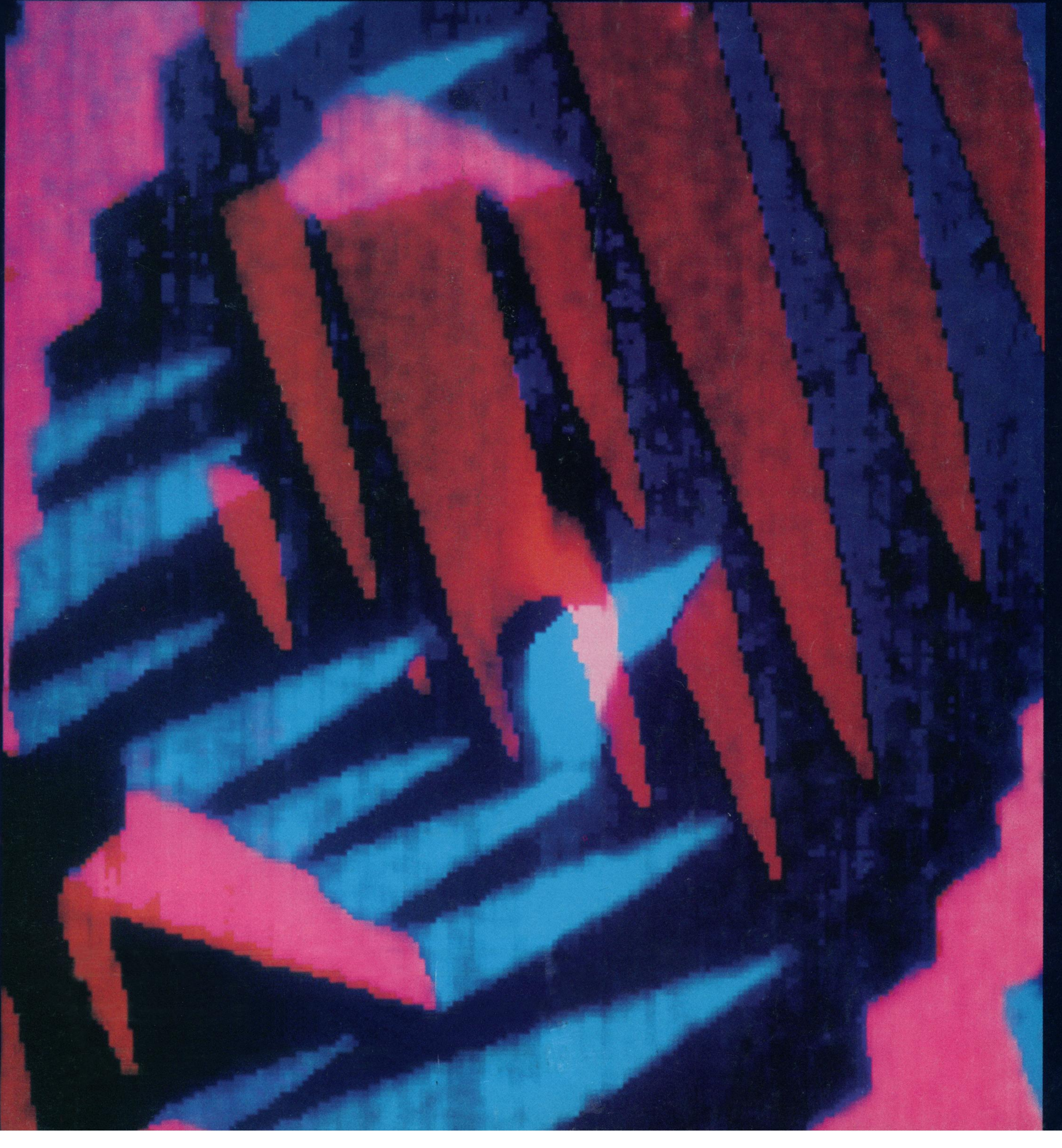
American
Association for the
Advancement of
Science

Science

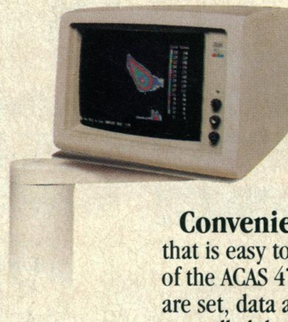
strumentation & Surface Scienc

17 October 1986 $2.50
Vol. 234 ■ Pages 249–400



For cells in culture

Discover the Power of the ACAS™ 470



Controlled Laser Illumination

with the ACAS 470 (Anchored Cell Analysis and Sorting) brings new light to discovery in cell biology. Focus the laser beam where you want it for

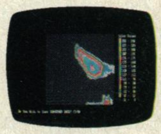
- fluorescence excitation
- photobleaching
- photoactivation
- cell surgery
- cell ablation

without disturbing the extracellular environment and attachment of cells.

Now you can use fluorescence to quantitatively measure

- orientation and localization of cellular components
- cell-cell interactions
- fluorescence redistribution after photobleaching (FRAP)
- cell subpopulations

and much more.



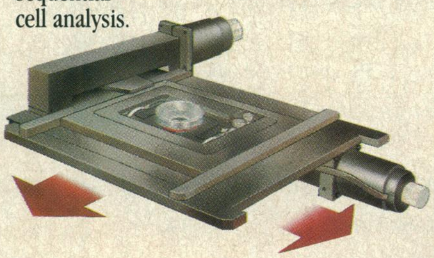
Isolate cells for propagation or analysis

Convenient Software

that is easy to learn and to use is the heart of the ACAS 470. Experimental parameters are set, data are accessed and the stage is controlled through an alphanumeric keyboard or hand-held mouse. The CRT screen displays collected data, results, menus and prompts for greater user interaction.

Computer-Controlled Stage Movement

allows precise and automatic targeting of the laser beam. Stage speed provides for rapid sorting of cell monolayers in culture. Stage coordinates can be used for repositioning with the high accuracy necessary for automated sequential cell analysis.



By integrating computer-controlled laser illumination and stage movement, the ACAS 470 lets you explore new frontiers in cell research. Now you can automatically isolate

- subpopulations of cells
- mutant cells
- transfected cells

for propagation or analysis.

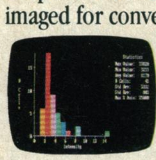
Circle No. 229 on Readers' Service Card

Cell Sorting of anchorage-dependent cells is now possible with the ACAS 470. Selective sorting is achieved by destroying unwanted cells via the laser beam, or by physical separation through a unique cookie-cutter selection method. In this way, homogeneous cell progeny can be obtained from a heterogeneous cell population.

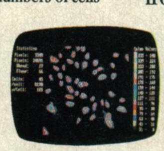
Study cell-cell interactions

Quantitative Fluorescence Analysis

is optimized with the ACAS 470. Cells are imaged for convenient manual or automated interaction. For fluorescence analysis, the ACAS 470 sequentially exposes only small areas of a cell to brief laser pulses. The resulting fluorescence represents emitted light from targeted fluorescent molecules, giving three-dimensional information.



Perform quantitative fluorescence analysis on large numbers of cells



Analyze fluorescent images

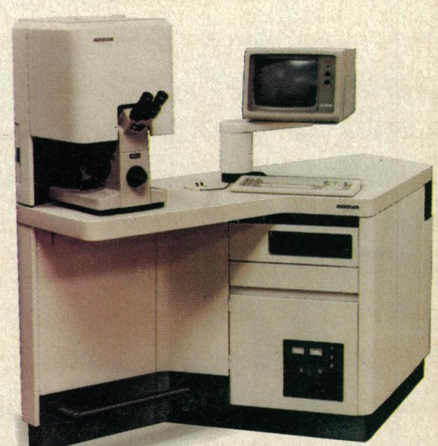
Are you considering instrumentation for CELL SORTING? FLUORESCENCE ANALYSIS?

TALK WITH US! Only the ACAS 470 brings the methods of cell sorting *and* analysis to cells in culture. Call collect, **(517) 349-7200,** for more information.

MERIDIAN™

Bringing Analytical Power to the Cell in Culture

Meridian Instruments, Inc.
2310 Science Parkway
Okemos, Michigan 48864



AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

ISSN 0036-8075
17 OCTOBER 1986
VOLUME 234
NUMBER 4774

■ **SCIENCE is published weekly on Friday, except the last week in December, and with an extra issue in May by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005.** Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Now combined with **The Scientific Monthly®** Domestic individual membership and subscription (51 issues): $65. Domestic institutional subscription (51 issues): $98. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $65. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $4 ($4.50 by mail); Biotechnology issue, $5.50 ($6 by mail); classroom rates on request; Guide to Biotechnology Products and Instruments $16 ($17 by mail). **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. The identification code for *Science* is 0036-8075/83 $1 + .10. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

■ 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 foster scientific freedom and responsibility, 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.

