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SCIENCE

Why the TJ-6 continues to be the most popular tabletop centrifuge.

Five years after its introduction, the Beckman TJ-6 in both its nonrefrigerated and refrigerated (TJ-6R) models, is even more popular in biochemical, clinical, and industrial labs.

Why? Users tell us every time they get a chance—in letters, phone calls, visits to our instrument exhibits. They like the TJ-6 because it is well designed, a pleasure to use, and is so trouble free. They like the unusually quiet operation; the rotor bowl that lifts completely out for easy cleaning; the stainless steel buckets designed to contain spillage in case of tube breakage. Those with a Model TJ-6R especially appreciate its advanced, frost-free refrigeration system.

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If you're thinking about a tabletop centrifuge, be sure to ask a TJ-6 owner. And send for a copy of our equally popular Centrifuge Primer with the abc's of centrifuge principles and operating tips. No lab should be without either one.

Write Beckman Instruments, Inc., Spinco Division, P.O. Box 10200, Palo Alto, CA 94304.

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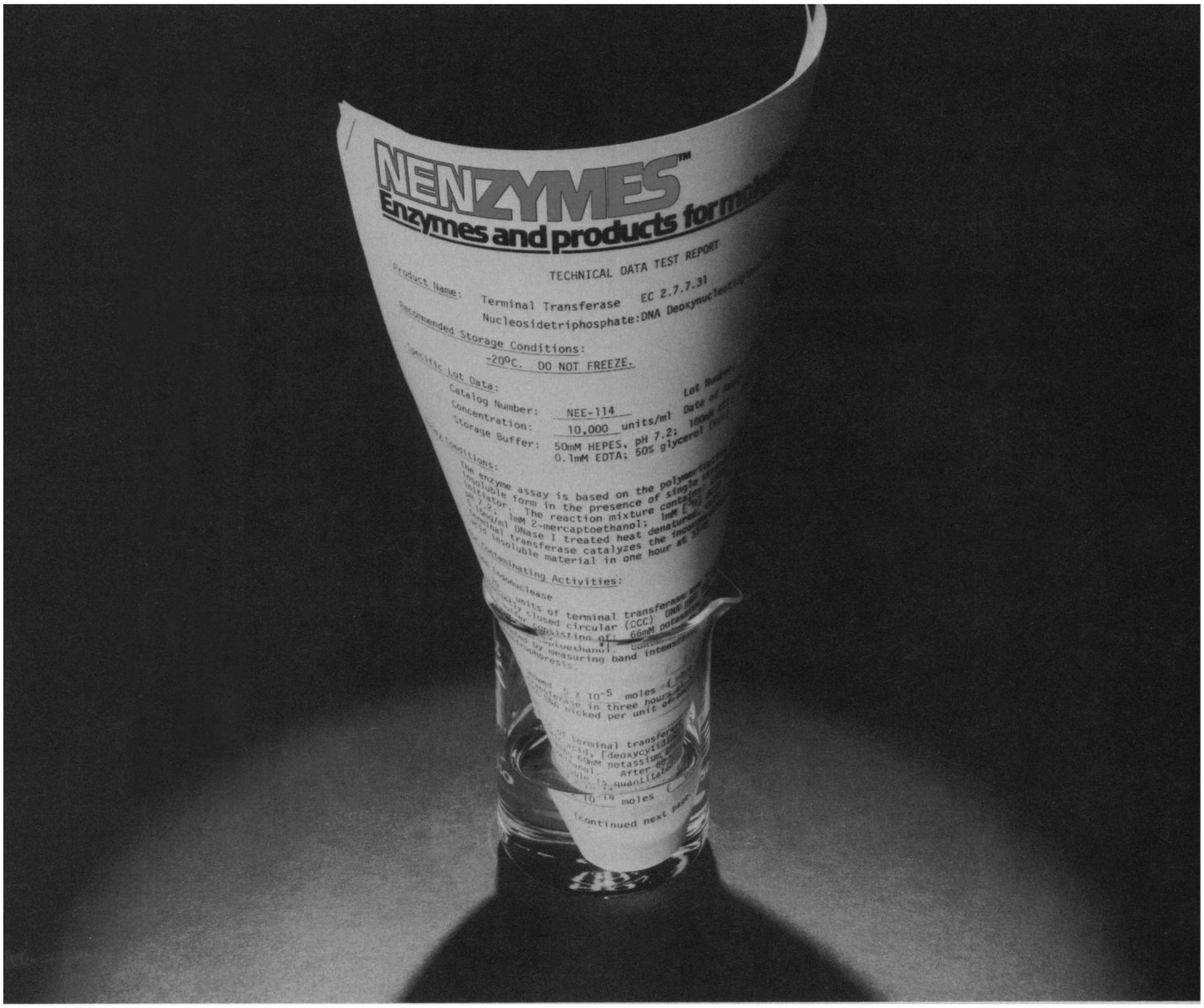

Before we call them ultra-pure, they have to get their feet wet.

NENZYMES™ is not simply a title bestowed on our ultra-pure enzymes and related products for DNA-RNA research. It is an award for performance.

NENZYMES must perform as standards in our routine biological testing programs for ^{32}P- and ^{3}H-labeled nucleotides, as integral components in our nick translation and end labeling systems, and as standard tools in our cloning laboratory. Even to qualify for this work each lot is first subjected to numerous specific assays (which are recorded for customer inspection).

So if NENZYMES weren't biologically pure we'd soon find out. We're just as insistent on trouble-free system performance as you are.

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SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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 seasons understand that balance
is the heart of change,
And understanding that, the seasons
always rearrange.
Yet still the order seems as endless
cycles round the sun,
And when we think we've learned
something, the lesson's just begun.

[From "Lighten Up and Let It Go," Bobby Bridger, © 1981 Stareyes Music (ASCAP), 708½ West 8th, Austin, Texas 78701; words used by permission; painting by George D. Boutwell, Jr., Austin] Texas longhorns at a waterhole. As the grazing industry developed at the turn of the century, the parasite *Cochliomyia hominivorax* became a major pest of livestock. Autocidal control of the pest has led to new problems. See page 361.

