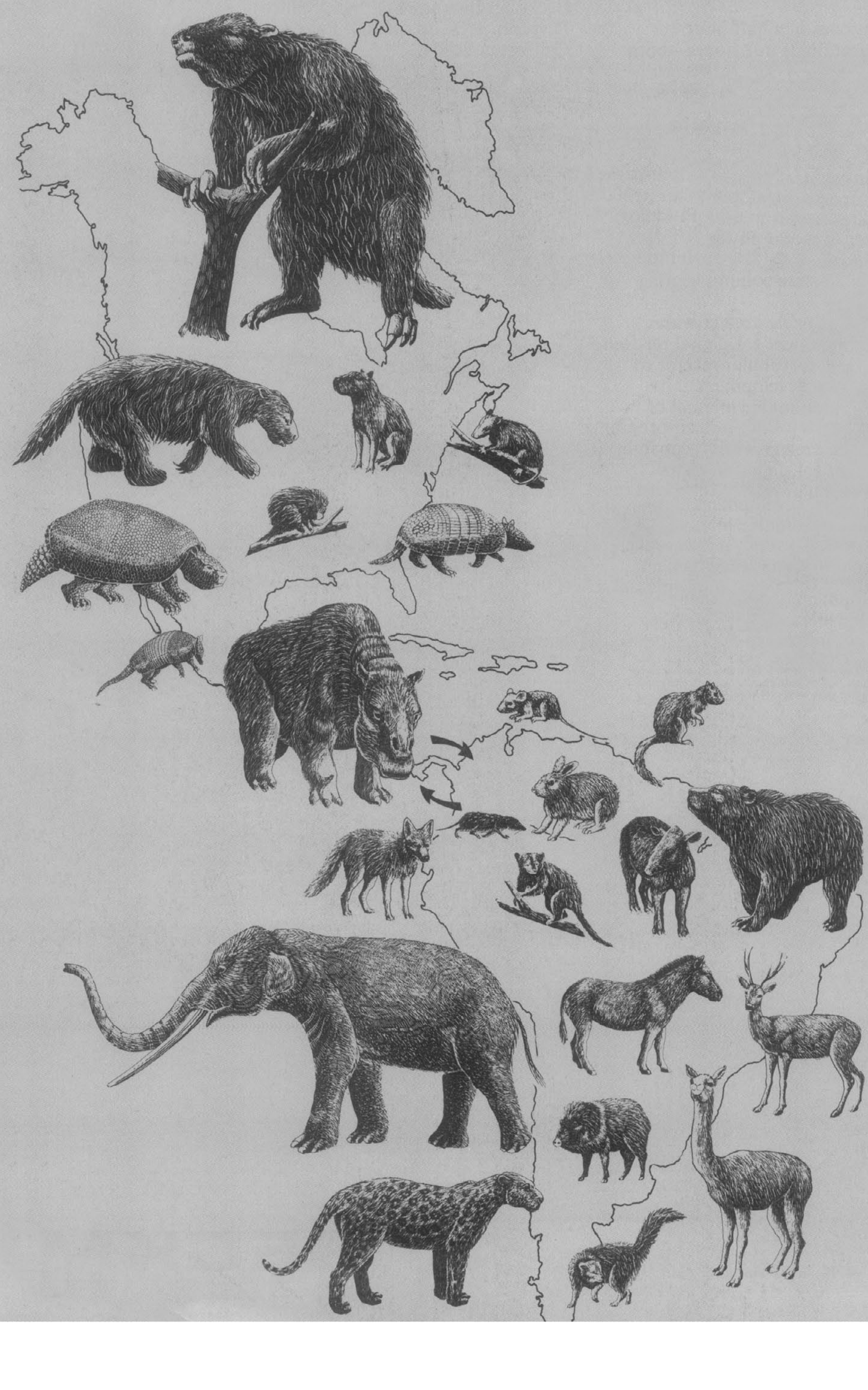
12 March 1982 • Vol. 215 • No. 4538 $2.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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:

