

You've never seen amino acids separated like this before.

Introducing Beckman System 6300—the high performance analyzer with state-of-the-art speed, sensitivity and accuracy.

Hydrolyzates in a half hour, physiological fluids in 2 hours—both with superb resolution. You can record sample components as low as 10 picomoles with confidence.

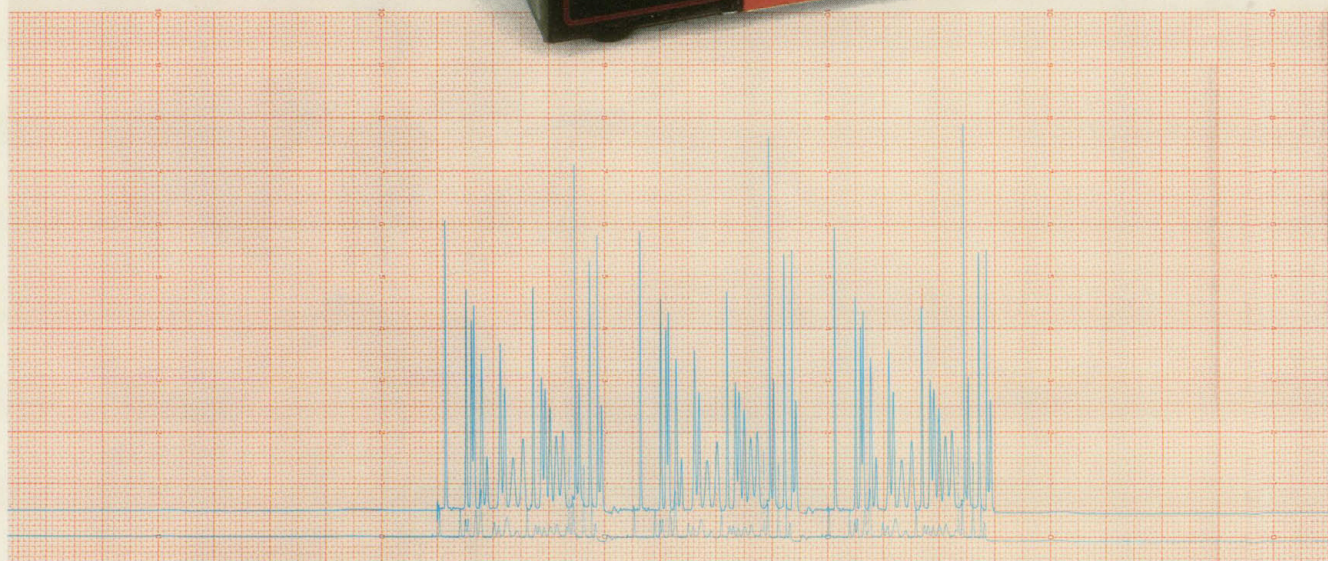
System 6300 is a new generation—the total systems approach in amino acid analysis:

- Single, stainless steel, pre-packed column with operation up to 3000 psi for hydrolyzates and physiological fluids.
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- Phototransistor flowmeter with instant measurement for digital readout.
- New, solid-state tubular reactor to maximize color development.
- Touch-programmable manual or automatic control, built-in four-program memory plus Memory-Pac™ capability.
- Specially formulated and tested Beckman reagents—a new standard in purity and value.

You can expect superior performance and ease of operation backed by nearly a quarter century of worldwide Beckman service and applications expertise in amino acid analyzers.

Reduced copy of actual System 6300 traces showing three half-hour replicate hydrolyzate runs. For a full size copy with data integrator tape write Ms. Jane Such.

System 6300—amino acids separated like never before. You'll see. Call your Beckman representative, or write: Beckman Instruments, Inc., Spinco Division, P.O. Box 10200, Palo Alto, California 94304.



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^3H nucleotides that solve a problem
with a better solution

^3H Nucleotides ready to pipet

To save you the bother of removing or concentrating the packaging solution, we've packaged seven ^3H nucleotides in aqueous solution at 2.5mCi/ml. At the same time we extended their radiochemical stability with 10mM Tricine, a proven stabilizer known to be compatible in research systems.

TTP, [methyl- ^3H]- 50-80Ci/mmol
NET-221A 250 μCi 1mCi 5mCi in dry ice

TTP, [methyl-1', 2'- ^3H]- 90-110Ci/mmol
NET-520A 1mCi 5mCi in dry ice

dATP, [8- ^3H]- 10-25Ci/mmol
NET-268A 250 μCi 1mCi 5mCi in dry ice

dCTP, [5- ^3H]- 15-30Ci/mmol
NET-369A 250 μCi 1mCi 5mCi in dry ice

dCTP, [5, 5'- ^3H]- 40-60Ci/mmol
NET-601A 1mCi 5mCi in dry ice

dGTP, [8- ^3H]- 5-15Ci/mmol
NET-429A 250 μCi 1mCi 5mCi in dry ice

dGTP, [8, 5'- ^3H]- 25-50Ci/mmol
NET-448A 1mCi 5mCi in dry ice

Also available in standard ethanol:water packaging by deleting the A from the ordering number.

