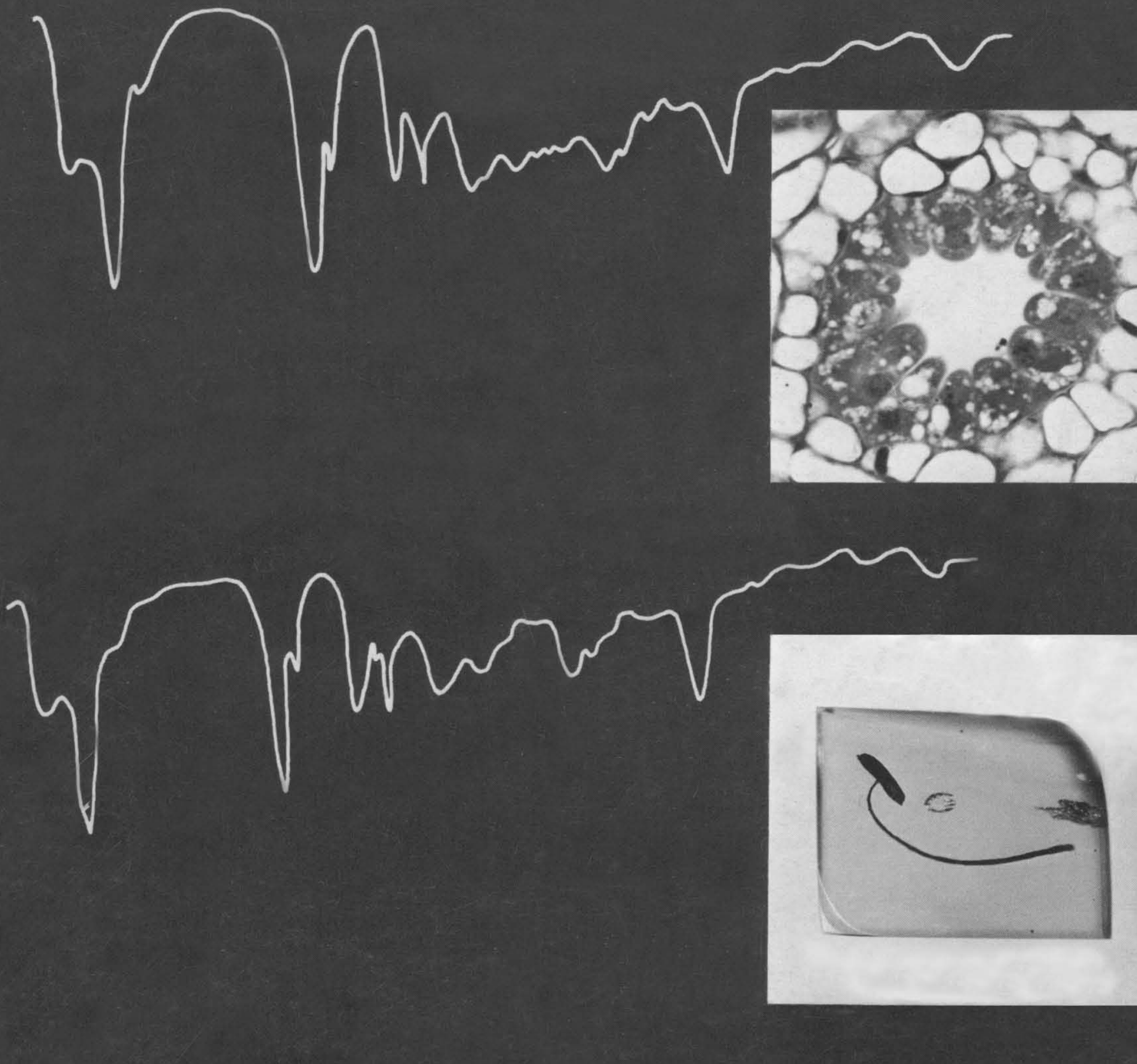