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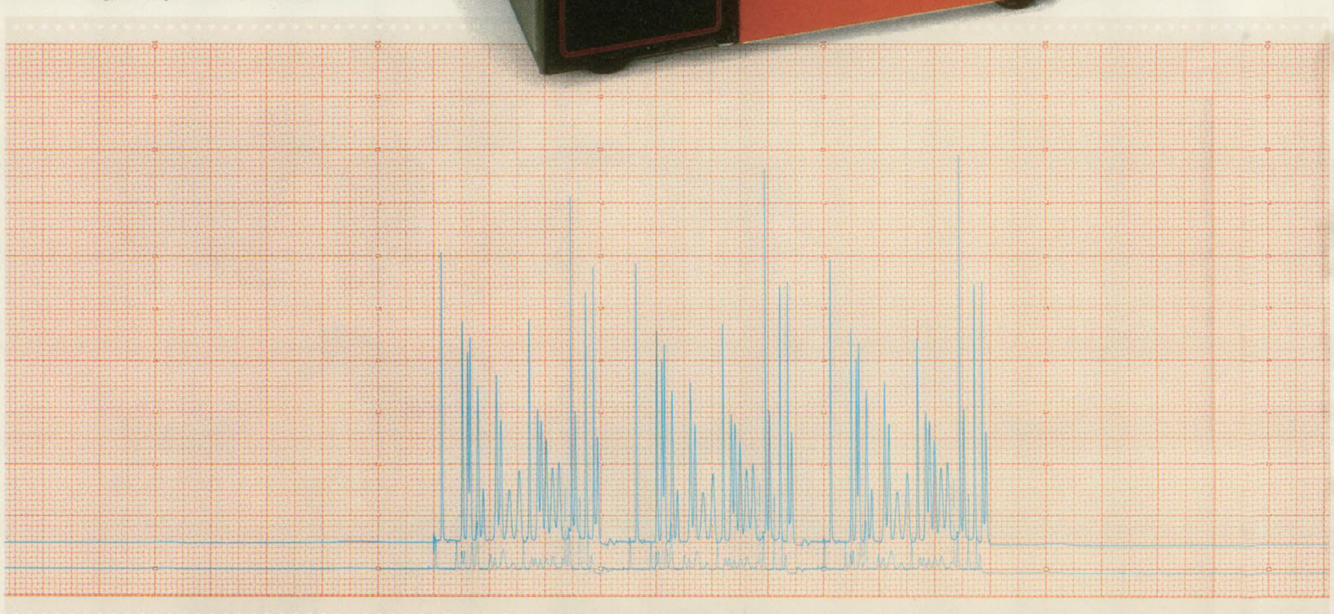
Reduced copy of actual System 6300 traces showing three half-hour replicate hydrolyzate runs. For a full size copy with data integrator tape write Ms. Jane Such.



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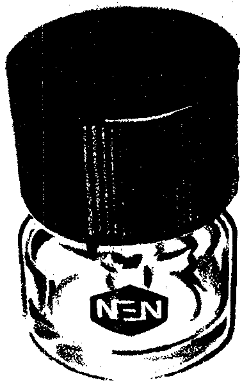

^{3}H nucleotides that solve a problem with a better solution

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At the same time we extended their radiochemical stability with 10mM Tricine, a proven stabilizer known to be compatible in research systems.

TTP, [*methyl*-^{3}H]- 50-80Ci/mmol
NET-221A 250μCi 1mCi 5mCi in dry ice
TTP, [*methyl*-1′, 2′-^{3}H]- 90-110Ci/mmol
NET-520A 1mCi 5mCi in dry ice
dATP, [8-^{3}H]- 10-25Ci/mmol
NET-268A 250μCi 1mCi 5mCi in dry ice
dCTP, [5-^{3}H]- 15-30Ci/mmol
NET-369A 250μCi 1mCi 5mCi in dry ice
dCTP, [5, 5′-^{3}H]- 40-60Ci/mmol
NET-601A 1mCi 5mCi in dry ice
dGTP, [8-^{3}H]- 5-15Ci/mmol
NET-429A 250μCi 1mCi 5mCi in dry ice
dGTP, [8, 5′-^{3}H]- 25-50Ci/mmol
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Also available in standard ethanol:water packaging by deleting the A from the ordering number.