Chromatofocusing

A new high resolution technique for protein separation

A COMPLETELY NEW TECHNIQUE

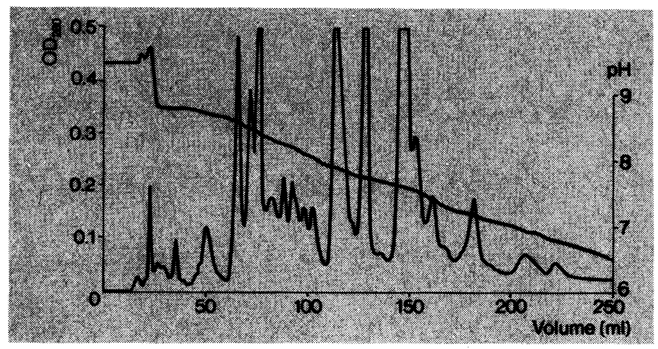
Chromatofocusing with Polybuffer™ and Polybuffer exchangers from Pharmacia Fine Chemicals is a completely new technique which combines the advantages of column chromatography and isoelectric focusing. Proteins are separated according to their isoelectric points in a self-generated pH gradient.

SIMPLE TO USE

Chromatofocusing is as simple to perform as gel filtration. All you need is a column, Polybuffer and Polybuffer exchanger.

HIGH CAPACITY AND RESOLUTION

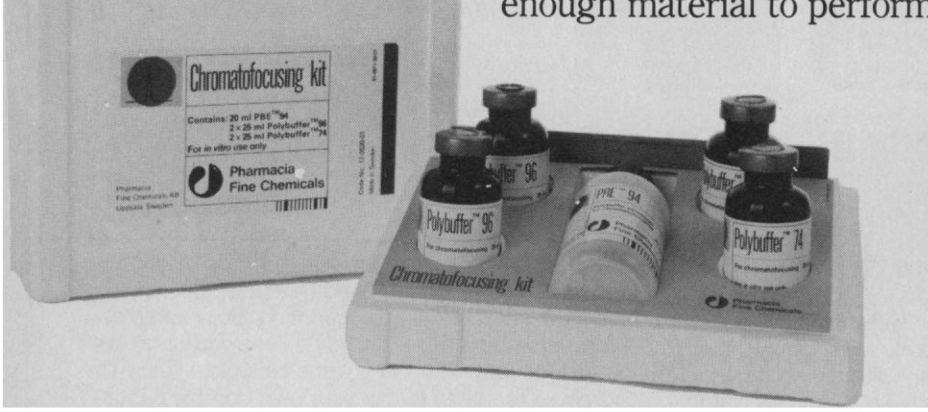
Several hundred milligrams of protein can be separated in a single run. Proteins are eluted as sharply focused, well separated zones, in a linear pH gradient.



Separation of proteins from mammalian muscle by chromatofocusing.

AVAILABLE IN KIT FORM

Two gels and three buffers cover the range pH 11–4. To help you get started, Pharmacia Fine Chemicals offers the Chromatofocusing kit, which covers the range pH 9–4. Included in this kit are full instructions and enough material to perform at least four runs.



Further information is available in the booklet "Chromatofocusing with Polybuffer and Polybuffer exchangers" available free on request.

Pharmacia Fine Chemicals
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"See us at The Pittsburgh Conference–Booths 3011, 3013 & 3015" 216

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QUEUE SINGLE COMPRESSOR CRYOSTAR FREEZERS ARE DELIVERING ULTRA-LOW TEMPERATURES TO -75°C, -100°C, AND -135°C WITH HALF THE EFFORT OF OUR CASCADE COMPETITORS.

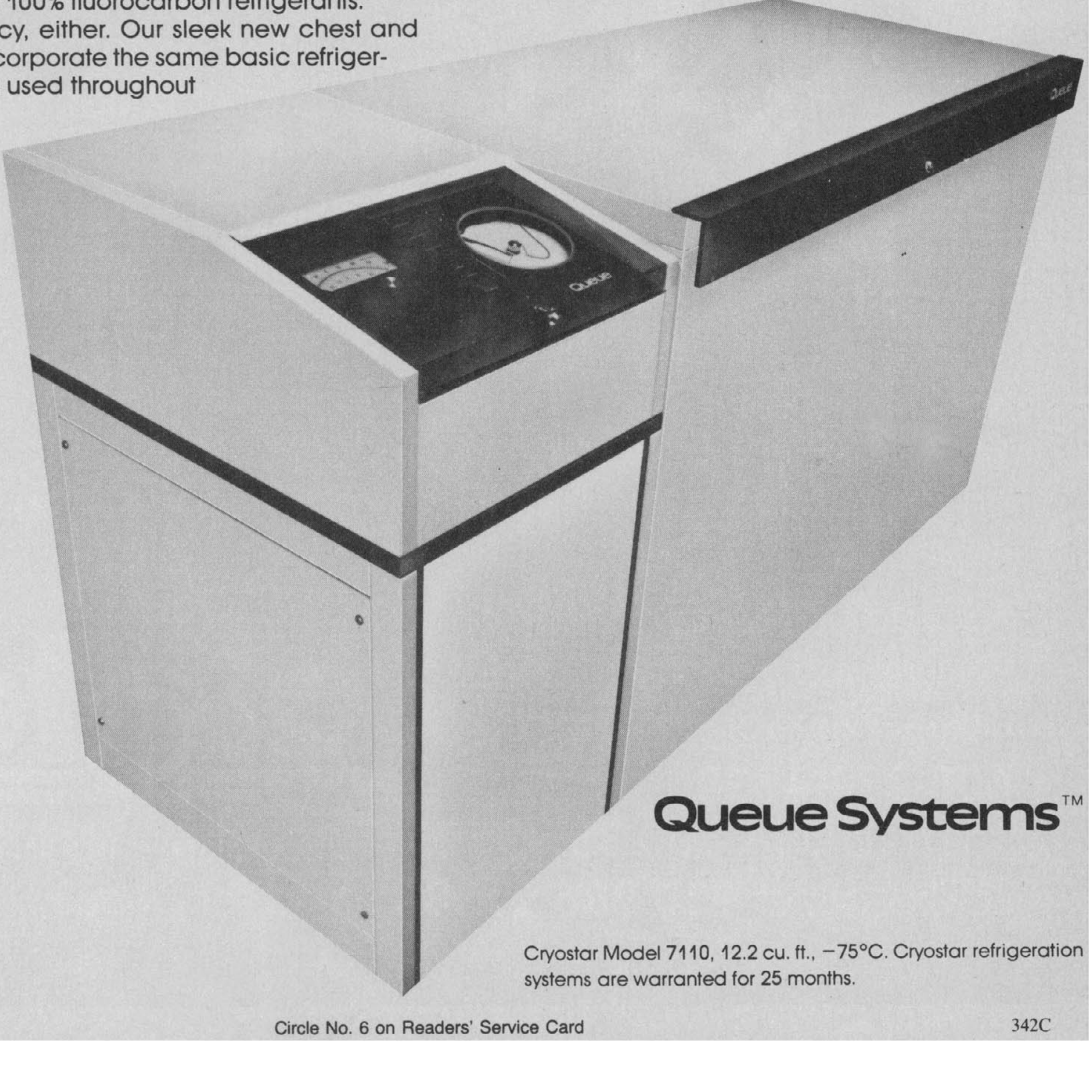
The most significant advancement in the state of the art since the development of ultra-low temperature freezers is the elimination of the cascade refrigeration system.