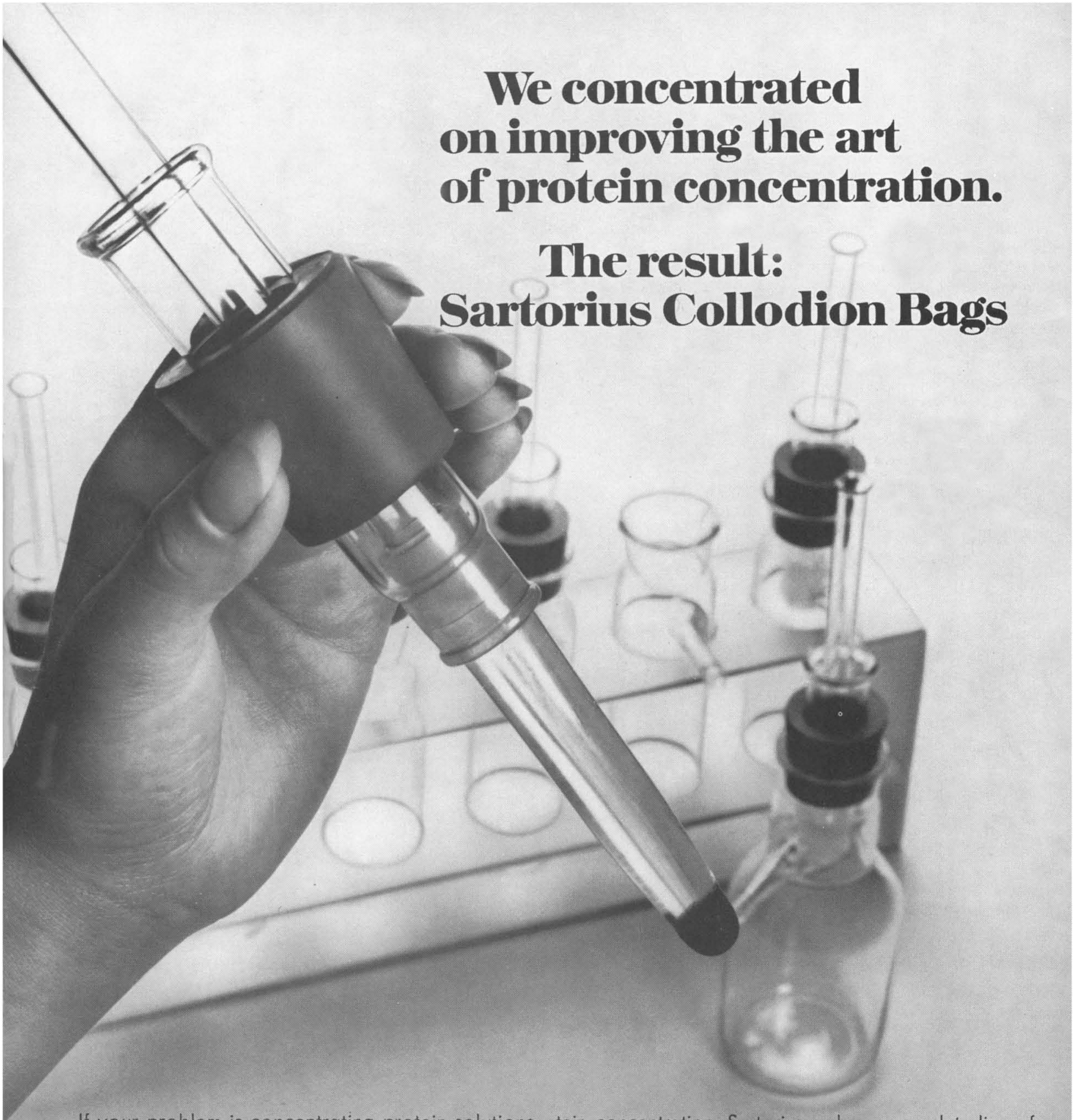
SCIENCE