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

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40-60mCi/mmol Ethanol under argon, in dry ice
NEC-779 50μCi 250μCi
Docosahexaenoic acid, 4, 7, 10, 13, 16, 19-[^{14}C(U)]-
>100mCi/mmol Ethanol under argon, in dry ice
NEC-784 5μCi 10μCi
Eicosapentaenoic acid, 5, 8, 11, 14, 17-[1-^{14}C]-
40-60mCi/mmol Ethanol under argon, in dry ice
NEC-772 10μCi 50μCi
Eicosapentaenoic acid, 5, 8, 11, 14, 17-[^{14}C(U)]-
50-100mCi/mmol Ethanol under argon, in dry ice
NEC-754 5μCi 10μCi

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Stable. Produced by Bolton-Hunter Reagent conjugation to bovine brain calmodulin
Tested for antibody binding
Calmodulin,[^{125}I]-
50-150μCi/μg
0.05M phosphate buffer, pH 7.4, 0.1M NaCl
0.1% gelatin, 0.05% sodium azide
NEX-172 5μCi 10μCi
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~27-40pmol) and specificity than iodohydroxybenzylpindolol
Carrier-free~5400μCi/μg
Iodocyanopindolol,[^{125}I]-
2200Ci/mmol
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NEX-174 100μCi 500μCi 1mCi

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FSH, LH [^{125}I]

Follicle Stimulating Hormone,[^{125}I]-
50-100μCi/μg
Lyophilized from sodium phosphate buffer, pH 7.4, containing BSA and a proteolytic enzyme inhibitor
NEX-173 10μCi 25μCi 100μCi
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50-100μCi/μg
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ISSN 0036-8075