Unlike cascade freezers that mercilessly push two or three compressors beyond performance specifications into chronic failure, the Queue Cryostar freezers have only one compressor, running cool and effortlessly, with non-explosive 100% fluorocarbon refrigerants.

Nothing fancy, either. Our sleek new chest and upright freezers incorporate the same basic refrigeration components used throughout your own home.

Remarkably, too, the Cryostar single compressor capabilities easily surpass the physical limitations of cascade designs to yield, at last, the first ever mechanically refrigerated −135°C cryogenic storage systems.

For details on the exciting Cryostar freezers that do twice as much with half the effort, call or write us at Box 1901, Parkersburg, WV 26102, 304-464-5400.



Queue Systems™

Cryostar Model 7110, 12.2 cu. ft., −75°C. Cryostar refrigeration systems are warranted for 25 months.

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Ortho-mune* monoclonal antibodies in only two years generated more than 100 published papers

In a way, this is a tribute to Köhler and Milstein. Because they're the ones who gave us the idea. But the scientists and engineers at Ortho deserve credit, too, for making it happen.

It started, of course, with monoclonal antibodies. Six years ago, when George Köhler and Cesar Milstein showed the world how hybridomas could be made to produce antibodies against specific immunogens, there was no way to predict exactly which questions the new technology would answer.

OKT*: WELL-CHARACTERIZED MONOCLONAL ANTIBODIES†

The questions we had at Ortho were immunological ones. Our researchers were particularly interested in human lymphocytes. We developed a series of monoclonal antibodies directed against purified human T cells and called them the OKT panel.

Then the real work began. Because clear-cut results can come only from well-characterized reagents, scientists at Ortho put a lot of emphasis on defining the specificity of each clone. Input also came from scientists outside Ortho who worked with the OKT reagents. And as more has been published about the reagents, they've become more and more useful.

New potential applications came to mind. It began to look like the OKT reagents could standardize T lymphocyte subset analysis. Some immune deficiency disease states turned out to be associated with abnormal ratios of T cell subsets. Research oncologists have now begun using the OKT reagents to characterize proliferative lymphocytic disease states, and they have been used to study immune responses to renal transplantation.

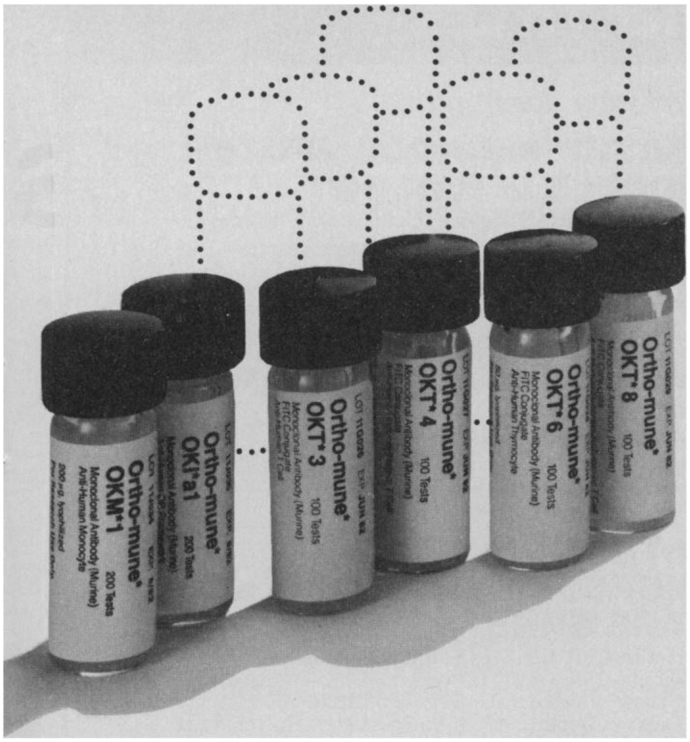
MONOCYTES AND Ia-POSITIVE CELLS

We continued to develop more monoclonal antibodies. The new ones could differentiate monocytes and Ia-positive cell subsets. More applications were developed—sorting human peripheral blood cells, elimination of cell populations by complement lysis, studies on cytotoxicity and histochemical staining of tissue sections.