14 March 1969
Vol. 163, No. 3872

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





We concentrated on improving the art of protein concentration.

The result: Sartorius Collodion Bags

If your problem is concentrating protein solutions quickly and efficiently, Sartorius Collodion Bags and accessories are something you really should look into.

Sartorius Collodion Bags are made of pure nitrocellulose and are tapered to facilitate protein collection. Their extremely fine pore structure retains any compounds with molecular weights over 30,000. Thus, a 5 ml. sample of body fluid can be reduced under vacuum to 0.02 ml. of concentrate in just two hours. An additional important advantage of these bags is that they need not be discarded after one-time use. Cleaned carefully and kept moist, Sartorius Collodion Bags may be re-used up to five times. To mount these bags for protein concentration, Sartorius makes a complete line of bag holders with ground-glass joints, flat and round bottom suction flasks, and racks made of PVC.

Sartorius Collodion Bags are just one of many different types of membrane filters and related apparatus made by Sartorius to meet virtually every laboratory need. All are fully described in our new Membrane Filtration Catalog. For your free copy, write: Sartorius Filter Division, Brinkmann Instruments, Cantiague Road, Westbury, N.Y. 11590.

sartorius membrane filters

A DIVISION OF BRINKMANN

In hope of doing each other some good

Filters for the infrared

A small manufacturing operation in Rochester, N.Y. known from the trademark "Kodak" produces various kinds of filters for the infrared region of the electromagnetic spectrum. Though the trademark is generally associated with photography, these filters have little to do with photography. Direct photographic sensitivity ceases above 1.2μ in wavelength, whereas the booklet "Special Filters from Kodak for Technical Applications" describes mostly filters that start transmitting at this point or longer wavelengths.

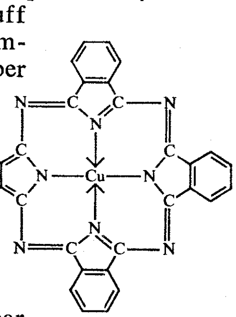
Several of the polycrystalline KODAK IRTRAN Infrared Optical Materials make excellent substrates for interference filters to shape spectral distribution of infrared energy. That's one reason for us to be in the filter business. Another reason is to lend a hand in meeting filter requirements that companies bigger in the business may be too busy to fill.

The booklet also gives curves for our "hot mirrors" (filters that transmit in the visible and reflect in the near infrared), "cold mirrors" (vice versa, often used behind a light source in a projection system), filters on AgCl substrate (strange, soft stuff) that open up at a choice of wavelengths from 1 to 6μ and remain open to 30μ (not interference filters), filters with conductive coatings, and interference filters on substrates other than Irtran materials.

Request Pamphlet U-73 from Special Products Sales, Kodak Apparatus Division, Eastman Kodak Company, Rochester, N.Y. 14650.

Rings of rings

On the morning of November 25, 1935, the New York *Times* reported somewhat belatedly the discovery of the first new blue pigment in a century. Though the report gave it only a commercial dyestuff name, the compound was copper phthalocyanine:



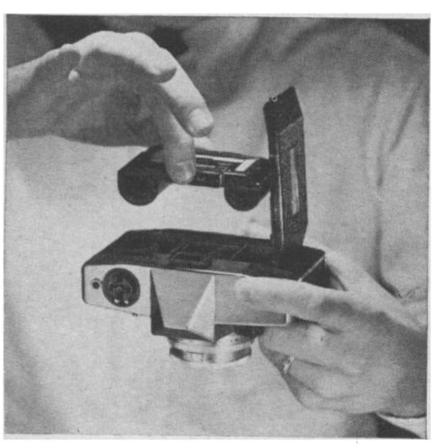
It is now clear that several hundred thousand additional phthalocyanine compounds can be synthesized if wanted. A whole book could be written on the subject and has been.* Study of the same compound that the *Times* announced as a dyestuff gives insight into mechanisms common to semiconductors and the cytochrome respiratory enzymes. Nickel phthalocyanine gets into quite a different field of inquiry by catalyzing the air oxidation of saturated fatty acid esters, which are not particularly prone to oxidation. Phthalocyanines are semiconductive, photoconductive, photosensitizing, fluorescent. They make good chemical jigs in which to hold metals for neutron irradiation. Inks that ushered in good full-color printing depend on them.

Phthalocyanines do not occur in nature, but more complex elaborations of its ring-of-rings structure do. The hemin that makes us red-blooded is such a structure, and so is the green chlorophyll that lets light support life. With an earlier view of magic, Merlin would have loved to get his hands on this blood-related stuff. With iron phthalocyanine he could have catalyzed the oxidation of Luminol (EASTMAN 3606) to give a crimson glow clearly visible in broad daylight without having to withdraw to a cave.