COVER The magnetic domains on the surface of an Fe–3% Si crystal as observed using the technique of scanning electron microscopy with polarization analysis. The four colors indicate four possible domain orientations corresponding to the four in-plane, easy axes of magnetization of the cubic lattice. See page 333. [Photograph by R. Freemire and B. Young, National Bureau of Standards, Gaithersburg, MD 20899]

Reports

Technical Comments

AAAS Meetings

Book Reviews

Products & Materials

This Week in SCIENCE

Surface corrosion

In the electronics industry, materials are chosen for their electronic, magnetic, and optical properties; they can falter or fail if they corrode (page 340). Like cars and bridges, electronic components can be damaged by humidity, temperature shifts, gases, and contaminating particulate materials. Even sealed surfaces are vulnerable if contaminants are sealed into the hermetic environment. Comizzoli *et al.* discuss how some corrosive processes can, under controlled circumstances, produce positive outcomes, and how scientists and engineers now face the challenge of creating contaminant-free manufacturing environments. Five other articles in this special issue address the diverse attributes of surfaces (cover) and the instruments being used to study them (pages 304–345). Abelson provides an overview of the new methods of observing atoms and electrons on surfaces, discussing how this "new phase of matter," the surface, is taking on increasing importance in electronics and other industries in which miniaturization has greatly increased the surface to bulk ratio (page 257).

Predicted structure of interleukin-2

Much can be learned about the function of a protein from an understanding of its structure (page 349). Cohen *et al.* describe a computer-assisted method for predicting the tertiary structure of interleukin-2 (IL-2) from primary sequence data and derived secondary structures. A combinatorial approach was used, and 3.9×10^4 possible structures for IL-2 were generated, but only 27 of these led to plausible tertiary structures that would satisfy the steric constraints, retain the connectivity of the chain, and accommodate a known disulfide bridge in the protein. Features of the molecular model fit nicely with other structure data. The final proof of this (or some other) predicted structure awaits x-ray crystallographic analysis; meanwhile, the predictions permit testing of the model and construction of analogs for experimental and clinical studies of this important cellular growth factor.

Interferon signals

Interferons, which have antiviral, antitumor, and immunoregulatory effects, very rapidly produce biochemical changes in cell membranes (page 355). Yap *et al.* report that when α and β interferons interact with their receptors, there is a rapid (within 15 to 30 seconds) and transient (returning to basal levels by 60 seconds) increase in membrane-associated diacylglycerol and inositol phosphates. Diacylglycerol increases two- or threefold dose-responsively (the phosphates less) depending on the number of interferon receptors present; the rise can be inhibited with antibody to the interferon molecule. Along with this increase, the cells lose their ability to support viral replication. Other substances, such as insulin and thrombin, also use diacylglycerol and inositol phosphates as signaling intermediates, but what makes each signal distinctive, causing particular cellular effects, remains to be determined. The subsequent messengers, yet to be identified, may bind with different kinetics to internal receptors or may activate different internal biochemical pathways.

Tracing nerves

There is now a technique for tracing the direction of normal transmission from the cell body of a nerve out through its projections (page 358). Sugiura *et al.* used a plant lectin (*Phaseolus vulgaris* leukoagglutinin) and antibody to it for tracking unmyelinated (C) fibers that originate in the skin and terminate in the central nervous system; these very thin fibers which, unlike myelinated fibers, had not previously been visualized, are the most numerous primary sensory fibers of vertebrates. Responses of individual fibers to painful and gentle mechanical stimuli and to temperature changes were first determined; then the marker was microinjected into the cell body from which it slowly (at a rate of about 2 to 3 millimeters per day) traveled along the fiber to the central nervous system. Each of four major categories of fibers identified ended in a distinct region in the spinal cord where the processing of sensory information apparently takes place. This technologic advance should contribute to a better understanding of vertebrate sensory neural arrangements associated with pain and other bodily sensations.

Little Ice Age

Data recovered in cores of ice from the Quelccaya ice cap (14° south) in the Peruvian Andes support the notion that the Little Ice Age (described in Europe and elsewhere in the Northern Hemisphere) that occurred between the 15th and 20th centuries was a global phenomenon (page 361). Ice cores are rare in the tropics, but in the Northern Hemisphere a number of studies have documented a stretch of colder temperatures and expanded glaciers. The Quelccaya summit (5670 meters) has an annual mean temperature of −3°C and a yearly accumulation of 300 centimeters of snow; little if any melting, evaporation, or percolation occurs. Visible annual dust layers in conjunction with other measures were used by Thompson *et al.* to date core samples with an accuracy of within 2 years back to 1500 and within 20 years before that. A major volcanic eruption in 1600 produced a thick layer of large ash particles that helped refine the dating. Measurements of conductivity, oxygen isotopes, concentrations and size distributions of particulate materials, and chemicals contributed to the identification of unusually wet and dry periods. Signatures in the ice, showing higher and lower average temperatures, date the Little Ice Age in the Southern Hemisphere from an abrupt beginning in 1490 to an abrupt end around 1880.

SCIENCE

17 OCTOBER 1986
VOLUME 234
NUMBER 4774

Instructions for contributors appears on page xi of the 26 September 1986 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500.

Advertising correspondence should be sent to Tenth Floor, 1515 Broadway, NY 10036. Telephone 212-730-1050.

Surfaces

The surface region of a solid can be thought of as a new phase of matter; its chemical composition often differs from that of the bulk. Atomic arrangements at or near the surface and electronic structures also differ from those in the solid. New and improved methods of observing inorganic surfaces are leading to findings that are important to fundamental science. The precise behavior of atoms at the surface is crucial in many practical applications, including catalysis, corrosion, adhesion, and lubrication. With further reduction in dimensions of microelectronic devices and increased use of epitaxial layers, surface effects will take on enhanced importance. This issue samples some of the activities of surface scientists.

The scanning tunneling microscope has been modified by Tromp, Hamers, and Demuth to permit simultaneous study of the electronic and geometric structure of Si(111) and Si(001) surfaces. They report observations on the electronic structure of single atoms on silicon surfaces. Silicon atoms are bound covalently in crystals, and it has been known that the discontinuity at the surface leads to a rearrangement (reconstruction) of surface atoms to minimize the number of dangling bonds. The new results correlate atomic position with electronic quantum states. The authors project broad usefulness for their type of equipment in further studies. Examples are crucial defect states in electronic devices and the role of adsorbed foreign elements in catalysis.

Unlike semiconductors, the surfaces of most pure metals are not reconstructed. However, Noonan and Davis note that the distance between the layer at the surface and the second layer is in general reduced—in one example, 8.5 percent. The surface composition of alloy samples is often drastically different from the bulk. For example, in a $Pt_{78}Ni_{22}$ alloy, the surface layer was enriched to about 99 percent platinum, whereas the second layer was only 30 percent platinum.

Engel has constructed a helium atomic beam apparatus for observing scattering from surfaces. The helium beam has an effective wavelength comparable to atomic spacings in surfaces, and the apparatus has features that give it great flexibility. It can be particularly sensitive to vacancies or kinks on surfaces and to adsorbed molecules. Most of our present understanding of hydrogen adlayers on various metal surfaces has come from atom beam diffraction experiments.

Madey has reviewed studies of electron and photon desorption of adsorbed gases from surfaces. These studies have shown that desorbed ions do not generally come off in an isotropic manner but in directions that are determined by the orientation of the surface molecular bonds. It is known that when CO is bound to Ni(111) the atom bonded to nickel is carbon, and the CO stands upright. Electron-induced desorption leads to escape of O^+ in the direction of the surface normal. Thus measurements of the electron-stimulated desorption ion-angular patterns yield direct information about the geometrical structure of molecules in surface layers. Experiments show that CO stands up on Ru(001), that CO lies down on Cr(110), and that CO is tilted on surfaces such as Pd(210).

Celotta and Pierce are part of a group that has developed instrumentation for polarizing electrons to study magnetic surfaces. Earlier they showed that they could obtain a good source of polarized electrons by shining circularly polarized light on GaAs. Recently, they have developed a small and simple polarization detector that will doubtless find a large number of applications in surface studies. One example of a relation between surface electronic structure and magnetism is the change induced by chemisorption of CO on Ni(110) surface. It was found that the adsorption of one CO molecule eliminated the equivalent of two nickel surface atom magnetic moments.

If microelectronics devices are to be reliable, the behavior of surface materials must be understood and the agents that can cause corrosion and other failure must be identified. Comizzoli and co-workers report on the many kinds of chemical and physical effects that must be minimized.—PHILIP H. ABELSON

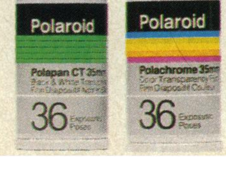
Research

Get the results you want instantly with the Polaroid 35mm Instant Slide System.

If you're looking for the perfect way to keep track of every twist and turn in your R&D programs, here's the instant answer. Polaroid 35mm instant slides.

There's simply no more convenient way to document what you're doing. And, when the need arises, no quicker way to present your findings.

Use Polaroid 35mm instant slide film with *any* 35mm camera to photograph those objects or procedures you need to capture on the spot. Use it with your most sophisticated test equipment – from CRT screens to microscopes. Or with a copy stand for slides of small objects or flat art. Capture each phase of step-by-step procedures so you can review them as soon as necessary.