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ω -3 Polyunsaturated Fatty Acids

For studies of the metabolic pathways and biological actions of these acids

Linolenic acid, 9, 12, 15-[1- ^{14}C]-
40-60mCi/mmol Ethanol under argon, in dry ice
NEC-779 50 μCi 250 μCi

Docosaheptaenoic acid, 4, 7, 10, 13, 16, 19-[^{14}C (U)]-
>100mCi/mmol Ethanol under argon, in dry ice
NEC-784 5 μCi 10 μCi

Eicosapentaenoic acid, 5, 8, 11, 14, 17-[1- ^{14}C]-
40-60mCi/mmol Ethanol under argon, in dry ice
NEC-772 10 μCi 50 μCi

Eicosapentaenoic acid, 5, 8, 11, 14, 17-[^{14}C (U)]-
50-100mCi/mmol Ethanol under argon, in dry ice
NEC-754 5 μCi 10 μCi

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Calmodulin [^{125}I]

Stable. Produced by Bolton-Hunter Reagent conjugation to bovine brain calmodulin

Tested for antibody binding

Calmodulin, [^{125}I]-
50-150 $\mu\text{Ci}/\mu\text{g}$
0.05M phosphate buffer, pH 7.4, 0.1M NaCl
0.1% gelatin, 0.05% sodium azide
NEX-172 5 μCi 10 μCi

Also available... Calmodulin, [^{125}I]- RIA Kit

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Iodocyanopindolol [^{125}I]

Specific to β_1 and β_2 adrenergic receptors
Higher affinity ($K_D \sim 27$ -40pmol) and specificity than
iodohydroxybenzylpindolol

Carrier-free $\sim 5400\mu\text{Ci}/\mu\text{g}$

Iodocyanopindolol, [^{125}I]-
2200Ci/mmol
n-Propanol:water:phenol (50:50:1.2), in dry ice
NEX-174 100 μCi 500 μCi 1mCi

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FSH, LH [^{125}I]

Follicle Stimulating Hormone, [^{125}I]-
50-100 $\mu\text{Ci}/\mu\text{g}$

Lyophilized from sodium phosphate buffer, pH 7.4,
containing BSA and a proteolytic enzyme inhibitor
NEX-173 10 μCi 25 μCi 100 μCi

Luteinizing Hormone, [^{125}I]-
50-100 $\mu\text{Ci}/\mu\text{g}$
Lyophilized from sodium phosphate buffer, pH 7.4,
containing BSA and a proteolytic enzyme inhibitor
NEX-170 10 μCi 25 μCi 100 μCi

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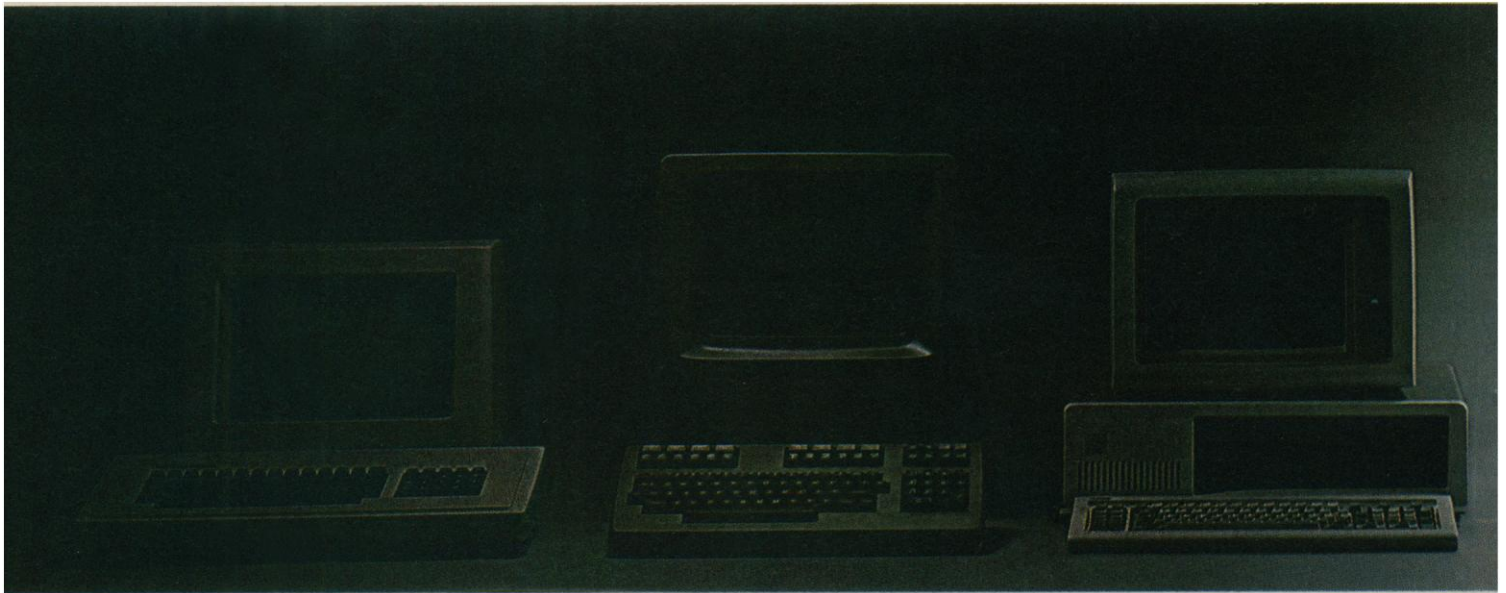
GENERAL (X)
Daniel Alpert
S. Fred Singer

COVER

Representatives of families of land mammals that participated in the Great American Faunal Interchange. Animals shown in North America migrated northward from South America (and vice versa) after the appearance of the Panamanian land bridge about a million years ago. See page 1351. [Marlene Hill Werner, Field Museum of Natural History, Chicago, Illinois 60605]

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.

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Welcome to a tour of the biggest Apple.
The Apple® III Personal Computer—the most powerful machine in its class.

Because it's the only personal computer that lets you add up to 256K RAM, hang on a full complement of peripherals, and still have four expansion slots left for future growth. (Unlike some micros which become woefully "slot-bound" when upgraded to maximum memory.)

Because it's the only machine now using 64K RAM chips to keep 256K tidy on a single board.

And because it's the only machine that gives you the help of SOS.

THE MOST SOPHISTICATED OS.

SOS is the Apple III's Sophisticated Operating System, an elegant software interface that frees you from most system control tasks. It features a hierarchical file system, device- and user-level interrupt capabilities, a device-independent file system and memory management capability.

Since all Apple III languages use SOS, they share a common disk format. So Apple III programs can merge and communicate—a Pascal application program can directly access a BASIC text file, for example.