The nearly 6,000 EASTMAN *Organic Chemicals for laboratory use might all be phthalocyanines and still give no assurance of serving all interests. We therefore officially list only a modest number of "non-commercial" ones, offer on a tentative basis a dozen or so additional phthalocyanines and the related octaphenylporphyrazines, and invite expressions of need for any of the other hundreds of thousands. Address Eastman Kodak Company, Eastman Organic Chemicals, Rochester, N.Y. 14650.*

*"Phthalocyanine Compounds", by Moser and Thomas, Reinhold, New York, 1963.

Observant, quick, clever, obedient

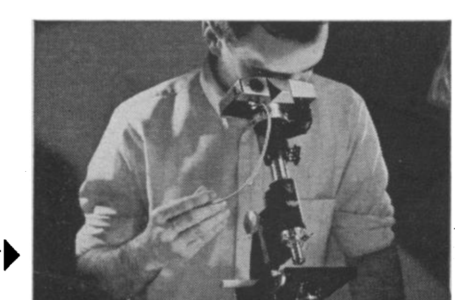


You can get a new KODAK INSTAMATIC® Reflex Camera body for less than $158.*

Less than $158! Incorporates interesting exposure control system to which you may not have been exposed. Leaves it to you to select aperture. You may wish to do so on depth-of-field basis. Since this is a single-lens reflex, preview on field-lens-brightened ground glass can guide you.

When picture is wanted, press button to open shutter. Will close by itself when enough light has hit film. Bases *its* decision on film speed information conveyed by notch on 126 "drop-in" cartridge. Principle: capacitor fed through photoresistive cell attains limiting charge. This may take 1/217 sec or 9.1 sec, or any other exposure time >.002 sec and <20 sec, *depending on light when picture is actually being taken.* If, however, it appears in advance that exposure will be longer than 1/30 sec, signal in viewfinder warns master to open lens more or rest camera on firm support.

This is a clever camera. Even has button to check battery condition. Camera shop will be pleased to point out other noteworthy features. Do not expect salesman to remind you that photography can also be done with a pinhole and home-made emulsion hand-coated on window glass.



*Less than $200 with 45mm $f/2.8$ Xenar Lens. Needn't get lens if you already have one from a RETINA Reflex Camera. Or if KODAK INSTAMATIC Reflex Microscope Adapter wanted instead of lens. For less closeup than microscopy, other accessories available. Prices subject to change without notice.

EASTMAN KODAK COMPANY An equal-opportunity employer

14 March 1969
Vol. 163, No. 3872

SCIENCE

SCIENCE is published weekly on Friday and on the fourth Tuesday in September by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with **The Scientific Monthly**®. Second-class postage paid at Washington, D.C. Annual subscriptions $12; foreign postage: Americas $3; overseas $5; single copies, 50¢ (back issues, $1) except **Guide to Scientific Instruments**, which is $2. School year subscriptions: 9 months, $9; 10 months, $10. Provide 4 weeks notice for change of address, giving new and old address and zip codes. Send a recent address label. SCIENCE is indexed in the **Reader's Guide to Periodical Literature.**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

(Top) Infrared spectrum of resin from *Hymenaea courbaril*, tropical leguminous tree. Inset is a secretory pocket from the medullary tissues of the petiole, showing the typical epithelial cells which secrete the resin in the young plant. (Bottom) Spectrum from Miocene amber, Pará, Brazil, shows the similarity of the spectra from this amber and resin from extant *Hymenaea*. Inset is amber from Chiapas, Mexico; it is also thought to be derived from *Hymenaea*, with an included stamen (about × 3). See page 1157. [Photography by Alan Donaldson and layout by Robert L. Page, University of Cali-

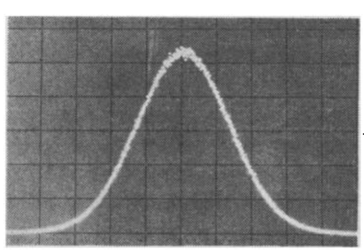
Tame complex scientific data...
produce useful information directly

How to See Through 1000 Windows at a Time

Since the early days of the Manhattan Project, the study of nuclear phenomena has been on a steep rise. Not surprisingly, this started a train of responses by the instrumentation industry to answer the need of research scientists for analytical data about radiation. Of most service have been instruments to measure the gamma radiation that originates in the unstable nuclei of radioactive isotopes as they decay to stable states.