*Trademark

†For research use only.
Not to be used for diagnostic procedures.

Ortho Immunology Systems: at the leading edge in human immunology research



CELL SORTING AND ANALYSIS: CYTOFLUOROGRAF®

We created the Cytofluorograf to meet the growing demands for laser based cell analysis and sorting. Then we combined it with the Model 2150 computer system to provide the flexibility needed for ever-changing research demands in immunobiology, chromosome analysis and molecular genetics. That's the kind of innovation that makes the Cytofluorograf a leader in flow cytometry.

ORTHO SPECTRUM III*

If you are involved in large volume clinical research projects, you may need high speed analysis of whole blood, without the inconvenience of time-consuming sample preparation.
That's what the Ortho Spectrum III does. Integrating Ortho-mune‡ monoclonal antibody technology and laser flow cytometry, this flexible microcomputer-based system can be programmed for accurate cell differentiation on the basis of size and immunofluorescence.

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‡Formerly Orthoclone*

FITC-CONJUGATED ANTI-HUMAN T CELL REAGENTS

We know how busy you are. Our new fluorescein-conjugated OKT monoclonal antibodies should help. They reduce staining procedures to one time-saving step. And more new monoclonal antibodies and fluorescent reagents are being developed and characterized at Ortho.

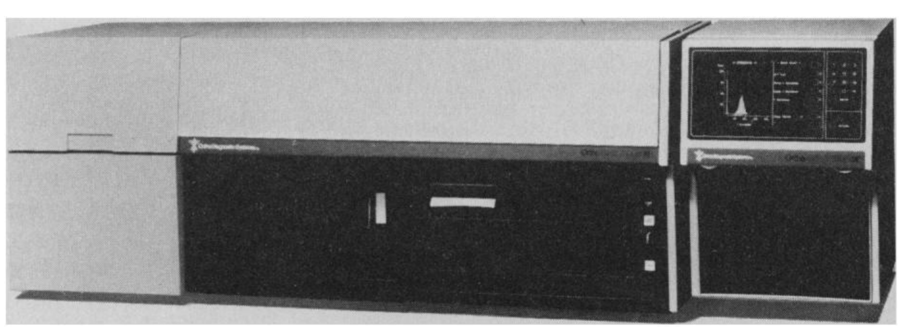
THE LEADING EDGE

Applications for the Ortho-mune products are following quickly on the heels of research developments. Research oncologists, rheumatologists and immunologists in and out of Ortho are using the System to take a closer look at leukemia, rheumatoid arthritis, multiple sclerosis, myasthenia gravis and response to infections. We've become more than just producers of monoclonal antibodies. We have a commitment to development of integrated systems for analysis of the human immune system. Ortho Immunology Systems is a name that seems to cover it.

Ortho brings you innovative technology—reagents and instruments developed by research immunologists for immunology research.

We'll be pleased to talk with you about setting up a system for lymphocyte subset analysis in your own laboratory. Call us at (800) 526-3875. In New Jersey, call (201) 524-1365.

Ortho Diagnostic Systems Inc.



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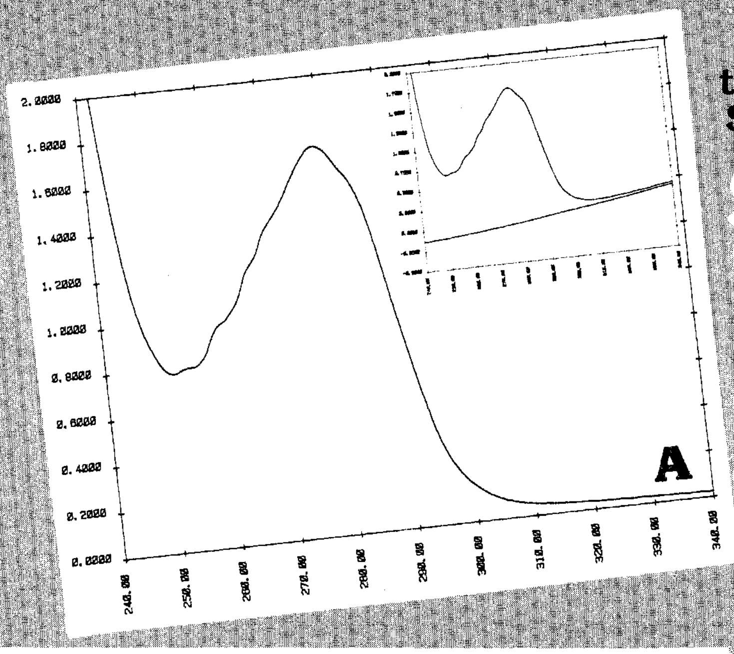
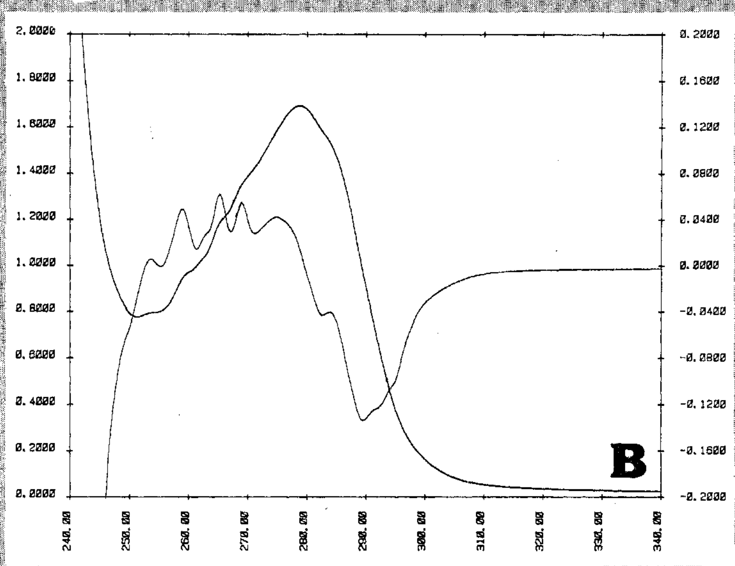
Gilford's