Xerox 820	Hewlett-Packard 125—Model 10	IBM Personal Computer	Apple III
<i>Standard Memory</i>			
64K	64K	64K	128K
<i>Maximum Memory when fully configured*</i>			
64K	64K	192K	256K
<i>Expandability</i>			
No expansion slots	No expansion slots	No extra expansion slots in fully configured* 192K system	4 extra expansion slots in fully configured 256K system*
<i>Diskette Storage (per drive)</i>			
92K	256K	160K	140K
<i>Mass Storage (per drive)</i>			
—	1.16 megabyte Floppy Disk	—	5 megabyte Hard Disk
<i>Display Graphics Capability</i>			
High resolution B/W	High resolution B/W	High resolution B/W or 4-color (color requires additional card)	High resolution B/W or 16-color
<i>Software Available</i>			
Word Processing Super Calc® — Communications — CP/M® library	Word Processing VisiCalc® 125 Business Graphics Communications — CP/M® library	Word Processing VisiCalc® — Communications — CP/M® 86 programs	Word Processing VisiCalc® III Business Graphics Communications Apple II software library CP/M® library (available Spring, 1982)

*"Fully configured" means system includes, at minimum, monitor, printer, 2-disk drives and RS-232 communicator. NOTE: Chart based on manufacturer's information available as of December, 1981.

WE'VE SEEN THEIR GENERATION AT OUR THIRD.



SOS allocates system resources to make the most of dynamic memory, simplifies programming with standard device and file interfaces for all languages, and speeds software development by reducing program size and complexity.

OUR NEW PROFILE.

ProFile™ is Apple's new personal mass storage system—a quick, quiet 5MB hard disk ideal for software development or any mass storage application. Shown above twixt monitor and console, it comes with everything you need to get up and running, including interface card and driver software.

The III's standard built-in drive is a 140-K floppy that can be daisy-chained with three additional drives through a back panel connector. Which leaves you plenty of expansion slots for things like our new Universal Parallel Interface Card or our OEM Prototyping Card.

CHANGE KEYS.

The 128-character ASCII-encoded keyboard happens to be fully-programmable. So you can (with SOS) do neat things like remap it into

DVORAK. Or create armies of special function keys. Or teach your Apple to display Chinese.

Its own languages already include Business BASIC, UCSD Pascal™, Assembly and, soon, a powerful new COBOL—and, in emulation mode, most languages available for Apple II.

Look up from the keyboard and you'll see our standard Monitor III green phosphor display (80 char. x 24 lines, u/l).

It can show you some of the highest resolution graphics available—280 x 192 in 16 gray scales, or, with a color monitor, in 16 colors.

HIT LIST.

We have a new edition of that monster hit, VisiCalc® with more modeling space than any other version. Plus AppleWriter III, a powerful new word processing package. Plus a new Business Graphics package. Plus a new Mail List Manager.

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Plus Access III—sophisticated smart terminal software to access mainframes with asynchronous communications up to 9600 bps.

Plus Apple II emulation to access that vast software library.

Plus, soon, a CP/M® card to access that other vast library.

Even with all this, the Apple III's potential remains essentially untapped.

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We're sure you'll find that between our third generation and their first, there's quite a gap.

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As well as our own fast, efficient, reliable operating system (RDOS). Our highly functional, user-friendly, multiprogramming operating system, (AOS). And a full range of computational languages: FORTRAN, BASIC, PASCAL, PL/I, DG/L (our systems programming language), and a complete set of programmer productivity aids.

And of course, the ECLIPSE peripherals. They're all here. Ready to go.

All of which means there is an ECLIPSE which has everything you need for everything you want to do. In medical instrumentation, process control, computer-aided design, automated test equipment, communications or what-have-you.

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THE LEADING EDGE

#2 in a series of reports on new technology from Xerox

Few inventions have proved more versatile than the laser.

It has been used as a super signal lamp for space communications. It has found a role in exotic metal-working applications, and the incredible precision that it offers has made new kinds of brain and eye surgery possible.

A system for playing TV shows from phonograph-like disks uses a laser to "read" the recorded program material.

Lasers are used in various forms of measurement and information handling systems. For example, one version of the bar-code reader used in supermarkets employs a laser scanner.

The Hologon Laser Scanner is one of the latest developments in practical applications of laser technology. It was invented by Xerox optical physicist Dr. Charles Kramer who wrote this article.

Lasers In Electronic Printing

At Xerox we use lasers in electronic printing systems that are based on xerography. Instead of making copies of existing documents, such printers create documents, drawing on information stored in a computer. In such a system, signals from the computer pulse the laser beam as it scans across a light-sensitive drum or belt that serves as the "camera film" in xerography. The image recorded in this way is then developed and transferred to

paper as in a copier.

Laser electronic printers offer the quality of offset printing with significant versatility compared with conventional computer printers. There is virtually no meaningful limit to format or to type style or size. Pictorial or other graphic material can be printed as easily as text. Arabic, Greek or Russian alphabets—even Oriental ideograms—are within its capabilities, provided appropriate programming is fed into the printing system.

Equally significant is the fact that, with electronic printing, documents originated in one location can be printed simultaneously at a number of different locations.

Xerox currently offers three such systems. The 9700 electronic printing system turns out almost two pages per second and has almost unlimited flexibility when it is used with the Xerox Integrated Composition System program. The 5700 electronic printing system is up to 40 times faster than conventional word-processing printers, which it can replace, and it can also be used for electronic mail and remote computer printing. A similar printer is offered as part of the Xerox 8000 network system. Designed for lower-volume applications, it is twelve times faster than a conventional word-processing printer.

In these printers, the scanning action of the laser beam is created by a relatively complex opti-

cal system that is based on a rotating, polygonal prism. Extremely high precision is required in such a system. This complexity and precision make such a laser scanner relatively expensive.

The Hologon Laser Scanner

To simplify laser scanners and reduce their cost, we considered holography to perform the functions of costly lenses and prisms.