12 March 1982

Volume 215, No. 4538

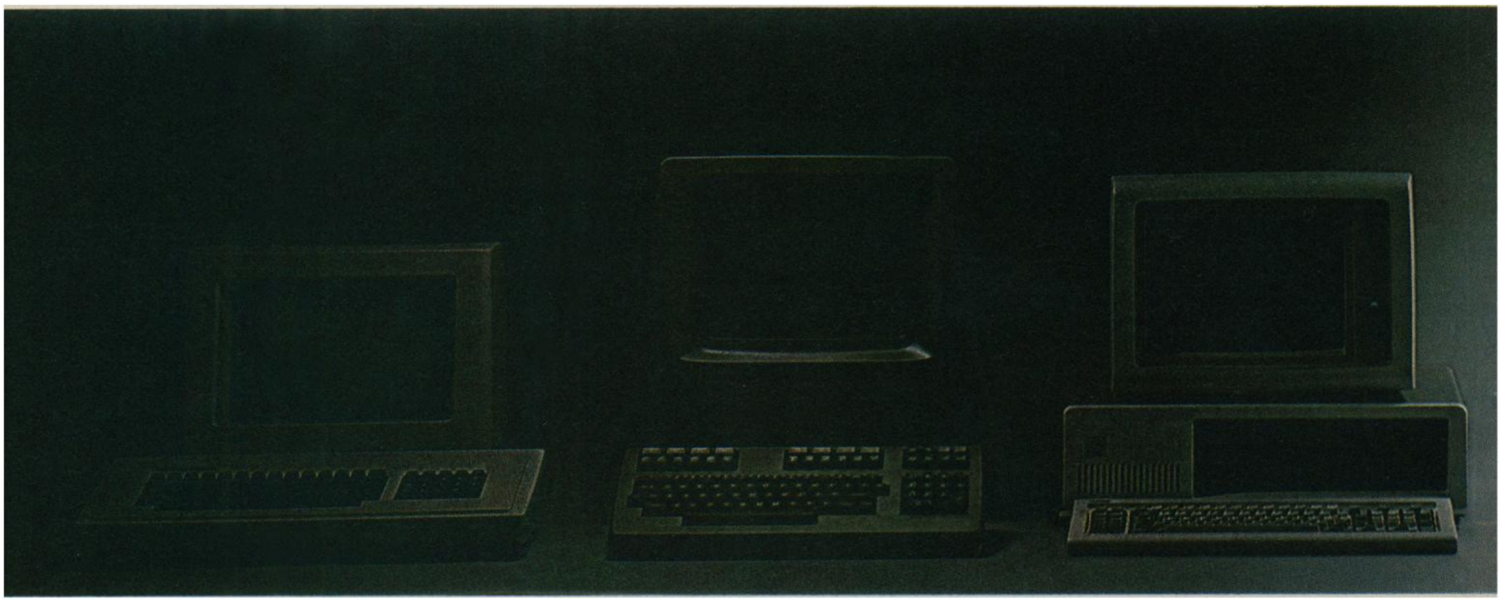
SCIENCE

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with **The Science Monthly**® Domestic individual membership and subscription (51 issues): $43. Domestic institutional subscription (51 issues): $80. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $55. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $3 ($3.50 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **Postmaster:** Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

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]

NOW THAT YOU'
FIRST GEN
TAKE A LOOK



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
Standard Memory			
64K	64K	64K	128K
*Maximum Memory when fully configured**			
64K	64K	192K	256K
Expandability			
No expansion slots	No expansion slots	No extra expansion slots in fully configured* 192K system	4 extra expansion slots in fully configured 256K system*
Diskette Storage (per drive)			
92K	256K	160K	140K
Mass Storage (per drive)			
—	1.16 megabyte Floppy Disk	—	5 megabyte Hard Disk
Display Graphics Capability			
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
Software Available			
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.

VE SEEN THEIR ERATION 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.

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THE MOST POPULAR PHENOMENON IN SCIENCE IS AN ECLIPSE.

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.

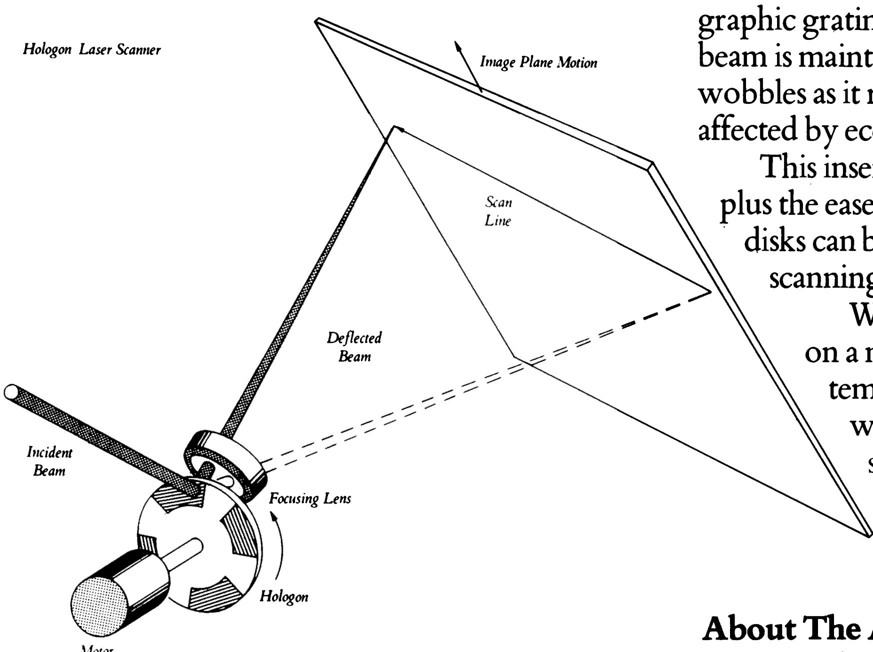
Xerox currently offers three such systems. The 9700 electronic printing system turns out almost two pages per second and has almost unlimited flexibility when it is used with the Xerox Integrated Composition System program. The 5700 electronic printing system is up to 40 times faster than conventional 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 optical 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 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 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.

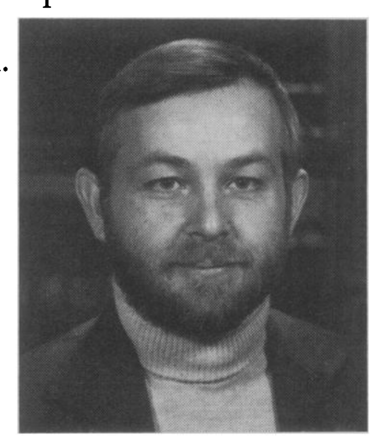
Because of the optical properties of the holographic gratings, the 90° diffraction angle of the beam is maintained even if the Hologon surface wobbles as it rotates. The beam angle is equally unaffected by eccentricities in the rotating disk.