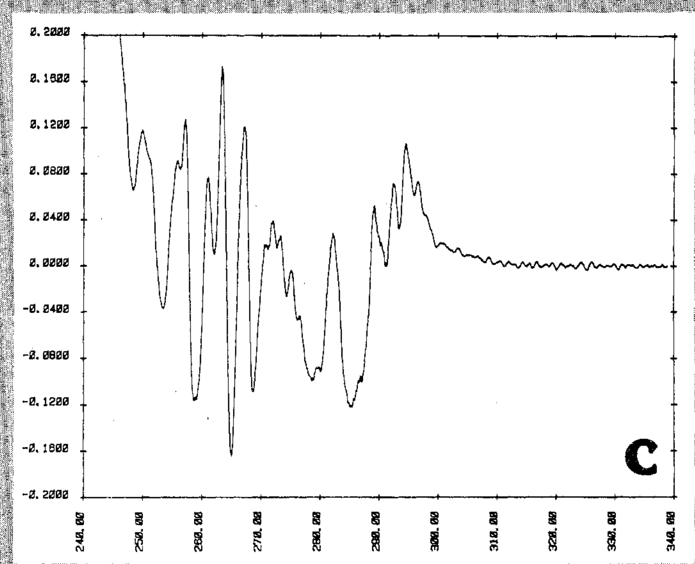
System 2600,

the Definitive UV-VIS Computing Spectrophotometer

So Much Information From a Single Scan...







A First, during a single scan, the microprocessor stores all the data the spectrophotometer measures. Automatically.

Once stored, this data can be manipulated in many ways. In our example, we assayed 0.3gm% of Bovine Serum Albumin in a 0.1M phosphate buffer, scanning from 240 to 340nm in 0.1nm steps. Graph A shows System 2600's replotting capability: we ran reference and sample separately (inset) and then System 2600 automatically plotted the difference spectrum.

B The second graph shows that difference spectrum with the first derivative automatically overlaid. We used a data window of 10 points. Note the automatic replotting, too, of the derivative scale on the alternate Y-axis.

C The third graph shows the second derivative by itself, produced digitally (like all derivatives) by System 2600. Here we used a data window of 5 points, with 5X amplification.

System 2600 does it all, presenting the data in its most significant format without rescanning. What's more, the system prechecks the validity of the data before "reformatting" it. It takes but the smallest fraction of a second, to save what sometimes seems like a lifetime of data-gathering.

System 2600: efficiency, flexibility and accuracy. Value that transcends its moderate price.

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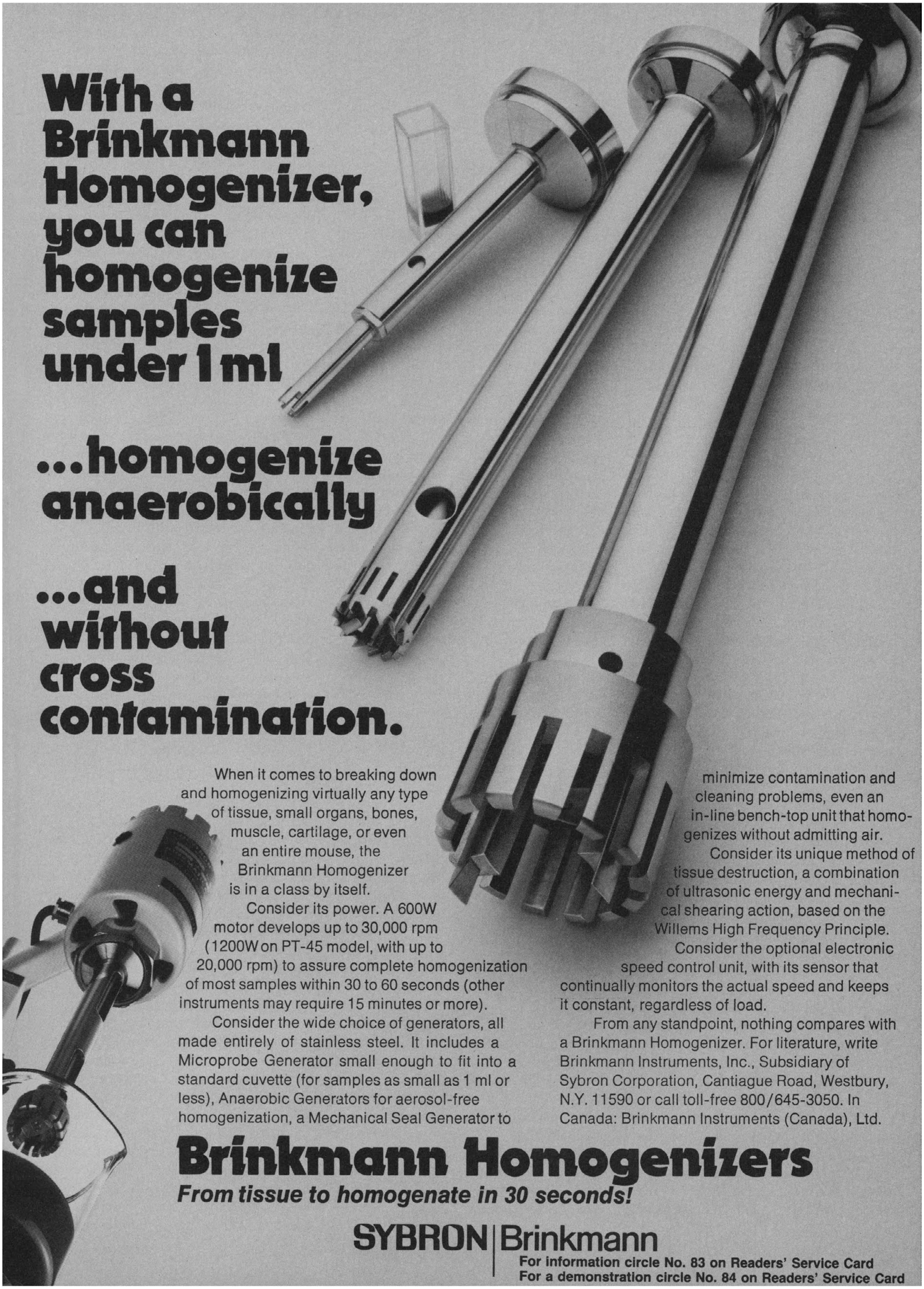


