform and other bacteria, yeast, and mold and for microbiological applications in quality control work. The unit features three aluminum shelves and overall dimension of 229 by 208 by 311 millimeters. The shelves are 279 by 140 millimeters. Temperature is indicated by an included thermometer and is thermostatically controlled to a variation of ± 5°C in stable ambients. Operating temperature is adjusted by a panel knob from room ambient to 55°C. Capacity is 37 disposable 47-millimeter petri dishes. Millipore Corporation. Circle 811.

Digital Timers

The LT-20B series of digital timers consists of more than 30 models with a choice of resolution in minutes, seconds, milliseconds, and microseconds. Each model features direct-reading digital displays, which, at ⅜ inch high, are legible up to 15 feet away. Models are available with from two to five digits. Advantages include solid-state circuitry and binary-coded decimal output for printing. Line frequency may be from 50 to 400 hertz for crystal oscillator models (0.005 percent accuracy) and 50 or 60 hertz for standard current models (0.1 percent accuracy). Durgin & Browne, Incorporated. Circle 815.

Photon Counter

The 5C1 photon counting system is designed to measure light from near infrared to ultraviolet wavelengths in a variety of applications. It operates at up to 100 megahertz with 10-nanosecond pulse-pair resolution. It can display, through an oscilloscope, the pulse-height distribution with marker pulses that show discriminator levels. The discriminator levels are selected by a dual-channel pulse-height analyzer that provides first-order pile-up correction at high counting rates and window-mode discrimination of high and low pulses. The 5C1 is thus able to operate within 5 percent of true linearity at counting rates where conventional systems "lose" counts. EG & G/Ortec, Incorporated. Circle 809.

Programmable Pocket Calculator

The HP-55 features simplified keystroke programming with 49 steps of program memory plus branching, testing, and editing capability. It has 20 addressable memories and full register arithmetic may be performed on and with the data in ten of the memories. It has 86 keyboard functions and a digital timer with 100-hour capacity and the ability to store and recall up to ten splits (elapsed time readings within an event). In addition to standard arithmetic, trigonometric, and logarithmic functions, the HP-55 will work in any of three trigonometric modes: degrees, radians, and grads. Statistical applications are possible with the memory registers. A storage register permits correc-

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (see pages 496A and 576C) and placing it in the mailbox. Postage is free.—RICHARD G. SOMMER

tion of an error in arithmetic or number entry in the midst of any calculation. The HP-55 displays up to ten significant digits with a two-digit exponent and appropriate signs. Hewlett-Packard Company. Circle 810.

Magnetic Fluid Design Kit

The K-102 Special Kit provides two low-viscosity ferrofluids that will perform in damping, sealing, lubrication, levitation, and other applications. Each kit includes 30 cubic centimeters of a diester-base 200-gauss and 7 cubic centimeters of a hydrocarbon-base 400-gauss ferrofluid along with magnets, accessories, and detailed instructions. Ferrofluidics Corporation. Circle 819.

Fluorescence Spectrophotometer

The SPF-1000 CS is a corrected instrument that offers quantum efficiencies and corrected phosphorescent spectra. It records corrected excitation and emission spectra in quantum or energy units. It corrects emission spectra for the variable wave-number bandwidth of the emission monochromator. It offers a differential fluorescence mode of operation which continuously subtracts the blank or amplifies small differences in the corrected emission spectra of two related compounds. When a polarizer accessory is used, it automatically corrects polarization data for artifacts of the grating. The SPF-1000 CS will record spectra on an X-Y recorder with wavelength and wave-number units on the X-axis. American Instrument Company. Circle 812.

Inkless Chart Recorder

The Speed Servo II recorder thermally brands analog data from 4, 6, 8, 12, or 24 channels on a 10-inch calibrated heat-sensitive chart. Data format is programmable as a dot with channel number, a series of dots, or a combination of both. Data are easily readable at chart speeds as slow as ¼ inch per hour. A universal input panel accepts millivolt/volt or thermocouple inputs. Options include channel print/skip switches, dual range control, alarms, and time or data identification number recording. Full-scale response is as rapid as 1 second per point and accuracy is ± 0.25 percent of span or ± 5 microvolts. Four chart drives are avail-

able, including a stepper motor drive with fixed and variable speed control from ¼ inch per hour to 1 inch per minute. Esterline Angus Instrument Corporation. Circle 814.