Holographic recordings, best known for their reproduction of three-dimensional images, take the form of gratings—corrugated or ridged patterns on a transparent medium, having a spacing of approximately twenty millionths of an inch. In pictorial holograms, these gratings contain the recorded cross section of the wavefront of light

novel configuration.

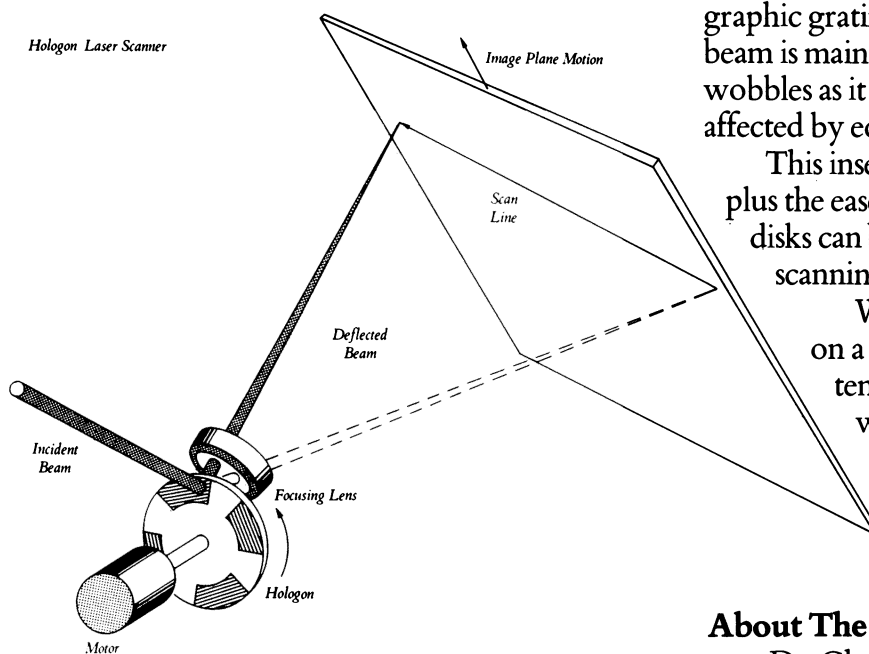
In a Hologon, a series of holographic gratings are formed around the circumference of a transparent disk. A laser shines through these gratings as the disk rotates. The gratings diffract the laser light, and the rotating action causes it to scan across the surface on which it is focused, as shown in the accompanying diagram. Focusing is done by a simple, inexpensive lens.

The laser beam in this system is aimed so that it forms a nominal 45° angle to the Hologon's surface as it enters a grating and a 45° angle as it emerges from the grating. In other words, it is diffracted through a right angle by the gratings. This angling results in a straight-line scan.

Because of the optical properties of the holographic gratings, the 90° diffraction angle of the beam is maintained even if the Hologon surface wobbles as it rotates. The beam angle is equally unaffected by eccentricities in the rotating disk.

This insensitivity to mechanical variation, plus the ease and low cost with which Hologon disks can be produced, make a Hologon laser scanning system relatively inexpensive.

Work is currently underway at Xerox on a new generation of laser printing systems utilizing the Hologon laser scanner with all its attendant benefits. This should enable Xerox to make the advantages of electronic printing more widely available than ever before.



that had been reflected from the pictorial subject. When coherent light—usually from a laser—is transmitted through such a hologram, a true three-dimensional image of the subject is reproduced.

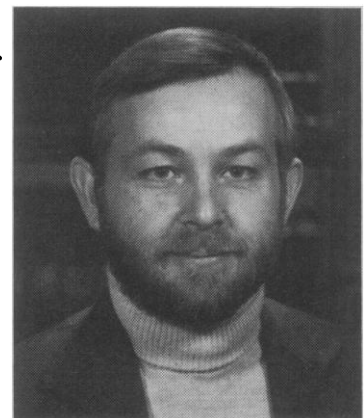
However, the holographic gratings used in a Hologon scanning system do not contain pictorial information. Only the optical diffraction properties of the gratings are utilized.

The Hologon System is one of several holographic approaches to scanning. But the others tend to scan in an arc-like pattern which is unsuitable for electronic printing, which requires a straight-line scan, much like the raster pattern used in television to create an image. The Hologon approach gets around this problem through a

About The Author

Dr. Charles Kramer is the inventor of the Hologon Laser Scanner. He is an optical physicist specializing in electro-optical reading and printing devices at the Xerox Joseph C. Wilson Center for Technology in Rochester, New York.

He holds a Bachelor's degree and a Master's degree in Physics from Fairleigh Dickinson University and a Master's degree and Ph.D in Optics from the University of Rochester.



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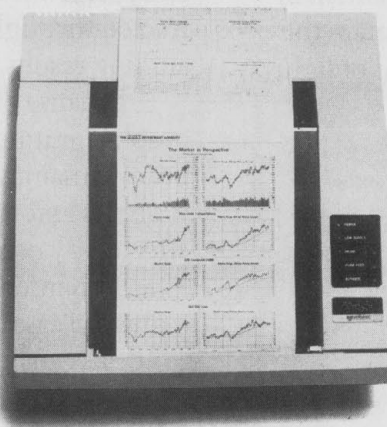
The Versatec V-80 is three times better than a conventional printer. It prints more than three times faster—1000 vs. 300 LPM for comparably priced matrix impact printers.

It prints with three times the character resolution—256 vs. 81 points to

define a standard character. Three machines in one—a printer, a plotter, a hard copy device for display terminals—V-80 does all three jobs without compromising speed or quality. And it does them all quietly, without the nerve-racking clatter of hammers.

