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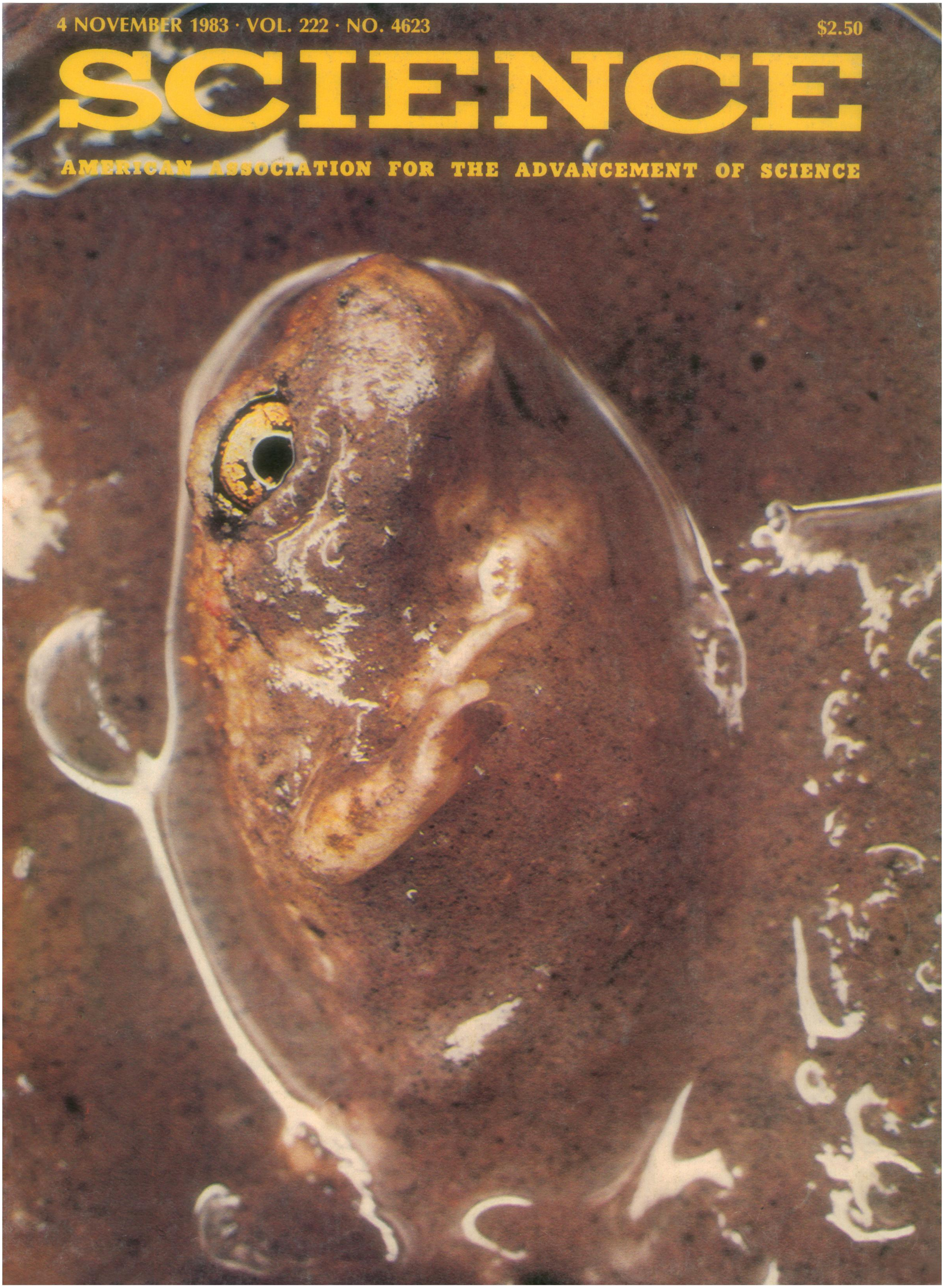
SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Responding today to your needs for Research Biochemicals

P-L Biochemicals – 30 Years of Service

If your laboratory is using research biochemicals, chances are you've heard the phrase "excellence in biochemistry". These are the words that have described the innovative, high quality research products of P-L Biochemicals for over 30 years. From the introduction of ATP in 1951 to the M13 cloning system in 1981, P-L Biochemicals has supplied research and industry with an array of over 2500 essential biochemical tools. In the field of Molecular Biology alone, P-L has been an early leader offering over 350 products, with nucleoside phosphates introduced as early as 1954. Enzymes, lipids, lectins, and carbohydrates, are just a few of the many other product areas where P-L Biochemicals has made an essential contribution.