Video Disk Recording System

The model 80-0002 features high-resolution and the ability to stop and hold a single picture indefinitely. The heart of this modular system is a 12-inch magnetic, coated aluminum disk that revolves at 3600 revolutions per minute and records up to 60 images per second. With adequate light, the camera can be used with its own variable shutter to photograph fast-moving objects. Where more light is required, the unit may be operated with a high-frequency strobe light for stopping moving objects. Pictures may be stopped at any point during playback. Up to 1 hour of information may be stored and played back at variable speeds or in stopped-action. Redlake Corporation. Circle 820.

Cartridge Tape System

DataPacer can read or write on tape at speeds of 30 inches per second with a transfer rate of 48,000 bits per second. It comes complete with single cable, single card interfacing, and DEC-compatible software. For file operations it is bidirectional with 90-inch-per-second speed for rewinding and searching. It can store 2.8 million bytes on up to four selectable tracks per cartridge module. Up to three modules fit across a 19-inch rack. There are switch panels below each transport module for track selection, on-line or local selection, and off-line rewind. Tape position indicators show mode and position of each module at any time. Tennecomp Systems, Incorporated. Circle 817.

Scanning Polarograph

The Digi-Scan analyzer features a peak-capture capability which displays maximum current on a digital readout. Visual scanning eliminates meter reading. Applications include rapid repetitive analysis of metals and organic compounds such as detecting formaldehyde in air, acetaldehyde in acetic acid, corrosion inhibitors in generator-cooling water, iodides and bromates in aqueous systems, and others. Sensitivity is in

parts per million for many applications. The device is simple to operate; a single switch initiates a scan. The unit is compact and weighs less than 10 pounds. Heath International, Instrument Division. Circle 816.

Holography System

H-LAB-1 is a self-contained holocamera with an integral helium-neon laser and reconstruction system. It weighs less than 60 pounds and will take reflection holograms of objects up to 60 cubic inches. Also included are all required reflecting mirrors, diverging optics, beam splitters, shutters, variable density filters, and plate holders. External controls allow adjustment of laser intensity, the reconstruction device, and the shutter. Panel lamps indicate the status of the laser source, alignment, shutter, and reconstruction system. Apollo Lasers. Circle 818.

Literature

Liquid Chromatograph Model 80-500 is described in a four-page bulletin that includes accessories, design specifications, and suggested experiments. Gow-Mac Instrument Company. Circle 821.

An Introduction to Time and Frequency Domain Modulation and Waveform Analysis deals with the superheterodyne spectrum analyzer and its uses. Tektronix, Incorporated. Circle 822.

Hi-Low Temperature and Temperature Humidity Test Chambers are compared and illustrated in a product bulletin. Tenney Engineering, Incorporated. Circle 832.

Biology Equipment for Classroom and Laboratory is devoted to aquariums and caging equipment for studies of marine and terrestrial animals and plants. Jewel Industries, Incorporated. Circle 823.

Index to Scientific Reviews will identify more than 20,000 review articles from over 2,700 scientific journals each year. Institute for Scientific Information. Circle 824.

Model 1230 Test System for Fracture Mechanics Studies is a six-page brochure that illustrates a system for materials investigations. Instron Corporation. Circle 825.

How to Buy an Atomic Absorption Spectrophotometer details features and relative advantages for systems for various applications. Instrumentation Laboratory, Incorporated. Circle 826.

Biochemicals for Scientific Research —Master Catalog II lists more than 4000 products with emphasis on those for life science studies. Research Plus Laboratories. Circle 827.

1550 Series Broadcast Color Film Camera is an eight-page brochure devoted to a color television camera and optical multiplexer system. Cohu, Electronics Division. Circle 828.

Quartz Multicomponent Measuring Platform measures forces exerted by a subject's feet in three orthogonal directions. Kristal Instrument Corporation. Circle 829.

Polarizing Mounts and Optics describes components and features a technical introduction to the polarization phenomenon. Oriel Corporation of America. Circle 830.

Universal Versaplot Software is a six-page pamphlet about a FORTRAN electrostatic plotting software package designed for virtually any computer, operating system, or plotting application. Versatec. Circle 831.

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