Polaroid films let you see your findings in the best light, too. Whether your demand is for black and white slides, high contrast or continuous tone – or for color – we have what you need for virtually any type of documentation or

How to take command of your UV-Vis Assays

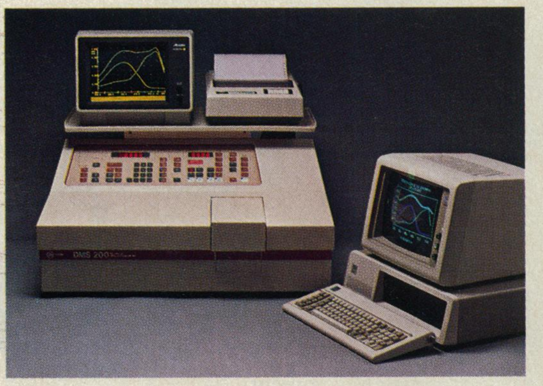
1. RECALL METHOD
2. START

If your analytical work involves the determination of

- purity of samples
- perturbation and dilution effects
- concentration of single or multicomponents
- decomposition studies
- comparison with reference materials

or other assays requiring advanced scanning capabilities, take command with the Varian DMS 200 UV-Vis Spectrophotometer. Combine its advanced calculator functions with its powerful COMMAND function and automate spectral data calculations. Calculated results are printed on-line, along with selected spectral data.

IBM PC/XT software enhances DMS 200 capabilities by extending method storage, storing spectral data and allowing application of user-developed spectral manipulations.



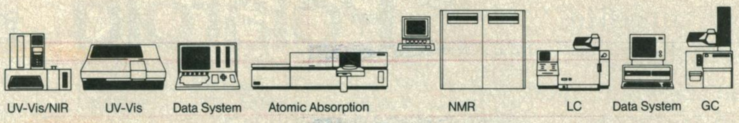
Call 800-231-5772
(in Canada 416-457-4130)
for more information on the DMS 200, one of Varian's family of high-performing UV-Vis-NIR spectrophotometers.

IBM and PC/XT are trademarks of International Business Machines Corporation

DETERMINATION OF TWO COMPONENTS IN A MIXTURE

YELLOW DYE CONCENTRATION 0.843
RED DYE CONCENTRATION 0.591

See us at the EAS in New York, October 20-24!



VERY INTELLIGENT SOLUTIONS FOR YOU

varian

Circle No. 199 on Readers' Service Card

Os^{187}/Os^{186} ratios rule out the crust, but are consistent with the mantle or meteorites (*5*). Yet Pt/Ir, Au/Ir (*4*) and Nd^{143}/Nd^{144} ratios (*8*) permit only minor amounts of mantle material. Volcanism has been proposed as a source of Ir (*9*), but there is no evidence whatsoever that it also accounts for the observed chondritic proportions of other siderophile elements (*3, 4*). Moreover, the Deccan plateau basalts, often invoked as a potential source of Ir (*10*), contain only 0.005 part per billion of Ir (*11*)—three to four orders of magnitude less than K-T boundary clays.

3) Shocked quartz (*12*) and feldspar (*2*) as well as traces of the high-pressure mineral stishovite (*12*) have been found at several K-T boundary sites, along with spherules resembling microtektites (*13*). No process other than hypervelocity impact is known to produce these features (*14*).

Officer and Ekdale invoke "condensation" of the Danish boundary clay (Fish Clay) to explain the fourfold enrichment in carbon content. This is a sham issue, as the real question is not the fourfold higher carbon content, but the 1000-fold shorter deposition time, which, in turn, hinges on the meteoritic nature of the boundary layer. Moreover, at two New Zealand sites, the soot content rises by factors of at least 40 and 800 (*1*). Nonetheless, we shall briefly respond to their arguments.

1) We agree that there is some evidence for a *small* degree of carbonate dissolution in the Fish Clay (*15*). Possible causes are local formation of sulfuric acid by oxidation of pyrite or a global increase in atmospheric-oceanic CO_2 content after a major fire. However, we find the evidence for a *large* "dissolution pulse" (*15*) quite unconvincing. The arguments at best are permissive but not compelling and at worst are ad hoc, designed to deny the role of meteorite impact. What Maxwellian demon protected the uppermost Cretaceous sediments, only centimeters below, from this "dissolution pulse"?

2) The putative factors by which the boundary layer "condensed" are not self-consistent: 4 for C, 7 for clay, and 2000 for Ir, when one uses the Ir-profile of (*4*) as an example. The Ir value requires that the boundary layer initially was some 600 meters thick and contained 99.95% carbonate!

3) Officer and Ekdale imply that Fish Clay is an artifact produced from a normal boundary section by selective dissolution of carbonate and cite as examples Dania (no Fish Clay, 4 parts per billion of Ir) and Stevns Klint (Fish Clay, 29 to 87 parts per billion of Ir). However, Ekdale in an earlier paper (*15*) acknowledged that the Dania site is "badly disturbed by relatively recent brecciation and apparent tectonic movement," and "thus may not reflect a continuous sedimentary sequence." Absence of evidence is not evidence of absence, especially in a section previously acknowledged to be incomplete.

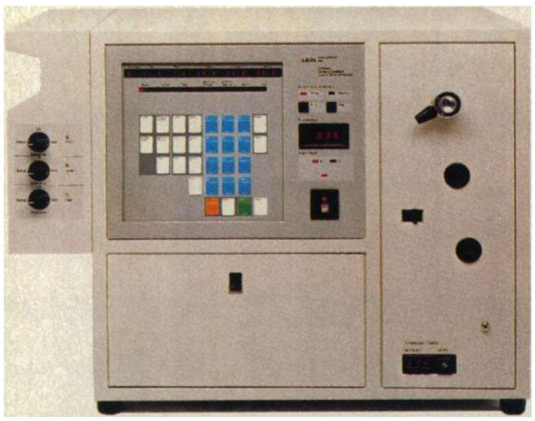
4) The K-T sequence in Denmark, although well studied, is badly disturbed and hence is not suitable for generalization. However, Smit and Romein (*13*), who have studied 22 K-T sites all over the world, conclude from this much larger data base that a boundary clay layer with Ir and microtektites is the norm rather than the exception. If it is missing at a particular site, this implies a later disturbance, as evidenced by a break in the fossil record (*13*). We refer Officer and Ekdale to Ekdale and Bromley (*15*), who found ample evidence for precisely such disturbance: "The clay layer obviously has served as a zone of weakness and as a lubrication plane for geologically recent movements," and "this carbonaceous, pyritic microfacies *pinches out* laterally up the flanks of the chalk mounds, so that it only occurs in the bottoms of the small troughs between the mounds" (italics ours).

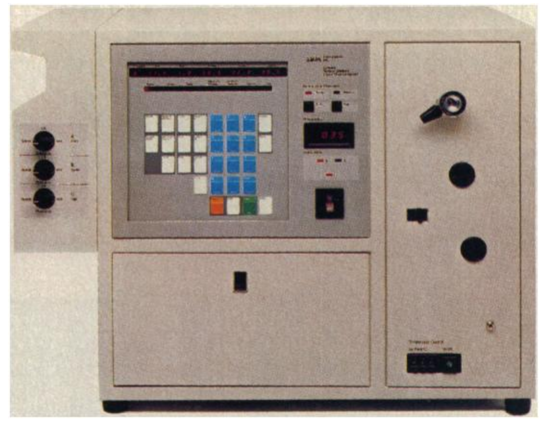
For a different view of K-T stratigraphy in Denmark, we refer the reader to three recent references not quoted by Officer and Ekdale (*4, 13, 16*).

Edward Anders
Wendy S. Wolbach
Roy S. Lewis
Enrico Fermi Institute, University of Chicago, 5640 South Ellis Avenue, Chicago, IL 60637

REFERENCES

1. W. S. Wolbach, paper presented at the 49th annual meeting of the Meteoritical Society, New York, 23 September 1986.
2. C. L. Pillmore *et al.*, paper presented at the annual meeting of the Geological Society of America, Orlando, FL, 28 October 1985.
3. R. Ganapathy, *Science* **209**, 921 (1980).
4. M. Kastner, F. Asaro, H. V. Michel, W. Alvarez, L. W. Alvarez, *ibid.* **226**, 137 (1984).
5. J. M. Luck and K. K. Turekian, *ibid.* **222**, 613 (1983); F. E. Lichte *et al.*, *Nature (London)* **322**, 816 (1986).
6. O. B. Toon *et al.*, *Geol. Soc. Am. Spec. Pap.* *190*, (1982), p. 187.
7. W. Alvarez, L. W. Alvarez, F. Asaro, H. V. Michel, *Science* **223**, 1183 (1984).
8. D. J. DePaolo, F. T. Kyte, B. D. Marshall, J. R. O'Neill, J. Smit, *Earth Planet. Sci. Lett.* **64**, 356 (1983).
9. W. H. Zoller, J. R. Parrington, J. M. Phelan Kotra, *Science* **222**, 1118 (1983).
10. D. M. McLean, in *The Carbon Cycle and Atmospheric CO_2: Natural Variations Archean to Present*, E. T. Sundquist and W. S. Broecker, Eds. (Geophysical Monograph 32, American Geophysical Union, Washington DC, 1985), pp. 493–503.
11. J. W. Morgan, *Proc. Lunar Planet. Sci. Conf. 9th* (1978), p. 2713.
12. B. F. Bohor, E. E. Foord, P. J. Modreski, D. M. Triplehorn, *Science* **224**, 867 (1984).
13. J. Smit and A. J. T. Romein, *Earth Planet. Sci. Lett.* **74**, 155 (1985).
14. B. M. French, *Science* **230**, 1293 (1985).
15. A. A. Ekdale and R. G. Bromley, *J. Sediment. Petrol.* **54**, 681 (1984).
16. W. Alvarez *et al. Science* **223**, 1135 (1984).





Introducing....