V-80 plots graphics, maps, even halftone

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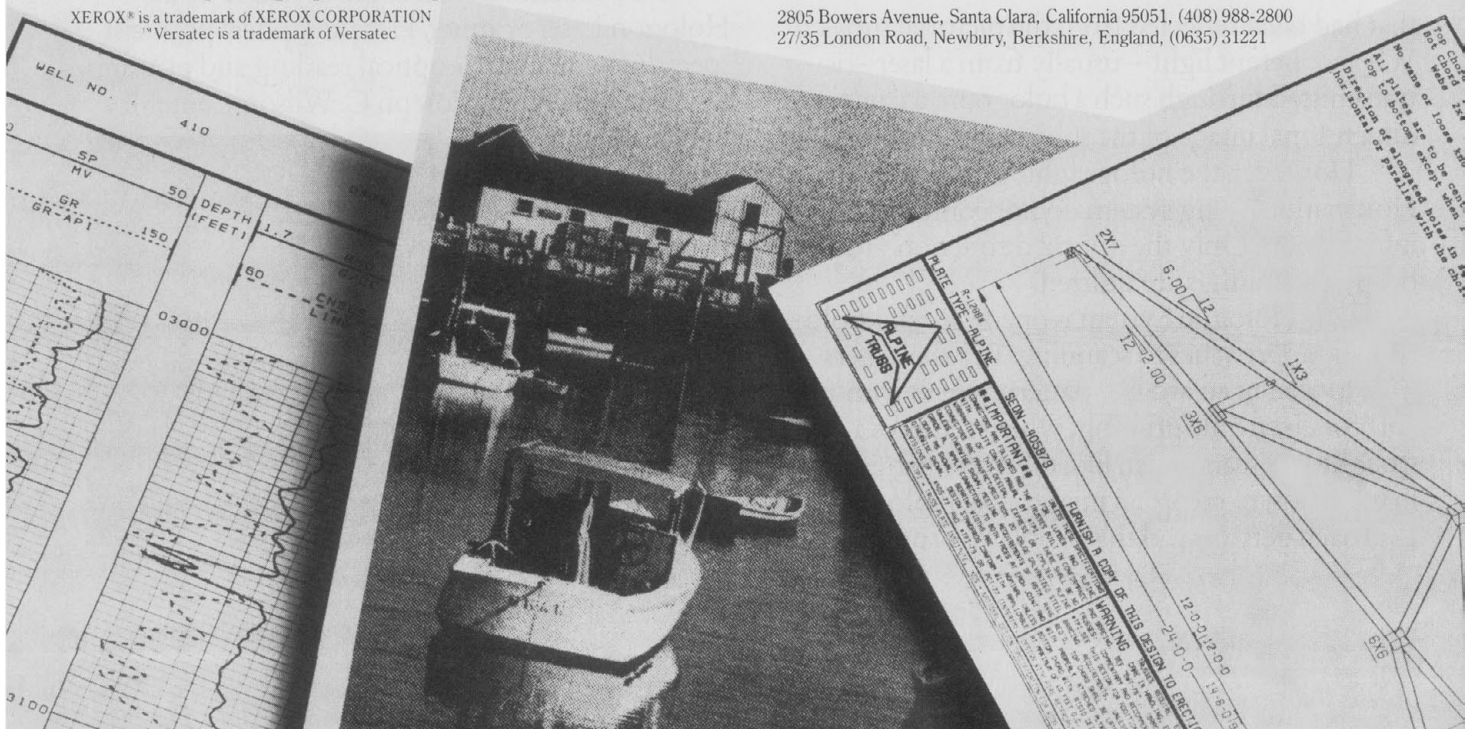
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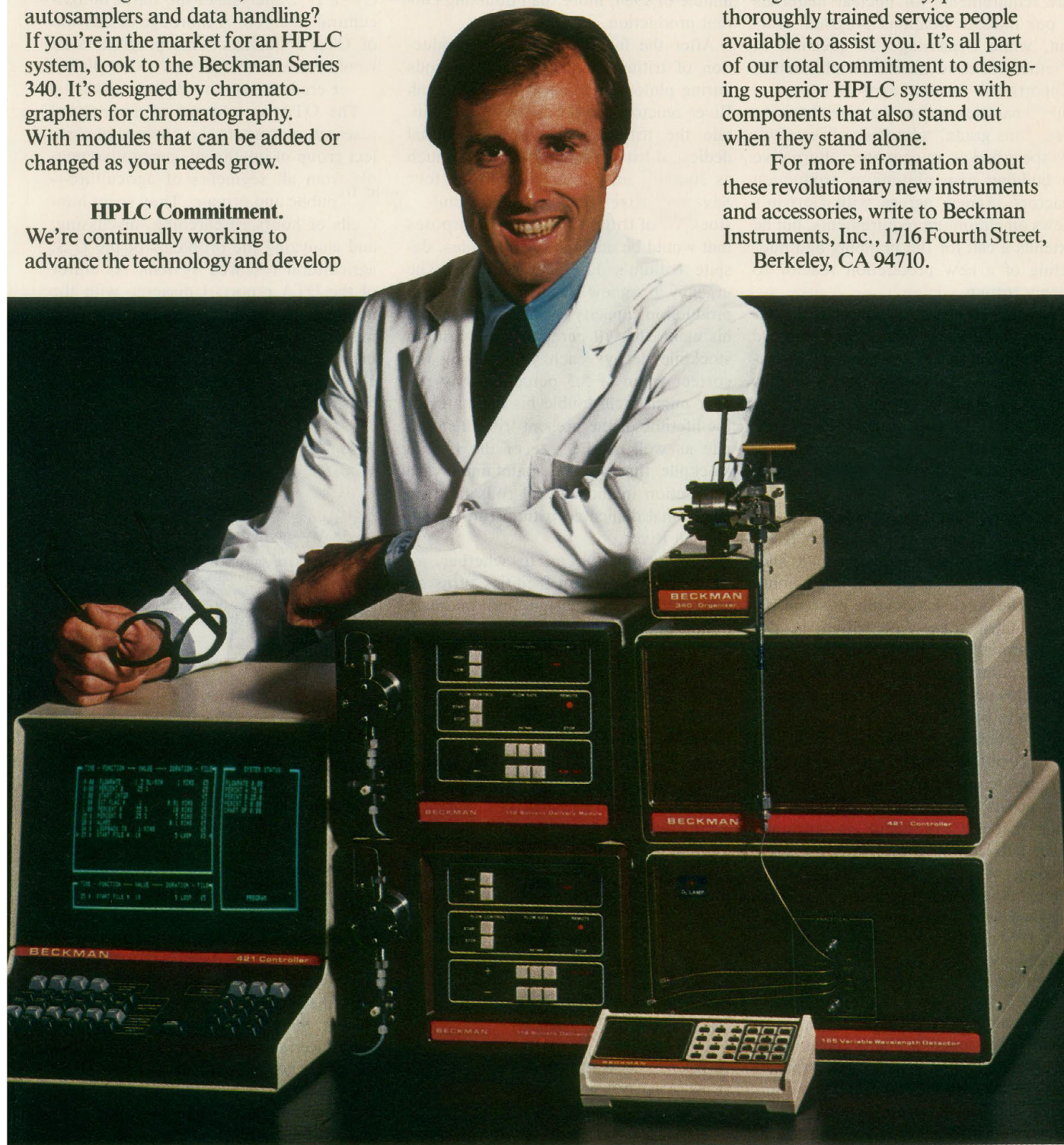
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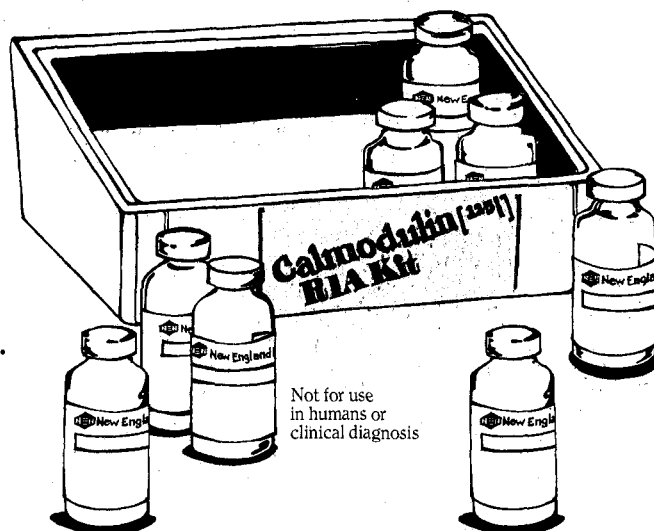
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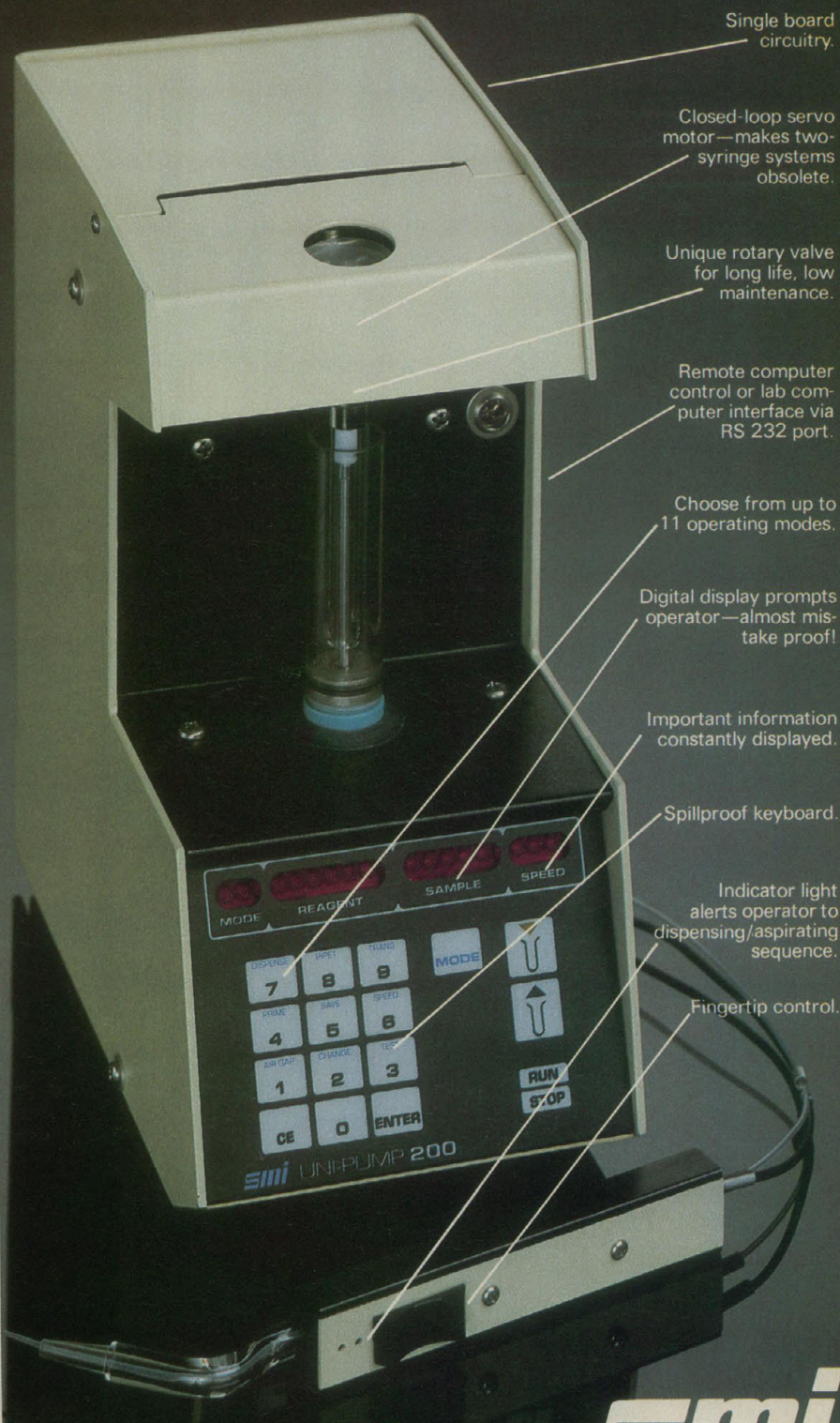