1529

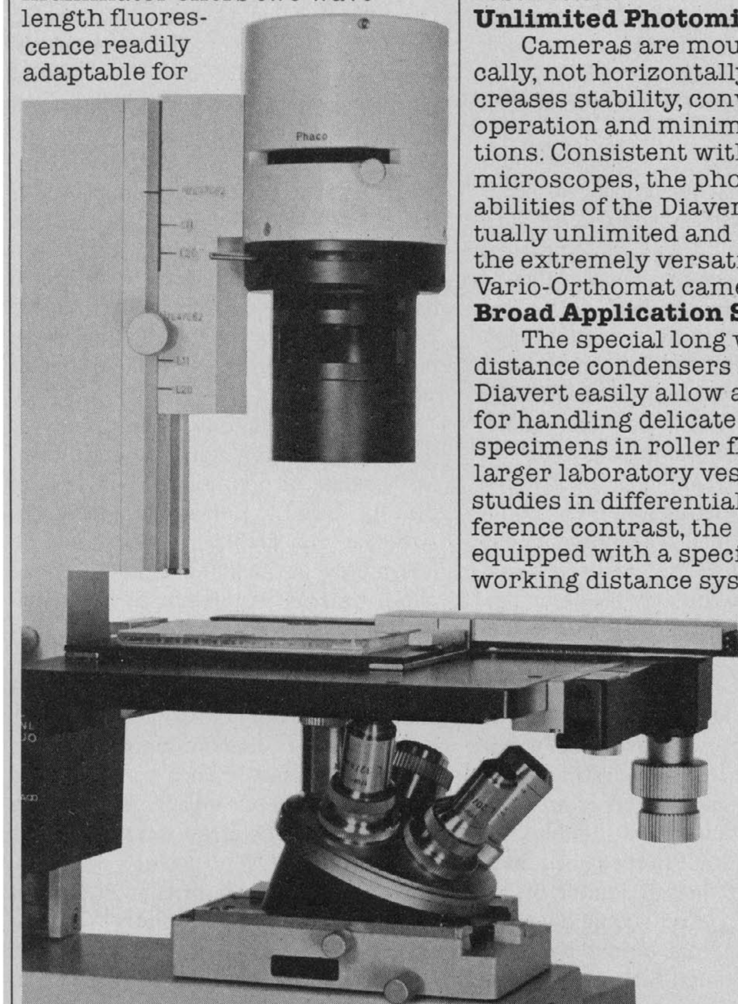
Leitz Diavert. **The only inverted microscope system with Leitz quality any way you look at it.**

The Leitz® Diavert is the perfect answer to the constantly changing applications of the inverted microscope. Because as lab needs evolve, the highly modular Diavert is made to meet them. All of them.

The core of the Diavert is an L-shaped stand. It easily supports elaborate photographic and specimen handling equipment as well as a multitude of accessories for transmitted and reflected light microscopy.

Microscopical Techniques

The condenser system provides a 62mm free working distance for brightfield and phase contrast up to 40x objective magnification. The optional Ploem incident light fluorescence illuminator offers two wave length fluorescence readily adaptable for fluorescence studies in multiple well dishes or regular slides. Of course, you can call upon darkfield, interference contrast and the new reflection contrast for the study of phase phenomena in tissue cultures.



Micromanipulation

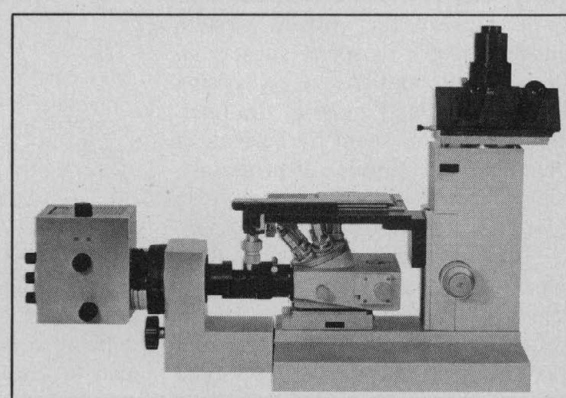
The stage is positioned low and the specimen is accessible from three sides. Plus a simple adaptation lets you focus the nosepiece rather than the stage. So you can use the renowned Leitz Micromanipulator without restriction.

Unlimited Photomicrography

Cameras are mounted vertically, not horizontally. This increases stability, convenience of operation and minimizes vibrations. Consistent with all Leitz microscopes, the photographic abilities of the Diavert are virtually unlimited and it accepts the extremely versatile new Vario-Orthomat camera system.

Broad Application Spectrum

The special long working distance condensers of the Diavert easily allow ample space for handling delicate in vivo specimens in roller flasks or larger laboratory vessels. For studies in differential interference contrast, the Diavert is equipped with a special long working distance system for objective magnifications up to 32x.



On a day to day basis, the Diavert becomes a very reliable laboratory asset. The images seen move in the same direction as the specimen moves. This is especially convenient for micromanipulation and whenever the culture vessel is moved by hand. Since the very large (164 x 160mm) stage is positioned relatively low, the technician can comfortably see the specimen during operation. There is a broad range of interchangeable components for studies in tissue culture, histocompatibility, physiology and marine biology.

The Diavert is the inverted counterpart of the upright Leitz Ortholux® II research microscope. All major components are freely interchangeable between these instruments.

The details and technical specifications are equally impressive.