SEPRACELL-MN

The most advanced technology in mononuclear cell separation from whole blood.

You demand performance and quality in the products used in immunology today. Yet, density media products for lymphocyte separation provided few choices in performance and quality—until now.

Sepracell-MN is a colloidal silica based medium for the separation of mononuclear cells from whole blood by *continuous* density gradient centrifugation.

PERFORMANCE

80%	lymphocyte recovery	75%	lymphocyte purity
98%	viability	20%	monocytes

QUALITY

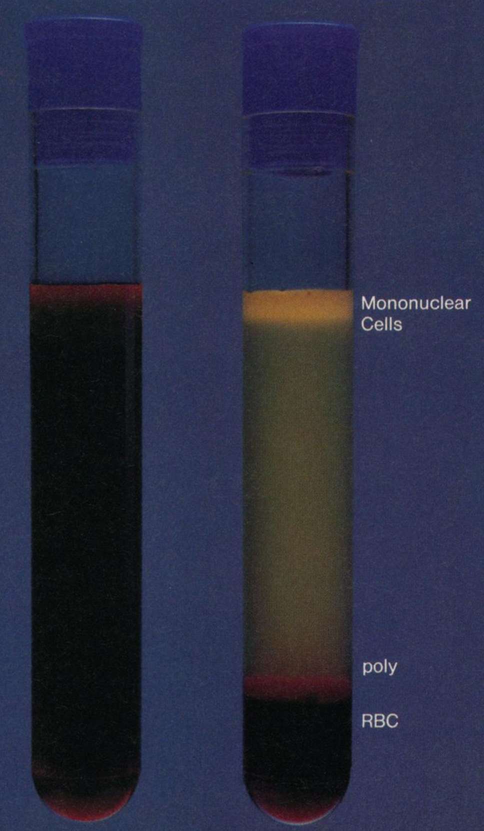
Sepracell-MN is sterile and non-toxic for functional studies. Results are included with each lot for lymphocyte recovery, purity, T and B cell ratios, and mitogen response.

CONVENIENT

Available in prepackaged racks of 50 sterile centrifuge tubes for whole blood separation.

ECONOMICAL

Prepackaged sterile tubes eliminate waste of separation media and use of expensive sterile centrifuge tubes. Quick separations and consistently greater lymphocyte recoveries reduces the time, blood, and supplies required for lymphocyte separations.



Sepracell-MN mixed with whole blood

Banding pattern after centrifugation (2,000 x G 10 min.)

Easy to use

No layering or dilution of blood. Just add whole blood (up to 6 mls.) to the prepackaged tube, mix and spin for 10 minutes.

CALL TOLL FREE
1-800-222-0924 for Free Samples (10 prepackaged tubes).
1-800-222-0924 for Ordering
1-800-222-0956 for Technical Assistance

Compare performance and quality.

SEPRATECH CORPORATION
Oklahoma City, Oklahoma, USA 73127

Designed For In Vitro Stability.
Built To Save Gas.
Priced To Sell.

CO_2 And Oxygen Incubators From Forma

The problem with buying a high technology incubator is that you get high technology problems. At a high technology price.

So much for expensive technology.

At Forma, we continue to develop economical, dependable water-jacketed incubators with common sense improvements to solve problems you know and understand.

Like better gas sensors for more accurate, more economical CO_2 control.

Easy oxygen control for **in vitro** modeling of any **in vivo** environment.

Self-diagnostic control modules that speed calibration and reduce maintenance.

Proven cabinet designs to inhibit contamination, reduce media desiccation, and to improve uniformity.

And because we build more incubators than anyone else in the world, we build them for less and pass the cost savings on to you.

That's the beauty . . . and the best technology of all.

Call Us!

Free Offer!
A handcrafted silk rose, for your time and interest in Forma water-jacketed incubators.

Detailed information on CO_2 automatics, controlled oxygen and constant flow models, all at attractive prices, is available now.

Call us today, toll-free.

Forma Scientific
DIVISION OF MALLINCKRODT, INC.
BOX 649 MARIETTA, OH 45750 TELEX 29-8205

Toll-Free USA 800-848-3080 In Ohio 800-848-3080 In Canada 800-848-3080

Circle No. 132 on Readers' Service Card

For People who make Peptides,

Here are five reasons why.

1 It's the Truly Efficient Way to Make Peptides

The Model 430A Peptide Synthesizer doesn't waste time, amino acids, or reagents. It consistently produces high yields of quality peptide which reduces post-synthesis purification and characterization significantly. You get more peptide for your effort *and* for your dollar.

2 It's More Flexible, Easier to Operate

The 430A meets the needs of every user whether new to peptide synthesis or very experienced. Software is written in plain English using familiar terminology. All control is implemented by simply touching the screen. Standard synthesis cycles and functions can be selected or new ones designed quickly and easily.

3 Its Chemistry is Proven and Unique

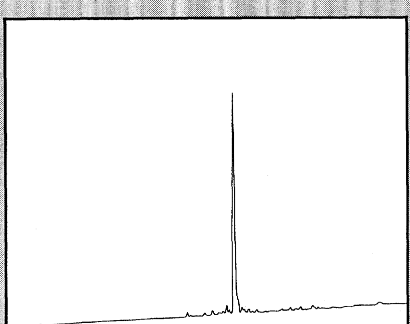
High stepwise yields, high purity and reproducibility are routine. Each step of the chemistry is specific to the requirements of the various amino acids. Coupling failures are eliminated or greatly reduced resulting in fewer double couplings. Both *t*-BOC and FMOC chemistries can be accommodated.

4 It Produces Superb Short Peptides

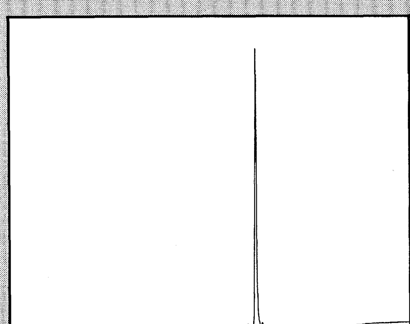
Step Yield (% Coupled) Standard ABI *t*-boc cycles, version 1.0

PEPTIDE SEQUENCE	LEU	HIS	PHE	PRO	HIS	ILE	TYR	VAL	ARG	ASP	AVG. STP. YIELD %
Ninhydrin Analysis	•	96.7	99.7	99.7	†99.6	98.9	99.5	98.3	99.5	99.4	**99.0**
Preview Sequence Analysis	•	•	•	99.5	99.2	94.9	96.6	96.5	97.1	97.9	**97.4**
RESIDUE NUMBER	10	9	8	7	6	5	4	3	2	1	

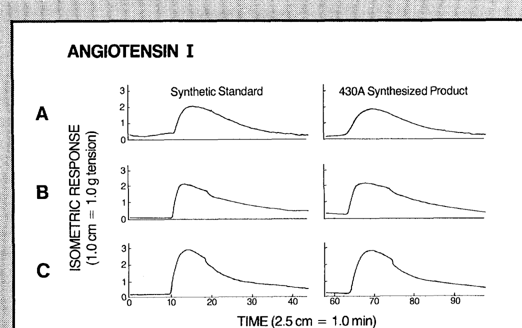
†Ninhydrin values for amino acids coupled to proline are not quantitative.



Angiotensin I, Crude
mobile phase 0.1% TFA/CH_3CN
gradient 0 to 60% in 60 minutes
flow rate 1.0 mL/min
detector 216 nm
column Brownlee, C-8, 300Å, 10μm 4.6 mm x 250 mm



Angiotensin I, HPLC Purified
mobile phase 0.1% TFA/CH_3CN
gradient 0 to 60% in 60 minutes
flow rate 1.0 mL/min
detector 216 nm
column Brownlee, C-8, 300Å, 10μm 4.6 mm x 250 mm



Panels A, B and C are isometric responses of two different Ile^5-Angiotensin I—a synthetic standard and the 430A-produced, purified peptide—on three separate rabbit aortic strips. The responses produced by the Applied Biosystems Ile^5-Angiotensin I were not significantly different than those of the standard. Sample concentrations were: in panel A, 564 ng/mL; in panels B and C, 500 ng/mL.

These response data were furnished by Drs. M. C. Khosla and A. Husein of the Cleveland Clinic Foundation.

the 430A is the No. 1 Choice.