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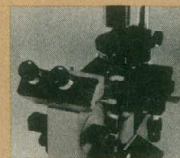
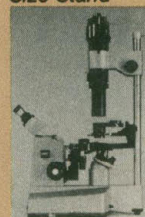
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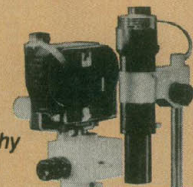
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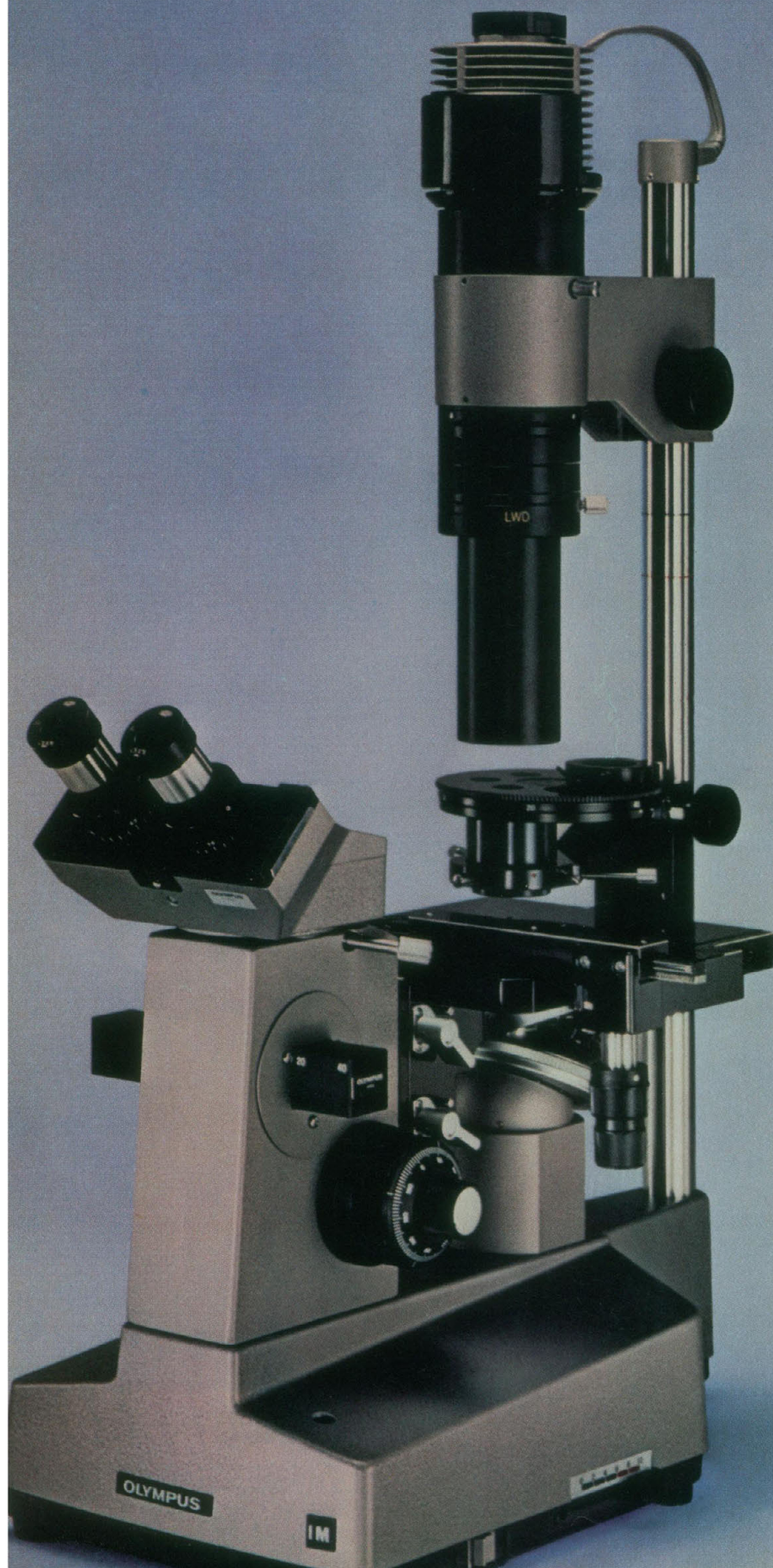
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Energy and Chemicals from Trees