It's not really difficult, with today's more sophisticated electronic instrumentation to measure accurately the energy of a discrete gamma ray and the time of its occurrence. But that's only a small part of the information that the nuclear scientist needs to know. Usually the radiation 'signature' that identifies a material consists of a variety of gamma rays at characteristic energy levels, and it's precisely the knowledge of this *variety*—or spectrum—that interests the scientist.

Initially the nuclear scientist measured the gamma spectrum by looking at voltage pulses derived from the overall radiation through a series of energy "windows", one window at a time. He built the "frame" for each window using a high and a low voltage discriminator, each with adjustable threshold, thus being able to look only at pulses whose peak value fell between the two levels. Since an adequate measure of the gamma spectrum may require that the scientist look at it through more than a thousand different windows, this one-at-a-time procedure is often inadequate. Not only is it laborious, it is also so slow as to be useless where the decay rate (half-life) is very short.



Probability density display of Gaussian noise

Enter the multichannel analyzer (MCA), newest of which is the H-P 5400A. The MCA looks at gamma radiation through as many as 1024 windows, *simultaneously* sorting the pulses into as many amplitude groups. It counts and totalizes the pulses in each group and stores the results in memory for live or static display on the built-in cathode ray tube, for readout on a paper record or for input to a computer.

Speed, the essential characteristic of an MCA, reaches its peak in the 5400A. Employing a new analog-to-digital converter with a clock rate of 100 MHz, the 5400A sorts and digitizes input signals into one of 1024 categories in no more than 13 microseconds.

In its present state of refinement, the 5400A MCA has not only met the nuclear scientist's need for a gamma spectrum analyzer, but has also attracted the attention of analytical scientists in other disciplines. Biochemists for example have used it as a multichannel scaler to accumulate time/rate curves of activity for uptake/clearance studies in nuclear medicine. Design engineers have performed probability density analysis of continuous input signals with the 5400A to isolate signal and noise characteristics. Other solutions of complex measurement problems are described in the March 1968 issue of the *Hewlett-Packard Journal,* yours on request.

Designing for the Electronics-Shy Analyst

Natural strangers to the complex world of electronics, chemists and other analysts have long since been trapped in it because of their seemingly insatiable appetite for analytical instruments that are essentially electronic creations. Both readily admit the impossibility of doing their analytical work at today's speed and accuracy standards without electronics. But upon introspection they also acknowledge a deep yearning somehow to exclude the whole complicated world of transistors, diodes and integrated circuits from their laboratories.

Yet exactly the reverse is happening: as the scientist uses more and more instruments in his quest for analytical speed, he produces greater and greater quantities of analog chart recordings, each of which he must laboriously interpret if he is to decode its analytical message. Bogged down in this task, the analyst once again has had to turn to the electronic designer . . . this time for a device which automatically interprets the *analog* output of such analytical instruments as the ubiquitous gas chromatograph, and translates it into *digital* data, the stuff of which quantitative analysis is made.