5 It Produces Superb Long Peptides

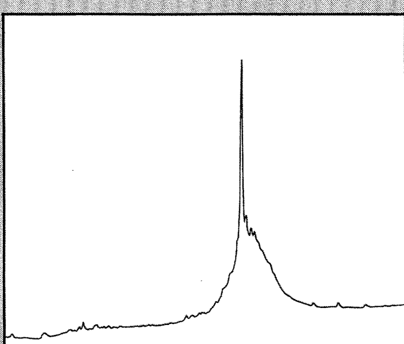
Step Yield (% Coupled) Standard ABI *t*-boc cycles, version 1.0

PEPTIDE SEQUENCE	GLY	GLY	LYS	GLU	SER	ARG	GLY	GLN	GLN	VAL	PRO	PRO	GLY	ASP	ARG	GLN	ALA	GLU	VAL	LEU →
Ninhydrin Analysis	99.7	99.8	99.5	99.4	99.2	*99.6	99.4	*99.6	*99.2	98.0	97.0	†99.8	†99.1	98.9	99.0	99.1	98.7	98.6	98.5	98.5
Preview Sequence Analysis	•	•	99.6	99.6	99.5	99.6	99.5	•	•	99.1	•	1	98.9	99.0	99.0	98.6	98.7	98.6	98.5	98.4
RESIDUE NUMBER	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48 →

→	LYS	SER	TYR	ASP	PHE	SER	ASP	GLY	SER	GLU	GLU	TYR	GLU	ALA	ASN	LEU	GLU	ALA	ASP	LEU	THR	THR	GLN	ALA	LEU →
Ninhydrin Analysis	95.8	97.4	97.2	97.8	98.3	98.3	97.9	96.9	98.5	98.3	98.0	97.1	97.2	98.2	*96.9	98.1	97.7	98.0	98.0	98.2	97.6	95.0	*82.7	96.0	96.1
Preview Sequence Analysis	98.5	98.5	98.5	98.5	98.8	97.9	98.0	97.8	97.0	•	•	98.8	•	99.3	99.3	99.3	98.9	99.1	98.9	93.9	•	•	98.4	99.0	98.1
→	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23 →

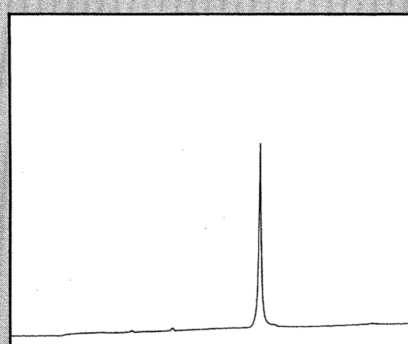
→	VAL	ARG	ALA	GLN	SER	SER	GLN	ARG	ASN	ARG	SER	SER	SER	SER	SER	ALA	PRO	ARG	SER	SER	SER	NET	AVG. STP. YIELD %
Ninhydrin Analysis	96.1	*94.9	95.2	*94.6	95.5	95.5	*96.4	*92.5	*92.2	*91.7	93.9	95.0	96.7	96.2	94.5	94.8	94.4	†*95.0	97.2	•	95.9	96.5	***96.9**
Preview Sequence Analysis	98.3	98.5	98.0	96.8	•	•	•	•	97.9	•	•	•	•	•	•	95.2	95.1	97.2	•	•	•	•	**98.9**
→	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	

*These are amino acid resin samples from the first coupling of the HOBT ester double couple cycles used for the Arg, Asn and Gln couplings. The calculation of the average step yield excludes these (*) residues. †Ninhydrin values for amino acids coupled to proline are not quantitative.



M-67-G ($CONH_2$), Crude

mobile phase 0.1% TFA/CH_3CN
gradient 0 to 60% in 60 minutes
flow rate 1.0 mL/min
detector 214 nm
column Brownlee, C-8, 300Å, 10 μm 4.6 mm x 100 mm



M-67-G, ($CONH_2$), Purified

mobile phase 0.1% TFA/CH_3CN
gradient 0 to 60% in 60 minutes
flow rate 1.0 mL/min
detector 214 nm
column Brownlee, C-8, 300Å, 10 μm 4.6 mm x 250 mm

Met-67-Gly ($CONH_2$) is a 69-residue peptide that is part of a 124k-dalton plant protein, Avena Phytochrome. This peptide is from an area of the Phytochrome protein that has been shown to be essential for complete biological activity. Although sequence analysis suggests the purified product contains minor peptide impurities, initial experiments have shown good peptide binding activity to antibodies made against the native protein. Work is continuing with efforts to map the exact reading frame of these antibodies by using deprotected, resin-bound peptides directly in the antibody binding assays.

This peptide was synthesized for collaborative research with Dr. Peter Quail, University of Wisconsin—Madison.

You Can Prove It for Yourself

Compare a 430A-synthesized peptide made to *your* specifications (and at a very reasonable price) with what you've been getting so far. The quality will convince you that the 430A is the first choice of more people who make peptides.

For more information, contact Jan Bowen at our U.S.A. office, your local Applied Biosystems Representative, or indicate Reader Service Number 403.

Applied Biosystems

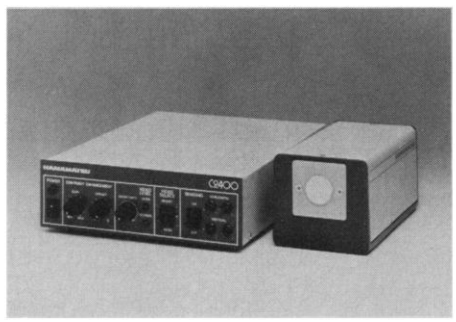
Sales and Service Worldwide: **U.S.A.** 850 Lincoln Centre Drive, Foster City, California 94404, U.S.A., Tel. (415) 570-6667, (800) 874-9868, in Calif. (800) 831-3582, Telex 470052 **U.K.** Birchwood Science Park, Warrington, Cheshire, U.K., Tel. 925-825650, Telex 629611 • **W.Germany** Bergstrasse 104, D6102 Pfungstadt, B.R.D., Tel. 6157-6036, Telex 4191746 **Australia** Suite 2, 1401 Burke Road KEW, Victoria, Australia 3101, Tel. (03) 859-9571

Four ways to improve your image.

PMI lets you choose from high performance cameras to advanced imaging systems designed specifically for videomicroscopy.

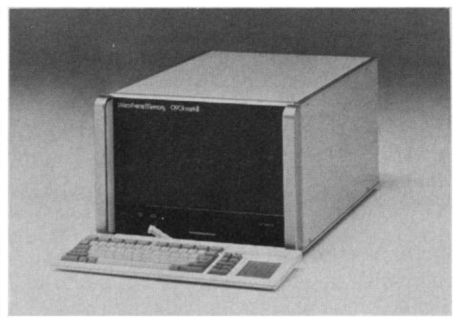
C2400 VIDEO CAMERA. Exceptional performance characteristics plus a variety of unique, user-oriented features enable the C2400 Video Camera to accurately detect details that are invisible with conventional video cameras. A modular control unit supports all available camera heads, and application-specific configurations are easily obtained through a wide choice of options and imaging tubes.

Circle No. 148 on Readers' Service Card



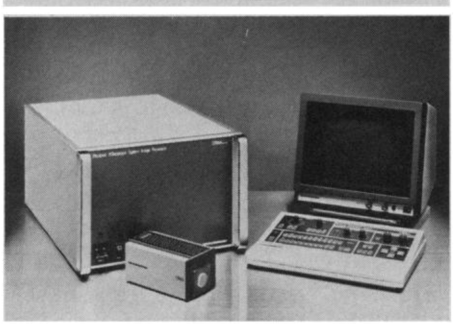
C1901 IMAGE PROCESSOR. This unique digital image processor employs two 16-bit video frame memories and executes a wide range of processing functions. Real-time features such as image integration, background subtraction and shading correction, as well as 3-D graphics and pseudocolor, make this system ideal for both image enhancement and low light level imaging.

Circle No. 150 on Readers' Service Card



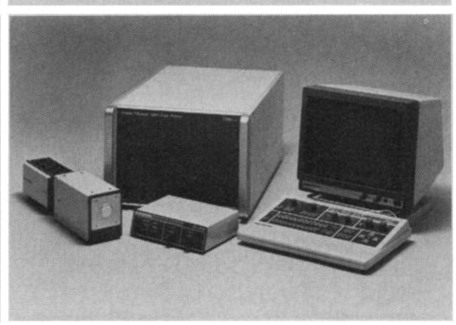
C1966 AVEC SYSTEM. A totally integrated, turnkey imaging system with extensive enhancement and real-time digital processing capabilities. The C1966 AVEC system can dramatically improve image quality and detectability when visualizing low contrast, low intensity and dynamic specimens. A wide selection of video detectors is available, with characteristics ranging from high resolution to high sensitivity, from UV to IR. Highly flexible and easy to use.

Circle No. 149 on Readers' Service Card



C1966 VIM SYSTEM. Employing a unique ultra high sensitivity camera capable of photon-counting imaging, this system permits high quality quantitative imaging at light levels far below those attainable with conventional low light level cameras (10^{-1} lux to single photons). Spectral sensitivities ranging from 140 to 850nm and Peltier cooling allow the system to be configured for numerous applications. An integral processor provides advanced image processing and analysis functions.

Circle No. 151 on Readers' Service Card



Tell us about your application.

The Photonic Microscopy family of imaging products is engineered by Hamamatsu Photonics, a world leader in imaging detectors and systems. To learn how these products can be useful to you, contact us today.

PMi

Achieving the Ultimate Image.

PHOTONIC MICROSCOPY, INC.
2625 Butterfield Road/204 South/Oak Brook, Illinois 60521
Telephone: 312/571-1241/Facsimile: G3 312/571-1244
A Hamamatsu Company

Don't work so hard.

Just turn a Rheodyne valve to make things happen.

LC sample cleanup. Sample enrichment. Solvent selection. Exchanging one column for another.