An analysis of presentations at a conference on "Biomass Substitutes for Liquid Fuels," held on 9 to 12 February at Campinas, Brazil,* shows that a combination of factors will guarantee the increasing importance of the culture of trees and the applications of forest products. Some factors—such as the need to develop renewable alternatives to oil and the growing requirements for food and energy—are well known. Less widely appreciated is the need to decrease soil erosion by growing vegetation that will hold the soil in place. Agricultural practices have led to loss of about one-fourth of the topsoil in the world as a whole and about one-third in the United States. Much of the erosion has occurred on hilly terrains, which should be protected with perennial vegetation such as grasses, shrubs, or trees.

One impediment to forestation has been economics. Individual farmers have been able to obtain a considerably larger return from an annual crop than from trees, and typical yields of wood from natural forests have been small. However, in the Pacific Northwest, hilly land devoted to timber produces a return far above what it would yield in annual crops. Moreover, we are in the early phases of improvement in biomass yield from trees. For example, before 1960 the natural annual growth of loblolly pine in South Carolina was 3 dry tons per hectare. Through selection of superior stock and better forest management, the annual growth has been increased to 11 tons per hectare; yields of 18 tons are in prospect and 30 tons is an ultimate possibility. In Brazil, growth of a *Eucalyptus* species is being evaluated. This species has a 7-year growth cycle. In a forest occupying 40,000 hectares, annual yields initially were 23 tons per hectare. With selection the second rotation improved to 33 tons, while a third rotation produced 40 tons. The five best clones would produce 61 tons per hectare and a target of 100 tons seems reasonable. Such improvements can be conducted on a large scale, for instance, by selecting and planting superior seedlings. In addition, techniques for tissue culture cloning of trees are well developed in both the United States and Brazil.