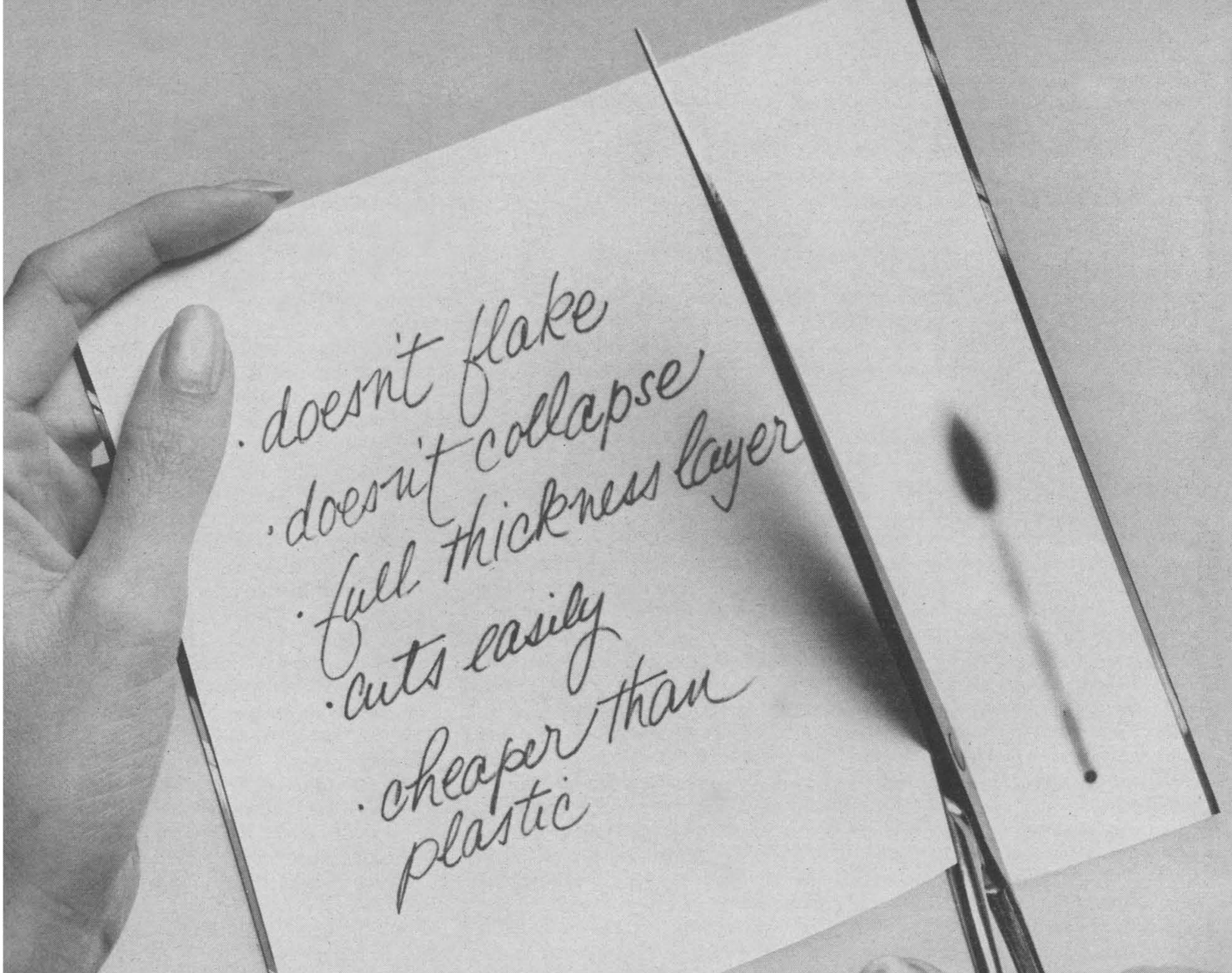
The device which does this job best—the digital integrator—employs even more complex electronic circuits than does the gas chromatograph. And it requires frequent adjustments of a dozen or more programming controls, each somewhat mysterious to the electronics-shy analyst.

For many, this is the last straw. Consequently they have refused to admit into their laboratories the one electronic device that, ironically, can do more than any other to speed their analyses and simplify their routine.

Aware of this problem in human engineering, a team of H-P chemists and electronic engineers together have recently completed the design of an integrator that can be programmed for an almost unlimited variety of analytical conditions just by pushing buttons. No longer must the recalcitrant analyst make the difficult choice of plunging into the strange world of integrator programming, or living in a world bereft of the benefits of digital integrators. The H-P 3370A lets him have the best of both worlds.

For electronics-shy chemists and other scientists who want to know how this was accomplished, we offer a new Bulletin 3370A, on request.

EM-Reagents are products of E. Merck A.G., Darmstadt, West Germany



Need any other good reasons to try new EM aluminum-backed TLC sheets?

In terms of cost, versatility and convenience, these new aluminum-backed silica gel, aluminum oxide, cellulose and polyamide-layered TLC sheets are nothing short of revolutionary.

Not only do they cost less than any other pre-coated system, but they are completely adaptable to your own particular needs. You can bend them into any shape you wish, cut them to any size you require, even punch them for easy filing. To develop, just stand them in a tank (they require no special support and will not collapse). These sheets also have a thick, abrasion-resistant layer that will not flake, permitting stacking and compact packaging.