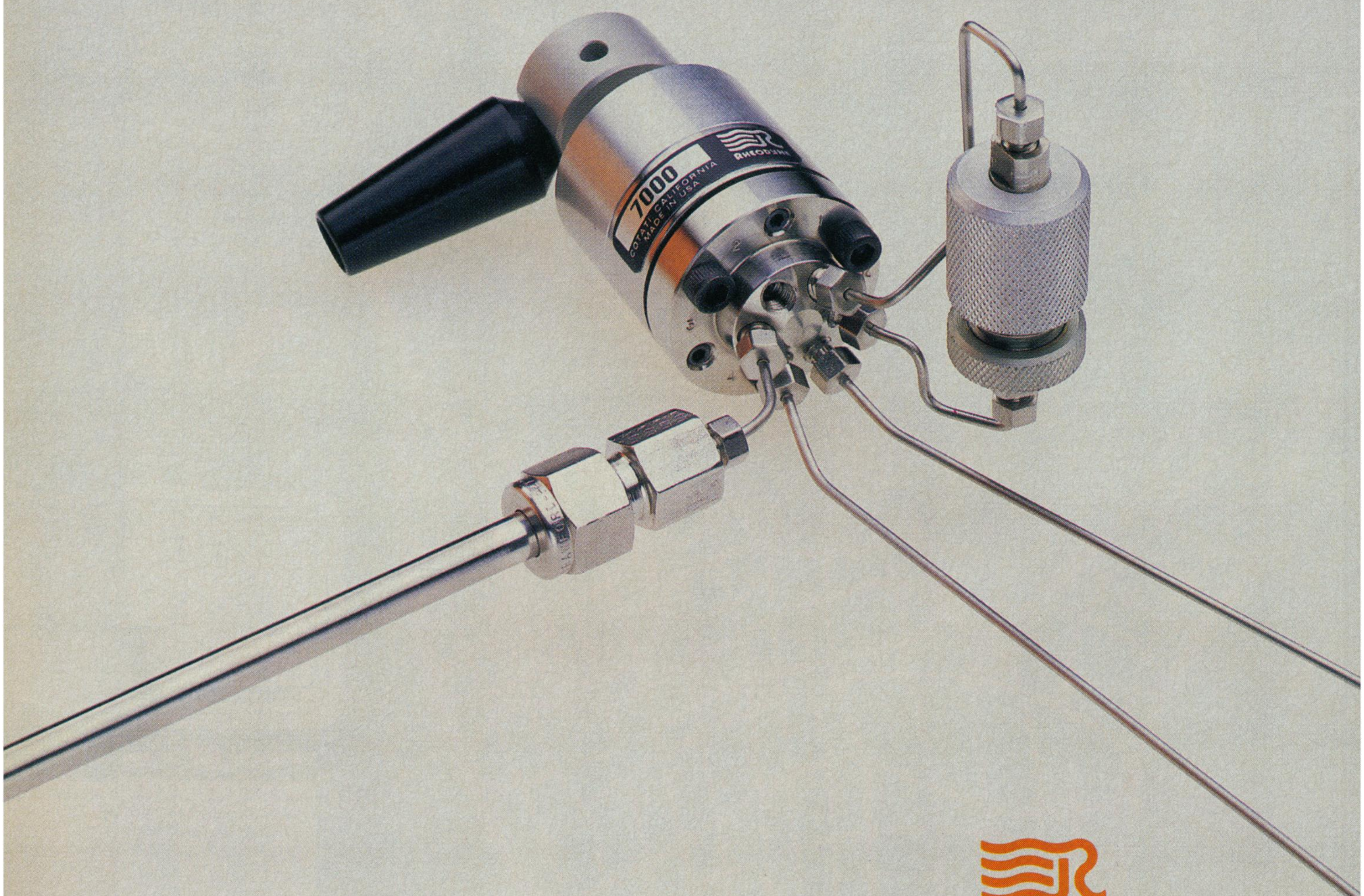
These are a few tasks that can be performed on-stream in a liquid chromatograph, saving your working time, by using Rheodyne valves.

You can use a switching valve to connect a sample cleanup or enrichment column directly to an analytical column, eliminating time-consuming batch processing. Or you can use a simple valve to select different mobile phases during method development. Or you can use a valve to exchange one column for another when changing methods, and escape the task of disconnecting fittings.

Rheodyne makes eight different switching valves for manual operation. And each is also available with a pneumatic actuator for automatic operation.

The valves are described in our catalog, which contains diagrams showing how to connect them to columns, pumps, and injectors.

For a copy of the catalog contact Rheodyne, Inc., P.O. Box 996, Cotati, California 94928, U.S.A. Phone (707) 664-9050.



RHEODYNE

THE LC CONNECTION COMPANY

Circle No. 197 on Readers' Service Card

Advance Registration Form

AAAS Annual Meeting ✦ Chicago ✦ 14 – 18 February 1987

Mail to: AAAS Meetings Office, Annual Meeting Registration, 1333 H Street, NW, Washington, DC 20005

Please Print or Type

Name of registrant ______________________
(Last) (First & initial)

Name of spouse registrant ______________________
(Last) (First & initial)

Institution/Company ______________________
(To be printed on badge) (Registrant)

____
(Spouse registrant)

Mailing address ______________________
(Street)

____
(City/State) (Zip code) (Telephone number)

Convention address ______________________
(Where you can be reached) (Hotel and/or telephone number)

Check days on which you will attend meeting: ☐ Sat ☐ Sun ☐ Mon ☐ Tue ☐ Wed

☐ Check here if you need special services due to a handicap. We will contact you before the meeting.

■ Your registration badge, receipt, and voucher for full Program and Abstracts will be mailed to you in early January. ■ Registrations received after 30 January will be held at the Advance Registrants' Desk at the Hyatt Regency Hotel. ■ Refund requests must be made by letter or telegram to the above address before 6 February 1987 and will be honored after the Meeting. No refunds are made on cancellations received after this date. ■ Student registration fees apply to full-time undergraduate or graduate students only.

*Membership includes 51 issues of *Science*. Inquire for Canadian and other foreign rates.

Name(s) of new member(s): ______________________

Registration Fees:

Members (check appropriate box):

☐ Regular ($65) .... $ ______

☐ Student ☐ Retired ☐ H.S. Teacher
or ☐ Spouse of registrant ($35) .... $ ______

Nonmembers (check appropriate box):

☐ Regular ($90) .... $ ______

☐ Student ☐ Retired ☐ H.S. Teacher
or ☐ Spouse of registrant ($45) .... $ ______

Join AAAS — register as a member:
(Add dues to member registration fee above)

*Single membership dues ($65) .... $ ______

*Double [member & spouse] ($82) ..... $ ______

*Single student or retired ($40) .... $ ______

*Double student or retired ($57) .... $ ______

Retired or spouse membership without *Science* ($17) .... $ ______

TOTAL AMOUNT $ ______

☐ Check enclosed

Charge my ☐ **VISA** ☐ **MasterCard**
(no other cards accepted)

____
Card number **Expires**

____
Signature

✂ --

Hotel Reservation Form ✦ Hyatt Regency Chicago

AAAS Annual Meeting ✦ Chicago ✦ 14 – 18 February 1987

Mail to: Reservations, Hyatt Regency Chicago, 151 East Wacker Drive, Chicago, IL 60601

Send confirmation to:

Name ______________________
(Last) (First & initial)

Mailing address ______________________
(Street)

____
(City/State) (Zip code) (Telephone number)

Other occupant(s) of room: ______________________
(Name) (Name)

Indicate special housing needs due to a handicap:
☐ wheelchair accessible room; other ______________________

Charge my major credit card (card type): ______________________

Card No. ______________________ Expires ________

Signature ______________________

Hyatt Regency Hotel Rates: Add 10.1% state and city sales tax. Check appropriate box for type of room desired.

Room Category	Single	Double or Twin	Parlor + 1 Bedrm.	Parlor + 2 Bedrms.
Standard	☐ $79	☐ $96	☐ $300 & up	☐ $379 & up
Club Level	☐ $102	☐ $118		

Arrival date ______________________

Time ____________ ☐ a.m. ☐ p.m.

Departure date ______________________

Time ____________ ☐ a.m. ☐ p.m.

Be sure to list definite arrival and departure dates and times. reservations will be held only until 6 p.m. unless accompanied by 1 night's deposit or major credit card guarantee.

■ Reservations must be submitted to the Hyatt Regency (address above) on this official form by **23 January 1987.** Reservations received after this cut-off date are conditional on space availability. ■ Make any changes or cancellations directly with the hotel, which will also confirm your reservations.

■ Rollaway bed or extra person in room: $15.

■ Children to age 18 free of charge in same room with parents.

...ABOUT ANALYZING YOUR DATA.

You might be spreading your spreadsheet a little too thin. Or maybe you're starting from scratch. But if you're serious about data analysis, you're ready for SPSS/PC+™ – a full software family that brings you six high-powered ways to complete any data analysis task.

Enter it. SPSS/PC+ Data Entry™ takes the effort out of entering and correcting data.

Analyze it. The SPSS/PC+ Base Package provides a powerful array of statistical and reporting procedures.

Examine it. SPSS/PC+ Advanced Statistics™ lets you get more serious with your data.

Table it. SPSS/PC+ Tables™ produces presentation-ready tables instantly.

Chart it. SPSS/PC+ Graphics™ featuring Microsoft® Chart creates show-stopping graphs and charts.

Map it. SPSS/PC+ Mapping™ featuring MAP-MASTER™ – our latest option – creates maps where vast amounts of data can be summarized and presented in one, simple picture.

SPSS/PC+ products are being put to productive use by serious fact finders in business, government and education. For countless purposes such as market research. Wage and salary studies. Survey analysis. And quality control. Plus each product is superbly documented and supported by SPSS Inc., a leader in statistical software for nearly 20 years.