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Please send me information on the Leitz Diavert inverted microscope.

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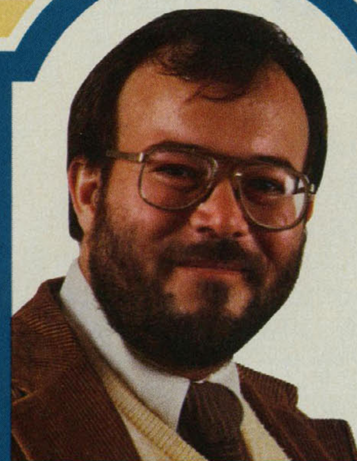
"When he grinned, I knew he was onto something. But what?"



"I was leading a seminar on fluorescence spectroscopy. My audience was small but represented some of the leading principal investigators in the country.

"After my presentation I invited questions. One researcher in attendance posed some very interesting ones.

"At first his questions were of a general nature: 'What's the fluorescence lifetime measurement capability of your SLM 4800 Spectrofluorometer?' 'How about fluorescence polarization?' Then they became more specific. And their delivery more rapid. His pauses between questions were punctuated by a contemplative tug on his left eyebrow.

"Our conversation—a quiz really—ended when I directed a specific question at him. A grin was his only response.

"Then I knew he was onto something. But what?

"After the meeting broke up, he cornered me and said he had more questions but would rather discuss them privately. With his colleagues present. In his lab.

"I've had this same experience more than once. That our scientific equipment can spark creative thought . . . provide a new link between ideas or simply vague concepts . . . and that our full-time staff, mostly PhD's, freely offer their expertise in diverse specialties to help solve complex research problems or analyze custom production line applications. That's performance and it's exciting.

"The fact that our SLM 4800 and 8000 Spectrofluorometers are unsurpassed in precision and capabilities . . . that's exciting, too. But, to me, that's more a matter of pride."

Dr. Robert Fugate is Customer Applications Manager for SLM Instruments, Inc. He or other members of our staff will be happy to answer your questions concerning fluorescence measurements as they might pertain to your needs. For detailed literature and a copy of our applications brief, write SLM Instruments, Inc., 810 West Anthony Drive, Urbana, Illinois 61801, U.S.A. or call (217) 384-7730. TELEX 20-6079.

SLM

Performance is the difference.

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22 January 1982, Volume 215, Number 4531

SCIENCE

Clean Fuels from Coal

Coal seems destined to become a major source of energy and chemicals. But present technology for its use is primitive. Direct combustion of coal results in the formation of oxides of sulfur and nitrogen. These gases have been linked to acid rain, which has become an increasing source of concern. Flue gas desulfurization is being practiced in new power plants and removes as much as 90 percent of their sulfur oxides, but this is accomplished at the cost of reliable operation of power plants and the production of enormous amounts of calcium sulfate sludge.

Improved technology for utilization of coal is on its way. Of special significance are developments in gasification. By this means one can quantitatively remove in the form of hydrogen sulfide and ammonia the sulfur and nitrogen that were originally present in the solid. When the gasification is accomplished at a high temperature with oxygen and water, the coal is completely destroyed and synthesis gas (carbon monoxide plus hydrogen) is formed. This gas can be burned as a fuel, processed to yield methane, or used as a feedstock for synthesis of many chemicals.

A number of processes have been devised for gasification. These include the Lurgi, the Koppers-Totzek, and the Texaco processes. It seems likely that the Texaco process will become widely applied. Its principal feedstock is a coal slurry, and coal slurry transportation will have a large future role. The process is flexible in its utilization of a wide variety of coals. The gasifier operates at temperatures of 1250° to 1500°C and pressures of 350 to 1200 pounds per square inch. Under these conditions the organic matter in the coal is completely gasified. There are no tarry residues. The Texaco process is highly suitable for integration with combined cycle electric power generation. This application is now about to be tested in a $300 million installation being built in southern California.

An article in a forthcoming issue of *Science* describes the overall system.* It is designed to convert efficiently the thermal and chemical energy of the hot gases into electricity. In order to remove particulate matter and H_2S and NH_3 from the gas, it must be cooled. This will be done by using heat exchangers, from which hot water and steam will be obtained. The steam will drive a turbine. Once the gas has been cleaned it will be burned in a gas turbine. Heat from the hot combustion gas will also be used to make steam.

The demonstration plant is designed to use 1000 tons of coal a day and to produce 100 megawatts of power. It is scheduled to become operational in 1984. Many tests will be conducted on it. Different coals will be burned. Its performance as one of the components of a generating system will be studied. Of particular interest will be the response of the plant to sudden changes in electrical demand. One of the hoped for advantages of this type of plant is that it will be cost-efficient on the scale of 100 to 300 megawatts. It is further believed that such plants could be constructed more rapidly than the 500- to 1000-megawatt installations currently being built. This would give the utility companies much more flexibility in matching capacity to unpredictable demand.

The demonstration plant is being constructed under the sponsorship of the Electric Power Research Institute, Southern California Edison, General Electric, Bechtel, and Texaco. No federal funds are involved. Siting of the plant in California makes good sense. As much as 79 percent of electricity generated by Southern California Edison is derived from oil or natural gas. The plant will easily meet the rigorous state standards for air pollution.

Sponsors of the demonstration plant merit congratulations for their initiative and risk-taking. It is likely that they will be rewarded. This new venture shows great promise, and its success would solve many of the problems of the utilities while giving them an opportunity to have a role in the synthetic chemicals field.—PHILIP H. ABELSON

*D. F. Spencer, M. J. Gluckman, S. B. Alpert, *Science*, in press.

PUREST COLLAGENASE

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Derived from *Clostridium histolyticum*

Collagen is the most pervasive protein in the animal kingdom. In man approximately one-third of the total protein content is collagen. Its triple helix structure, which contributes to its great strength, may also account for its resistance to all non-specific proteases at normal pH and temperature. It's not surprising therefore that the unique ability of collagenase to digest native collagen has exciting potential. We're proud that we were the first company to win approval for medical use of this fascinating enzyme. Collagenase has been one of our major efforts for more than 20 years. We'll be glad to make available to you our accumulated information for your studies with this most protean protein.