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.

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 best components combined. Yet, when you put them all together, you get a unique combination of capabilities that is unmatched by any other HPLC system.

While you can use other detectors with our system, only the Beckman Model 165 Detector gives you on-the-fly spectral scans, or Ratio™grams (real-time ratio plots) that give you positive peak confirmation of compounds and monitoring of two wavelengths simultaneously. And though our pumps are excellent by themselves, connecting them with other Beckman components gives you a solvent delivery system of unparalleled flow control. Even the slightest change in solvent compressibility or viscosity is instantly detected and compensated.

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The Beckman system solution. So why do without any of these

is its total capability.

superb components? Or the accessories that go with them, like autosamplers and data handling? If you're in the market for an HPLC system, look to the Beckman Series 340. It's designed by chromatographers for chromatography. With modules that can be added or changed as your needs grow.

HPLC Commitment.
We're continually working to advance the technology and develop HPLC methods in our six applications labs. We even have dozens of HPLC specialists in our offices throughout the country, plus thoroughly trained service people available to assist you. It's all part of our total commitment to designing superior HPLC systems with components that also stand out when they stand alone.

For more information about these revolutionary new instruments and accessories, write to Beckman Instruments, Inc., 1716 Fourth Street, Berkeley, CA 94710.

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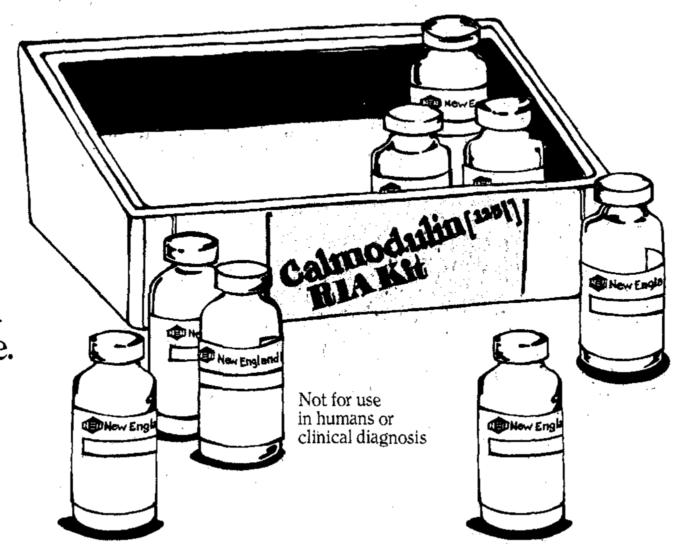

Calmodulin [^{125}I] RIA Kit

Includes all reagents for the quantitation of calmodulin in extracts derived from biological samples. A protocol for preparing the sample is provided in the instruction manual. Prior to shipment a standard curve is generated for each lot of kits in a complete RIA procedure. The curve is included with your kit. Send for complete technical information by circling this inquiry number.