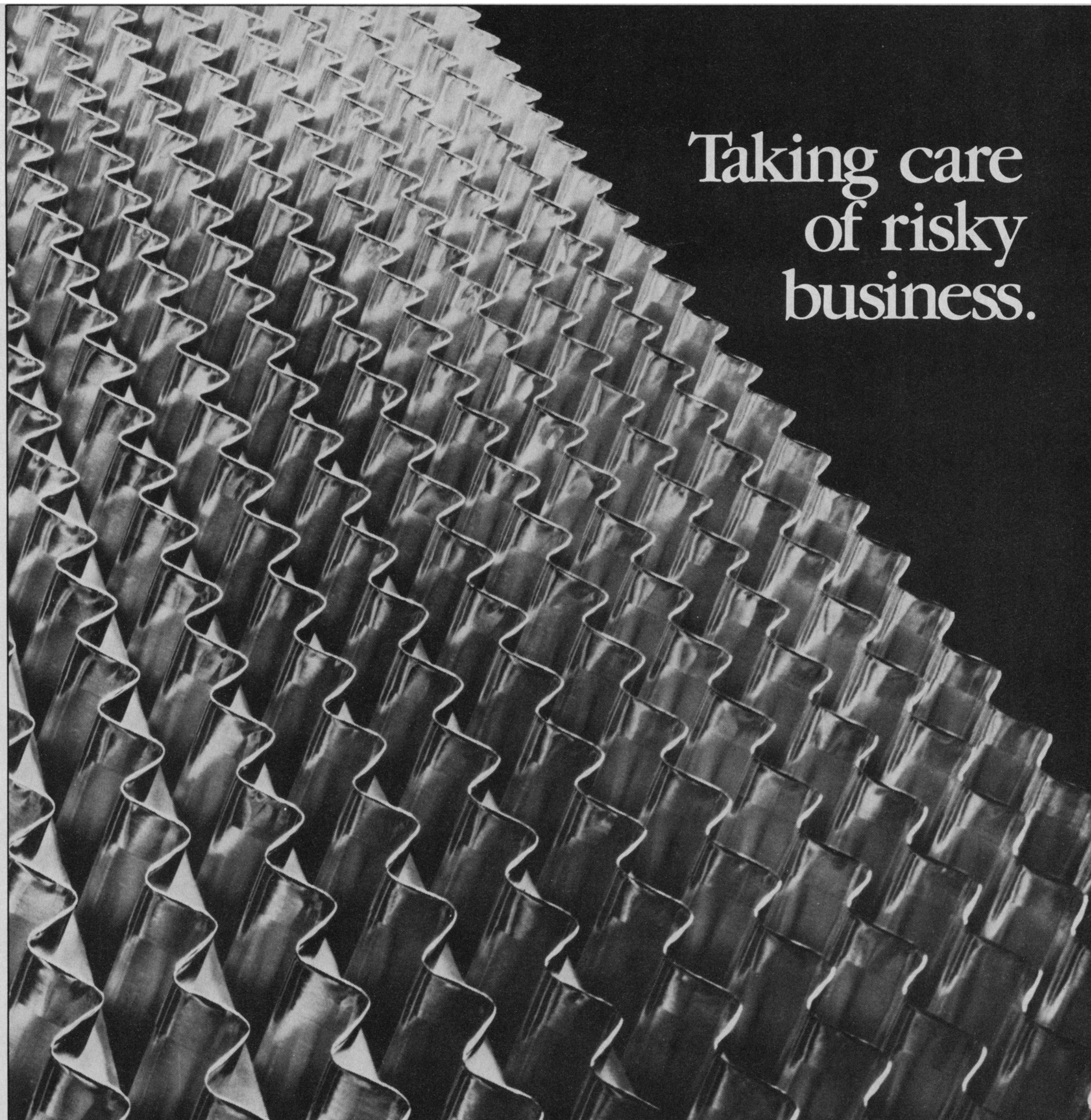
So if you're serious about data analysis, step up to SPSS/PC+. For details, contact our Marketing Department. **CALL 1/312/329-3500**

SPSS inc.

SPSS Inc. • 444 North Michigan Avenue, Suite 3000 • Chicago, Illinois 60611
In Europe: SPSS Europe B.V. • P.O. Box 115 • 4200 AC Gorinchem, The Netherlands • Telephone: +31183036711 • TWX: 21019

SPSS/PC+ runs on IBM PC/XT/AT's with hard disk. Contact SPSS Inc. for compatible microcomputers. SPSS/PC+, SPSS/PC+ Data Entry, SPSS/PC+ Advanced Statistics, SPSS/PC+ Tables, SPSS/PC+ Graphics and SPSS/PC+ Mapping are trademarks of SPSS Inc. for its proprietary computer software. Chart and Microsoft are trademarks of Microsoft Corporation. MAP-MASTER is a trademark of Decision Resources.

Circle No. 169 on Readers' Service Card



Baker long-life HEPA filters maximize investment protection.

Investing in inferior biological safety equipment can be a dangerous—and costly—business.

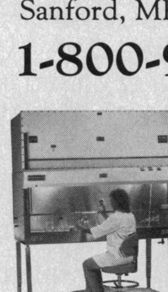
The best way to reduce the risk? Baker Biological Safety Cabinets. With the best materials. The best workmanship. The best performance.

Baker cabinets are famous for *reliability and extended useful life.* At the heart of every cabinet, our high-efficiency HEPA filter systems often last more than 10 years. So there's less downtime. Less need for decontamination. And less danger to product and personnel.

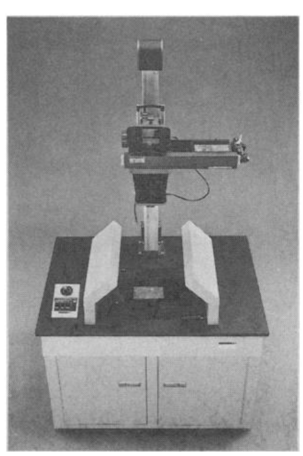
At The Baker Company, we never compromise on protection. Should you?

Call toll free for complete data. Or write to The Baker Company, P.O. Drawer E, Sanford, ME 04073.

1-800-992-2537



the BAKER COMPANY, inc.
Maximized Protection.



The New Fotosystem 1000


Panasonic
Color Video Medical Monitor
MT-1340G
Panasonic
MD

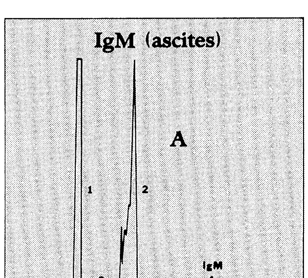
"There is an enormous area in here, where man will start to try, with simple organic chemistry, to mimic antibodies, and I think Baker has now done that."

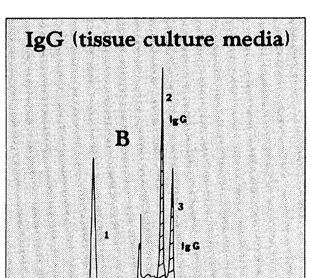
—**Fred Regnier** to the
1986 Pittsburgh Conference

Introducing BAKERBOND ABx.™

A technological advance for immunoglobulin purification.

The separation of antibodies derived from double producing hybridomas shown below, is an example of ABx™ resolving power.





ANALYTICAL CONDITIONS:

Column:	Bakerbond ABx,™ 4.6 x 250 mm, 5 micron
Mobile Phase:	A=10mM KH_2PO_4, pH 6.0 B=500mM KH_2PO_4, pH 6.8
Gradient:	0% B to 50% B over 60 min.
Flow Rate:	1mL/min.
Pressure:	1,000 PSI
Detection:	UV at 280nm; AUFS: see +
Peaks	1. Albumins, transferrin 2. Weakly bound proteins 3. IgM 4. IgM
Sample:	Mouse ascites fluid 0.5 mL
IgM Purity:	Greater than 95%

Separation of Monoclonal Antibodies from Double-Producing Hybridomas

ANALYTICAL CONDITIONS:

Column:	Bakerbond ABx,™ 4.6 x 250 mm, 5 micron
Mobile Phase:	A=10mM MES, pH 6.0 B=250mM KH_2PO_4, pH 6.8
Gradient:	0% B for 10 min. Step gradient to 20% B 20% B to 50% B over 60 min.
Flow Rate:	1 mL/min.
Pressure:	1,000 PSI
Detection:	UV at 280 nm; AUFS: see +
Peaks:	1. Albumins, transferrin 2. IgG 3. IgG
Sample:	Tissue Culture Media 0.5 mL
Purity:	2. greater than 95% 3. greater than 95%

+ Peak 1 of non-retained proteins represents 90-95% of all non-immunoglobulin proteins. Detector sensitivity for all other retained peaks has been increased ten-fold to emphasize retained proteins and monoclonal antibodies.

J.T. Baker has developed Bakerbond ABx (antibody exchanger), a patented, highly-resolving silica-based "mixed mode" chromatographic matrix which provides rapid purification of immunoglobulins from any biological fluid.

ABx exhibits high affinity and specificity for all types of immunoglobulins—all IgG subclasses, IgA, IgD, IgE, and IgM—without binding albumins, transferrins, and other protein contaminants common to **cell culture media, ascites fluid,** and **serum/plasma.**

Bakerbond ABx is available in a full range of particle sizes, (5, 15, and 40 micron). Offered in bulk and pre-packed columns, it provides superior performance for HPLC, traditional low pressure LC, and batch purification.