Need more good reasons? Consider these: You can use EM aluminum-backed TLC sheets with almost all popular solvents (except aqueous solutions). They may even be sprayed with aggressive reagents, such as sulfuric acid.

Cost-wise, our popular 20 x 20 cm sheets coated with a 250 μ layer of silica gel are less than 60 cents each in quantity.

Doesn't this sound like the kind of TLC sheet you've always hoped for? If it does, we'd be happy to send you a free sample (and our catalog).

Just write: EM–Reagents Division, Brinkmann Instruments, Cantiague Road, Westbury, N.Y. 11590.

A DIVISION OF BRINKMANN

14 March 1969, Volume 163, Number 3872

SCIENCE

Toward a Public Policy for Graduate Education in the Sciences

The first Annual Report of the National Science Board under the Daddario bill* sets the goal that the federal government should accept a significant, and perhaps major, share of the total support of graduate education, not by indirect subvention but by intention. The report urges a six-part coordinated system of federal funding, including (i) substantial institutional sustaining grants and a restricted program of prestige fellowships under a single unnamed agency; (ii) developmental, departmental, and graduate facilities programs administered by several agencies; and (iii) continued multiagency support of individual research projects. Implicit is the general applicability of this policy for the arts and humanities. Such a major restructuring of the federal granting system will be challenged by scientists, spurned by bureaucrats, and welcomed by university administrators. It merits more thoughtful examination by all.

There is urgent need for wise planning of this fastest-growing and most costly segment of American higher education, in order to instill quality and assure just opportunity for all, in all regions. The report makes recommendations to educational institutions, to state and regional planning groups, and to the federal government: that the government should supplement, not replace, nonfederal funding; that the institutions should be entrusted with building the quality of education; and that each metropolitan area with population over 500,000 should have graduate-education resources. The almost exponential growth of graduate education affords a unique opportunity to redress the inequitable distribution of federal funds and to foster the growth of new centers of excellence in needed areas, both urban and regional. The responsibilities must be shared by the institutions, the state and regional planning groups, and the federal government. Federal support must be incremental, not just redistributive, and it must be provided in the name of graduate education, not just in that of research and development.

The cost of quality is high. Institutions moving into graduate work are warned to build only on existing strength. Enrichment of the master's degree and development of multidisciplinary graduate programs are urged. A companion volume† analyzes the characteristics of graduate education and the correlates of quality, as well as the maze of present financial support. Unless drastic measures are taken, one-third of the output of Ph.D.'s in 1980 will be from institutions that fail to meet minimum standards. The remedy is not indiscriminate proliferation of graduate centers but selective expansion of those with existing strengths and the creation in some metropolitan areas of new institutions of high quality.

The choice is not easy, but it is upon us. The current hearings on the Miller Bill, the recent cutbacks in research funding, and the unease of the Congress about geographical maldistribution will force an early change in the patterns of federal funding. Personal perquisites and institutional rivalries must be subordinated in a search for a long-range national policy for graduate education. The National Science Board Report points the way.—FRANK W. PUTNAM, *Division of Biological Sciences, Indiana University, Bloomington*

* Public Law 90-407. The report is entitled *Toward a Public Policy for Graduate Education in the Sciences* (Government Printing Office, Washington, D.C., 1969; 40¢).
† *Graduate Education: Parameters for Public Policy* (National Science Board Report) (Government Printing Office, Washington, D.C., 1969; $1.25).

Calendar of Events — Courses

Integrated Circuits Institute, Tucson, Ariz.; will be offered at two different times: 7–18 July and 28 July–8 August. Will provide the participant with an understanding of the design and fabrication of integrated circuits. In addition to the fabrication of actual circuits, device theory will be reviewed and engineering design compromises will be considered. It will be an intensive 80-hour program with an emphasis on practical experiences. Lectures explaining the theory will be interwoven with the laboratory experiences, and technology-imposed limitations will be pointed out. Component and device parameters will be related to processing steps during the lectures, and engineering trade offs will be explained. All participants will perform the processing steps including mask fabrication, photoengraving, wafer preparation, diffusion, oxidation, metallization, wafer scribing, die and wire bonding, and circuit testing. The enrollment fee for each Institute is $1000. (Dr. Roy H. Mattson, Electrical Engineering Department, University of Arizona, Tucson 85721)