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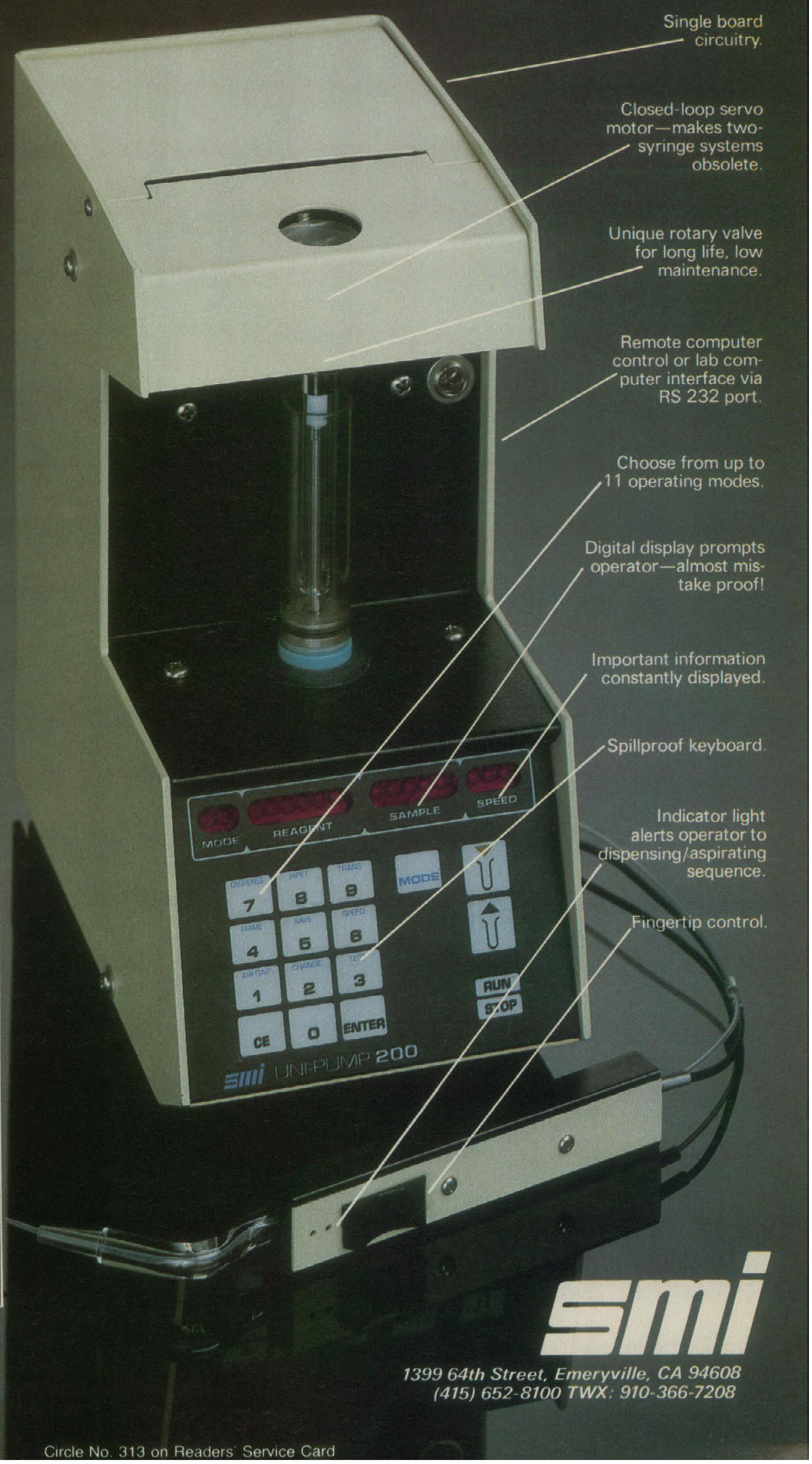