For technical assistance or ordering information on ABx, and the entire Bakerbond family of silica-based bonded phases for protein purification, call toll free 1-800-JTBAKER. (In NJ, 201-859-2151). Or write J.T. Baker Chemical Company, 222 Red School Lane, Phillipsburg, NJ 08865.

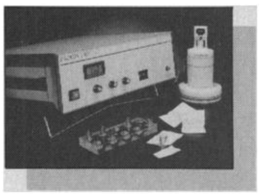
J.T.Baker®

J.T. Baker Chemical Co.
222 Red School Lane
Phillipsburg, NJ 08865

SCIENCE/SCOPE®

Patented Gene Transfer Technology with Proven Success:
Applicable to all Biological Systems

BAEKON2000 Advanced Gene Transfer System



PRECISELY CONTROLLABLE PARAMETERS: Amplitude, Number of Pulses, Burst Time, Cycle, and Intensity of Turbulence.

CONSISTENT QUALITY RESULTS TIME AFTER TIME.

Unique merits of *BAEKON2000*

- STERILITY by the use of a sterile disposable receptacle;
- TWO modes of operation: Non-contact and Contact;
- CONTINUOUS output of electric discharges;
- Virtually NO limit in species and number of cells and DNA;
- CONTROLLED turning and mixing of gene-cell mixture DURING transfer.

Our clients are leading scientists in the area of animal, plant and bacterial biotechnology.

***BAEKON2000:* THE OPTIMAL SOLUTION!**

BAEKON, INC.
18866 Allendale Avenue, Saratoga, CA 95070
(408)741-0404

Complete details upon inquiry.

Circle No. 98 on Readers' Service Card

HELLMA®

There are no better CELLS.

Ask for our literature on Cells, Filters, and Optics. Also UV and Laser Light Sources.

For over 20 years . . .
HELLMA
tomorrow's designs today.

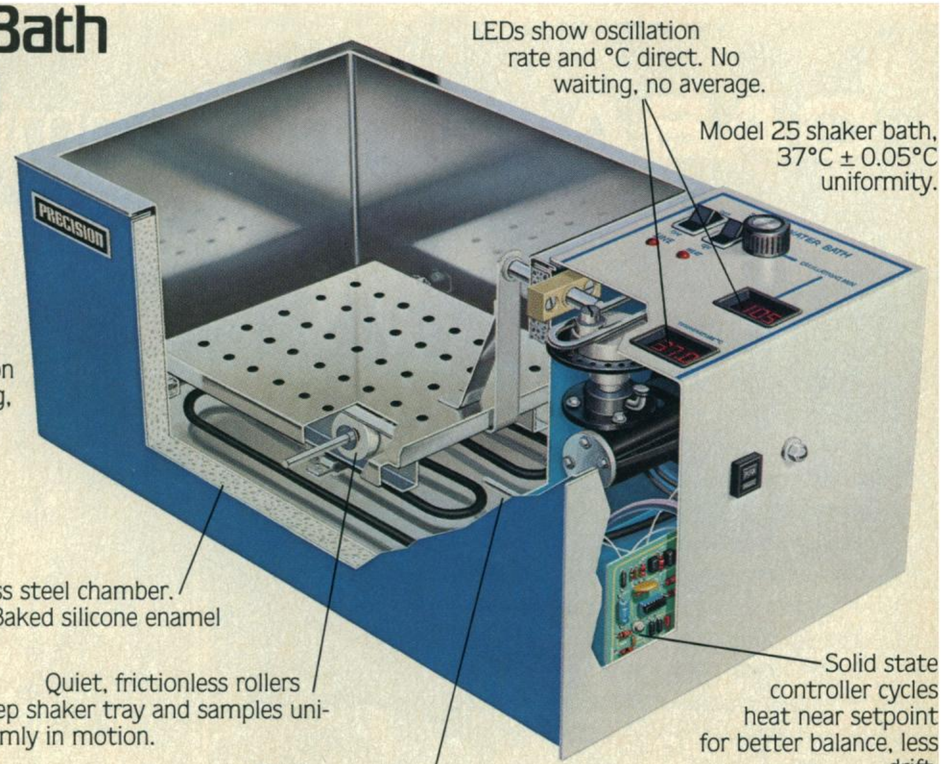
Hellma Cells Inc.
Box 544, Borough Hall Station
Jamaica, New York 11424
Telephone (718) 544-9534

Circle No. 133 on Readers' Service Card

How To Buy A Bath Without Taking One

Learn how constant temperature happens. Precision baths show you how. We've made more constant °C appliances for the lab than anyone else in the world. FREE GUIDE on how to buy a bath plus literature on general purpose, circulating, and shaker baths. Write Precision Scientific, 3737 West Cortland Street, Chicago, Illinois 60647. Or call 1-800-524-9482.

HOW TO BUY A BATH WITHOUT TAKING ONE



MEMBER
SAMA
SCIENTIFIC APPARATUS MAKERS ASSOCIATION

Precision® Scientific

To have a representative call circle reader service number 189
For literature circle reader service number 190

LC

With Buy-Back™ Warranty

FUTURE-PROOF CHROMATOGRAPHY

LKB

90023955

Only LK
the Buy-Ba

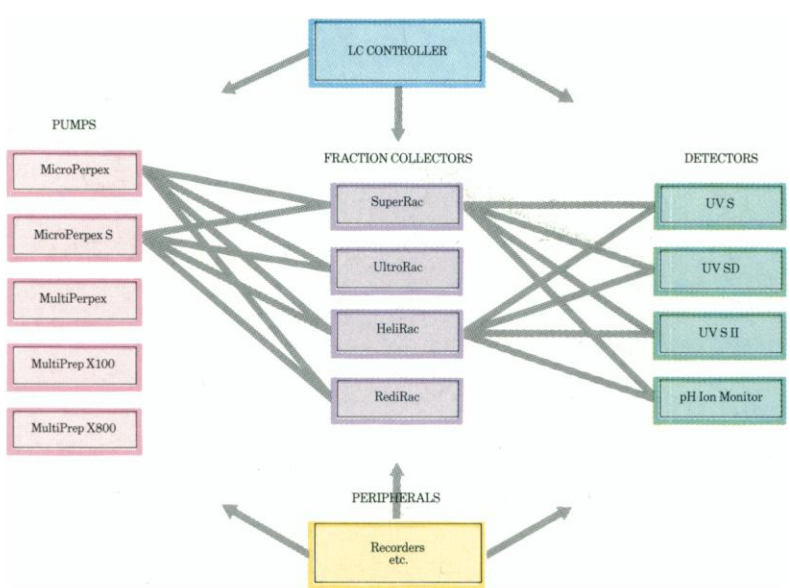
The Buy-Back Warranty gives you an assurance no other LC supplier can make. The built-in flexibility to let you simply convert from soft gel methods to HPLC. Whenever you want, with absolute confidence and at minimal cost.

When you're ready to change, just return us your MicroPerpex® peristaltic pump, and we'll refund you exactly what you paid for it. LKB will then supply you with an HPLC pump that instantly transforms all your existing equipment into a high performance chromatography system. With units that retain the simplicity of a system that's already become familiar routine to all your staff.

The Buy-Back Warranty carries only one condition. That you purchase your next LC system from LKB. And with more than 100,000 LKB instruments successfully at work, you'll be talking to the world's leading LC supplier. We've got over 30 years' experience in chromatography systems to prove it.

The right system

Only LKB offers you the world's largest and most comprehensive range of high quality instruments and accessories. Giving you unlimited choice to configure exactly the right system that meets both your needs and your budget. With modular and fully compatible components that can be perfectly matched into a totally integrated system. To give you command, control and communication. From basic LPLC to automated methods development. On a laboratory, preparative, pilot or even large scale. For isocratic or gradient work. Whatever system you choose, you'll know it's the right one. It's already equipped with the freedom to let you customize, extend and convert it as new needs arise.



B gives you ck™ Warranty

Future-proof chromatography

The selection of an LC system from LKB gives you future-proof chromatography. You'll get the ultimate specification for your current LPLC, with products that are designed and engineered to be used for HPLC. Fraction collectors, detectors, system peripherals and a gradient controller.

You only need a pump, plus an HPLC Conversion Kit. And our Buy-Back Warranty makes this conversion very easy. We'll offer you the best HPLC pump available, with a choice of fluidics for either standard work or fully biocompatible purification. Future-proof chromatography ensures that LKB will always be there to help you. Continuously updating you with new techniques and applications.

High quality and low cost for unbeatable value

For around $5000 LKB can supply you with a system that qualifies you for the Buy-Back Warranty. You'll get the latest fraction collector, a UV detector and the New MicroPerpex peristaltic pump. Because it's so easy to calibrate and set a flow rate, a much more accurate flow through your column can be achieved. So you'll be able to collect precise volume fractions. Add an LKB recorder and you'll be able to control the chart speed by flow, correlate tubes with peaks and automate your chromatography. This high quality yet low cost system can be purchased by simply phoning your nearest LBK office. You'll get the unique Buy-Back Warranty as soon as you order. And our new LC guidebook helps you design exactly the system you need.

Whether you want to replace outdated equipment with the latest LPLC system, or your work now needs HPLC, any MicroPerpex user still qualifies for this unique offer.