Current Methods of Immunological Research and Diagnosis, Buffalo, N.Y., 21 July–8 August. It will consist of practical laboratory exercises supplemented by demonstrations, lectures, and discussions, designed to provide the participant with a survey of presently available methodology and insight into the underlying immunological principles. The topics will include antigen preparation methods, gel diffusion precipitation, passive agglutination, immunofluorescence, mixed agglutination, complement levels, complement fixation, localized hemolysis in gel, blood group determination and compatibility testing, immediate hypersensitivity, delayed hypersensitivity, transplantation, and tissue typing. Attendance will be limited to 20 participants. Limited fellowship support can be provided to applicants with financial need. Tuition is $300. (Professor N. R. Rose, Center for Immunology, Room 321, Sherman Hall, State University of New York at Buffalo 14214)

Subcellular Particulates: Medical and Biochemical Applications, Indianapolis, Ind., 16–19 June. Is intended for medical research workers, chemists, and biologists. The basic goal is to survey normal, pathological, and experimental organelle systems amenable to subcellular fractionation technology. Major problems of interest to the pathologist will be brought to the attention of other research workers. Efforts will be made to present the latest developments in methods of organelle separation and characterization which are applicable to the study of such problems in pathology. Latest techniques in subcellular isolation methodology will be demonstrated including differential, density gradient, and zonal centrifugation. Other techniques will include foam fractionation, filtration, and flotation methods. Subcellular procedures, including virus isolation, will be presented for brain, heart, kidney, liver, and culture cells. Nuclei, endothelial cells, mitochondria, mitochondrial subparticles, myelin, microsomes, ribosomes, lipofuscin, and virus particles will be emphasized, but other particles also will be considered. Emphasis will be placed on the isolation, electron and phase microscopic identification, lipid composition, and biochemical characterization of particulates from normal and pathological tissue. Registration fee: $100. (Dr. A. N. Siakotos, Department of Pathology, Indiana University Medical Center, Indianapolis 46202)

Microbes as Models for the Investigation of Biological Problems, Jerusalem, Israel, 27 April–16 May. The primary purpose of the course is to acquaint participants with techniques and concepts involved in the use of bacteria and bacteriophage as tools for the investigation of biological problems at the molecular level. Particular emphasis will be placed on the genetic approach to these problems. Attendance will be limited to 20 postgraduate students in mathematics, physics, chemistry, or biology. The course will be conducted in English. Each student will receive a sum of IL. 500 to cover living expenses. A limited number of travel grants will be available. Application deadline: *27 March.* (Professor M. Shilo, Institute for Microbiology, Hebrew University–Hadassah Medical School, P.O. Box 1172, Jerusalem, Israel)

Theoretical Physics, Waltham, Mass., 16 June–25 July. Lectures and seminars will be devoted to atomic physics and applications to astrophysics. (The Secretary, Physics Summer Institute, Brandeis University, Waltham, Mass. 02154)

Computer Applications in Chemistry, DeKalb, Ill., 4 June. An all-day workshop consisting of an introductory lecture, programming experience, numerical methods and applications. The fee is $30 plus registration at the Great Lakes Regional Meeting, American Chemical Society. Deadline: *8 May.* (Great Lakes Regional Meeting, Department of Chemistry, Northern Illinois University, DeKalb 60115)

Research Instrumentation, Brooklyn, N.Y., 19 July–9 August. The course is open to industrial and academic scientists and engineers from all disciplines. Medical research workers will find it valuable and are also invited to apply. It is intended for those who need a working knowledge of electronic instrumentation as applied to problems in research. There are no specific prerequisites beyond a basic understanding of college physics. The course will be supported in part by the National Science Foundation under its College Teacher Programs. Twenty-four college teachers from the United States will attend the course free of charge, and will receive a stipend from NSF for 3 weeks plus travel allowance. Applicants from business and industry will be accepted on a tuition-paying basis at $500, covering all laboratory fees, textbooks, and special notes. Applicants should secure a place in the course as soon as possible. *The final date for consideration of applications for NSF support is 1 April.* Industrial participants must file application by 1 June. (Professor Kenneth Jolls, Office of Special Programs, Polytechnic Institute of Brooklyn, 333 Jay St., Brooklyn, N.Y. 11201)