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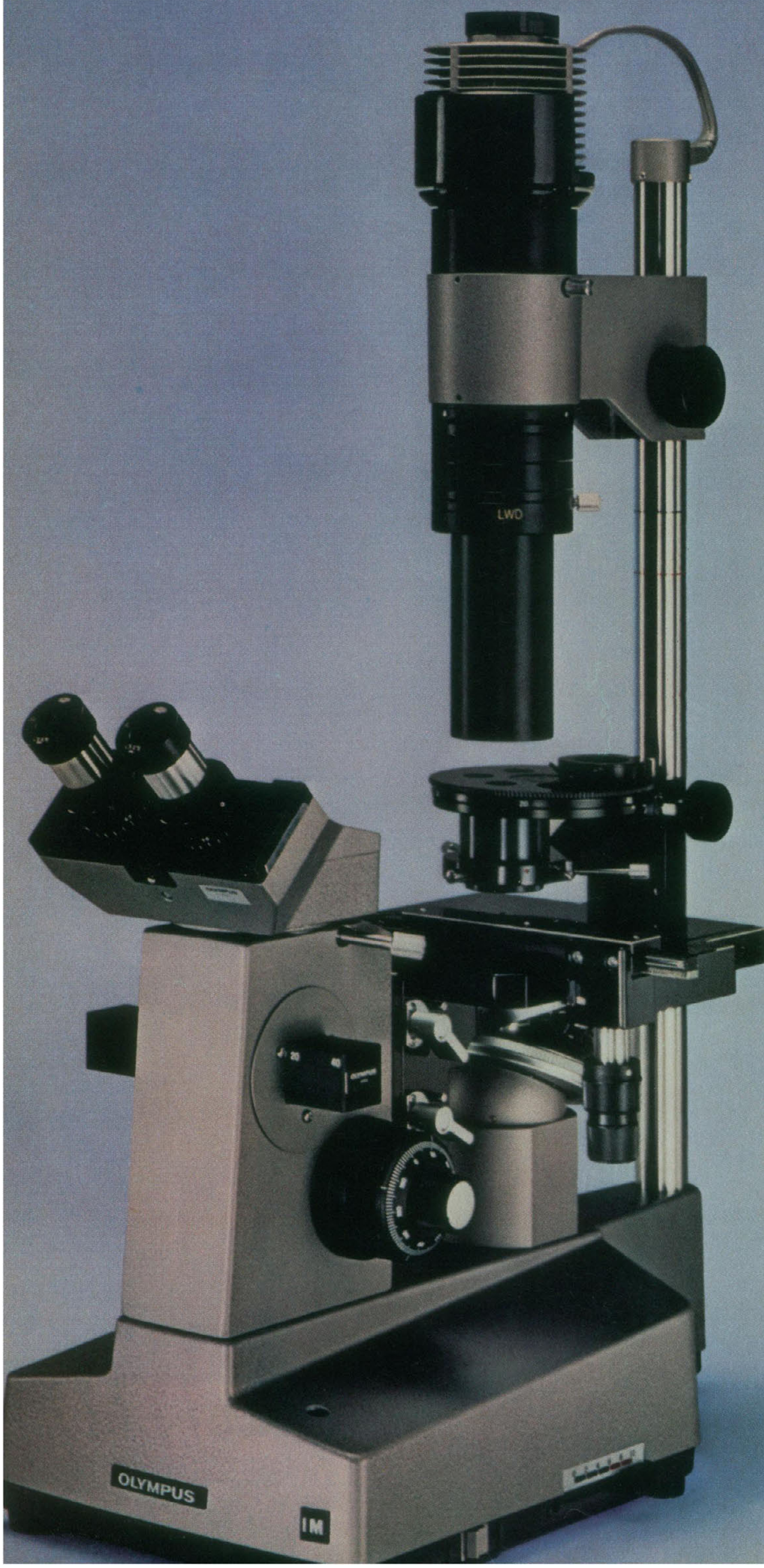

Finally, a system microscope offering fullest inverted microscope capabilities. From Olympus. So advanced it facilitates fatigueless operation under extended use. It offers the versatility to perform under a wide range of techniques, utilizing a large variety of cell and tissue culture vessels.

Some of the IMT advantages: a choice of *three condensers* allowing the use of different shape culture vessels; *four special objectives* for high performance at long working distances: *high intensity light sources* for optimum, constant brightness; *polarizing filter set* to easily detect birefringent substances; long working distance *phase contrast* as standard equipment. *Differential interference contrast attachment, automatic photo, cine and time lapse accessories* optionally available.

All of this added to the higher quality Olympus optics make the IMT a powerful, wide ranging investigative tool warranting your examination. Contact the Olympus Authorized Dealer listed in your Yellow Pages, or Precision Instrument Division, Olympus Corporation of America, 4 Nevada Drive, New Hyde Park, NY 11042.

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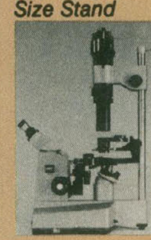

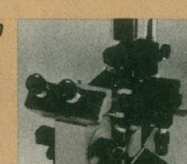

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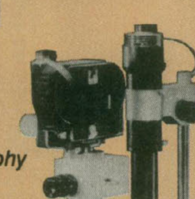

OLYMPUS

The Science Company

Circle No. 35 on Readers' Service Card

12 March 1982, Volume 215, Number 4538

SCIENCE

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 Interciencia 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.