COLLAGENASE ABC FORM III

Our purest collagenase, with no detectable non-specific protease

We're also proud that our purest fractions have won approval from biochemists throughout the world. You may be interested to learn what some of them are doing:

FROM MICE TO ELECTRIC EELS

Collagenase ABC Form III has been used to study collagen metabolism

In cell free systems – steps in collagen formation

- collagen mRNA (from chick embryo)
  Neufang, O., & Tiedemann, H. (1975) Hoppe-Seyler's Z. Physiol. Chem. *356*, 1445-50.
- collagen synthesizing polysomes (from rat lung)
  Cutroneo, K.R., Newman, R.A., Prichard, P.M., Guzman, N.A., & Sharawy, M.M. (1977) Int. J. Biochem. *8*, 421-6.
- lysyl hydroxylation of collagen (in rat lung)
  Guzman, N.A., Rojas, F.J., & Cutroneo, K.R. (1976) Arch. Biochem. Biophys. *172*, 449-54.
- lysyl hydroxylation of collagen (in chick embryo)
  Murray, J.C., Lindberg, K.A., & Pinnell, S.R. (1977) J. Clin. Invest. *59*, 1071-9.
- proline hydroxylation of collagen (in guinea pig granuloma)
  Miller, R.L., & Udenfriend, S. (1970) Arch. Biochem. Biophys. *139*, 104-13.

In tissue culture – collagen biosynthesis

- by human lung explant
  Bradley, K., McConnell-Breul, S., & Crystal, R.G. (1975) J. Clin. Invest. *55*, 543-50.
- by human skin fibroblasts
  Booth, B.A., Polak, K.L., & Uitto, J. (1980) Biochim. Biophys. Acta *607*, 145-60.
- by 3T6 mouse fibroblasts
  Bates, C.J., Pyrnne, C.J., & Levene, C.I. (1972) Biochim. Biophys. Acta *263*, 397-405.

Other applications of Collagenase ABC Form III

- isolation of tissue collagen (from rat aorta)
  Newman, R.A., & Langner, R.O. (1975) Anal. Biochem. *66*, 175-84.
- characterization of collagen precursors (from rat skin and bone)
  Smith, B.D., McKenney, K.H., & Lustberg, T.J. (1977) Biochemistry *16*, 2980-5.
- degradation of basement membrane collagen fragments (from bovine lens capsules)
  Uitto, V-J., Schwartz, D., & Veis, A. (1980) Eur. J. Biochem. *105*, 409-17.
- release of fibronectin from trophoblast and alveolar basement membrane (human placenta and lung)
  Bray, B.A. (1978) Ann. N.Y. Acad. Sci. *312*, 142-50.
- modification of acetylcholinesterases (in the electric organ of *Electrophorus electricus*).
  Johnson, C.D., Smith, S.P., & Russell, R.L. (1977) J. Neurochem. *28*, 617-24.

For Tissue Dissociation

Tissue dissociation requires an optimum ratio of collagenase to protease for maximum yield and viability of the dispersed cells. Tissues from different organs need different ratios of collagenase to protease. In order to achieve the correct ratio in your system you can now select one of our partially purified collagenases (TD series) and use it in combination with our clostridial non-specific protease (NSP series). You can then be assured of reproducing this same ratio from experiment to experiment. These enzymes and their relative activities are described below.

Enzyme	Units per mg		
	Collagenase (ABC units)	Protease (Kunitz units)	Ratio Coll./Protease
• Collagenase ABC Form I	100-150	6-9	16
• Collagenase ABC Form TD	300-400	7-10	40
• Collagenase ABC Form TD-A	1000-1600	30-40	40
• Collagenase ABC Form TD-B	4000-8000	1-3	3000
• Protease ABC Form NSP	Trace	60-120	

PRICES

	Per Vial	Per 100 mg	Per gram
Form III	$31.50	–	–
Form I	–	$ 8.25	$65.00
Form TD	–	$10.00	$75.00
Form TD-A	–	$40.00	–
Form TD-B	$45.00~4mg	–	–
NSP	$20.00~4mg	–	–

You May Be Interested To Know...

That we are the world's largest and probably only producer of pharmaceutical grade collagenase. Obviously, we're interested in working with people on the other clostridial enzymes such as clostripain, proline-prolidase, etc. We also produce a number of other enzymes (chitinase, fibrinolysin) and would be glad to work with you on custom fermentations or purifications of different microbial products.

PUREST IS PRETTY PURE

The purity of our Collagenase ABC Form III and its freedom from non-specific proteolytic activity has been shown by a number of investigators.

Some quotes follow:

"We have now used... Collagenase Form III ... which you sent us, and found that it gave very good results in the preparation of mouse spleen macrophages, both as regards yield and viability." N. Wedderburn, personal communication.

"The collagenase used for these assays did not release any radioactivity when incubated with [^{3}H]tryptophan-labeled proteins from *Escherichia coli*." Guzman *et al.* (1976) Arch. Biochem. Biophys. **172,** 450; and Cutroneo *et al.* (1977) Int. J. Biochem. **8,** 422.

"A more critical criterion of the specificity of the purified collagenase in this system is that it did not digest tryptophan-^{14}C-containing proteins isolated from guinea pig granuloma (collagen does not contain this amino acid)." Miller & Udenfriend (1970) Arch. Biochem. Biophys. **139,** 106.

"However when chick globin mRNA. . . . was added to wheat germ extract, about 15% of the newly synthesized, [^{3}H] proline labelled protein was degraded by rechromatographed Worthington collagenase, but only 0.5% by the Advance Biofactures collagenase." Neufang & Tiedemann (1975) Hoppe-Seyler's Z. Physiol. Chem. **356,** 1446.

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