A factor that could lead to greater emphasis on growth of trees is the possibility that the market value for wood will experience a long upward trend. Wood is considerably more valuable when processed to make lumber or paper than it is when used directly as a fuel. An important challenge for scientists is to discover and develop better methods for exploiting the chemical potentials of wood.

In terms of organic matter, wood is approximately 50 percent cellulose, 20 percent hemicellulose, and 30 percent lignin. A number of schemes are being employed to separate these components for various uses. One method is solvent extraction of the lignin followed by removal of the hemicellulose leaving the cellulose. Another is a short exposure of the wood to steam followed by explosive decompression and removal of the lignin by dilute alkali. Lignin can be used as an adhesive, and at present it commands as much as \$400 a ton in this application. It can also be used as a filter in plastics and, when pyrolyzed, it forms a superior metallurgical coke.

Cellulose can be used directly as cattle feed or converted to glucose by acid hydrolysis or use of an enzyme. The enzyme method gives the highest yields and is becoming less expensive. Thus, prospects are good that large quantities of glucose derived from wood will become available. This product could be used as food for humans, as a carbon source for microbial formation of protein, or as a feedstock for fermentation processes yielding liquid fuels, chemicals, and pharmaceuticals.

For a brief period of human history oil dominated the energy and chemical scene. Wood is in the process of resuming its ancient central role, but on a broader scale as science and technology point the way to more effective production and use.—PHILIP H. ABELSON

*The conference was sponsored by Inter-ciencia Association, Sociedade Brasileira para o Progresso da Ciência, U.S. National Academy of Sciences, Secretaria de Tecnologia Industrial—Ministério da Indústria e Comércio, Conselho Nacional de Desenvolvimento Científico e Tecnológico, and Empresa Brasileira de Pesquisa Agropecuária.

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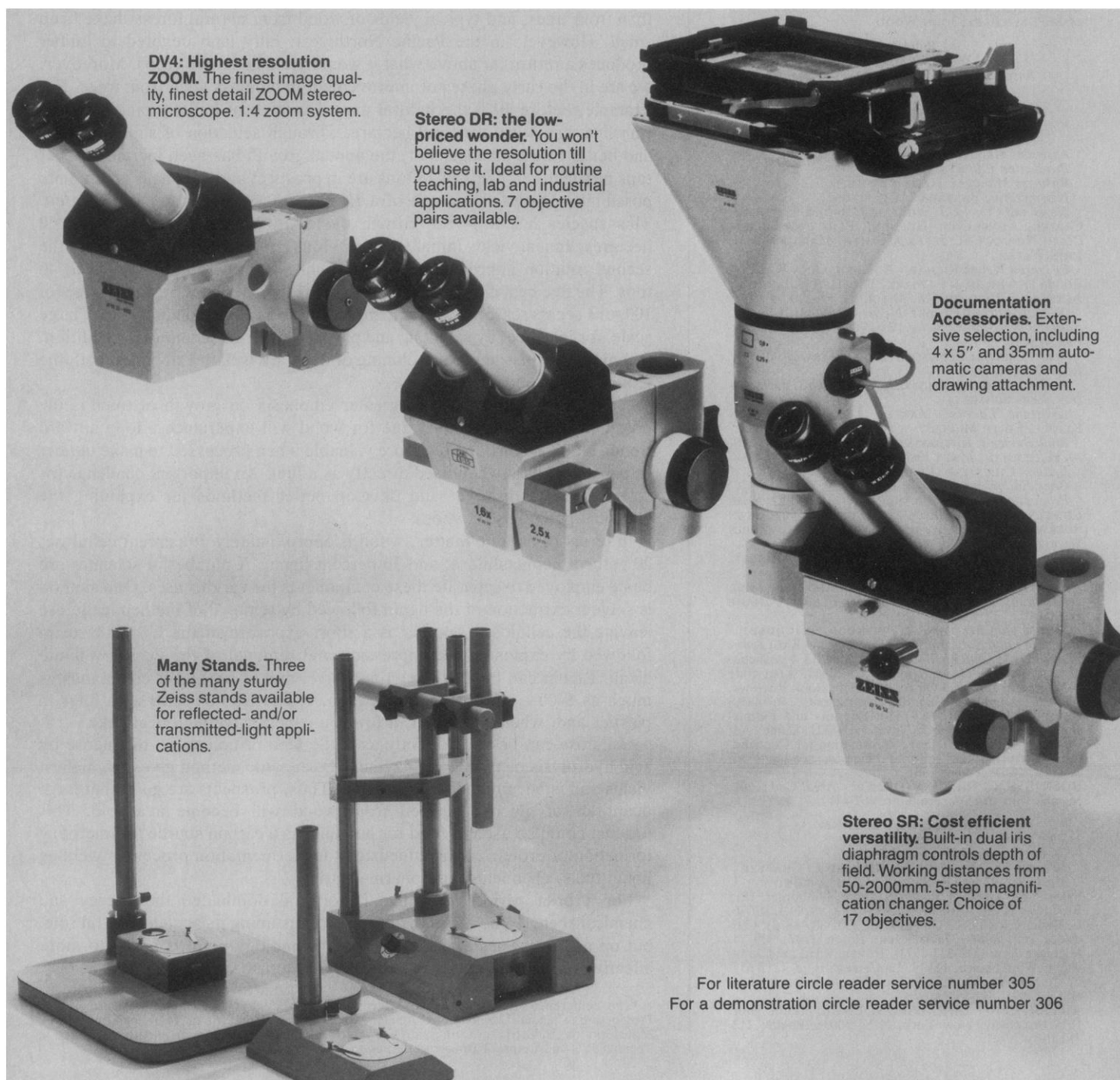
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