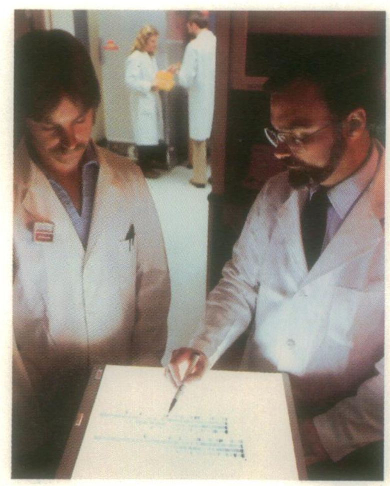
P-L Acquires New Strengths

Essential to the production of any high purity biochemical are the purification strategies and materials used. P-L has established a well-deserved reputation for producing some of the highest purity materials in the world. It is because of the priority of process development that the news of the acquisition of P-L Biochemicals by Pharmacia, Inc. comes as a welcome addition to the already massive amount of purification experience at P-L.

Pharmacia Fine Chemicals introduced Sephadex® in 1959, the first separation media designed specifically for purification of biologically sensitive molecules. Since then, Pharmacia has been known for its aggressive introductions of completely new separation methods and high standards of product quality and technical support; the very same business precepts exhibited over the years at P-L Biochemicals.

Quality of product, quality of service and an unblemished, long-standing history of each for both Pharmacia and P-L are perhaps the most significant reasons why the new P-L organization, Pharmacia P-L Biochemicals, Inc. will be important to you.

excellence in biochemistry



Look to the Future

Effective immediately, distribution of P-L products will be available through the technical representatives of the Pharmacia organization. Pharmacia and P-L will also be together on the exhibit floors of many major meetings. Pharmacia Fine Chemicals and P-L Biochemicals have a long standing commitment to produce outstanding products from the most recent technologies. This remains foremost in the objectives of the new organization. Look to the future for exciting new developments from Pharmacia P-L Biochemicals, Inc.

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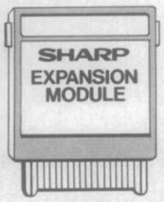
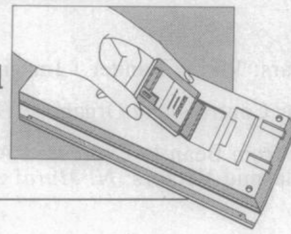
THE HAND-HELD COMPUTER WITH POWERFUL CONNECTIONS.

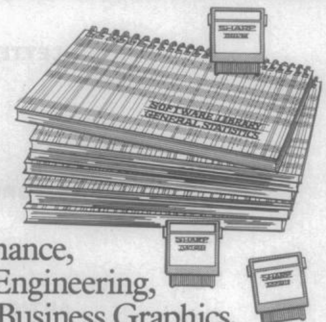


24K (8K + 16K)

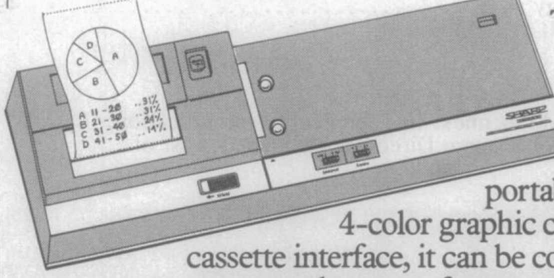
Now you can take 24K with you wherever you go—thanks to the new Sharp PC-1500A. It's the 8K hand-held computer that expands to a powerful portable 24K computer system when the optional 16K memory module is added. And because it's programmable in Basic, the most popular computer language, it gives you the power and capabilities to handle most scientific, engineering and management uses.



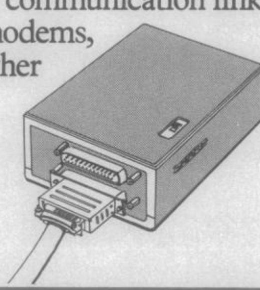
The PC-1500A also has a complete library of plug-in software programs including: Sharpcalc (Spreadsheet), Finance, Math, Electrical Engineering, Circuit Analysis, Business Graphics, General Statistics, Statistical Distribution and Graphics Development.



195(W) x 25.5(H) x 86(D) mm



The optional CE-150 Color Graphic Printer/Cassette Interface not only gives the system portable printing but also 4-color graphic capabilities. And as a cassette interface, it can be connected with up to two cassette tape recorders—one for storage and one for recall. The CE-158's RS-232C Interface allows communication links to a wide variety of peripherals such as modems, bar-code readers, data bases, as well as other micro, mini or mainframe computers.



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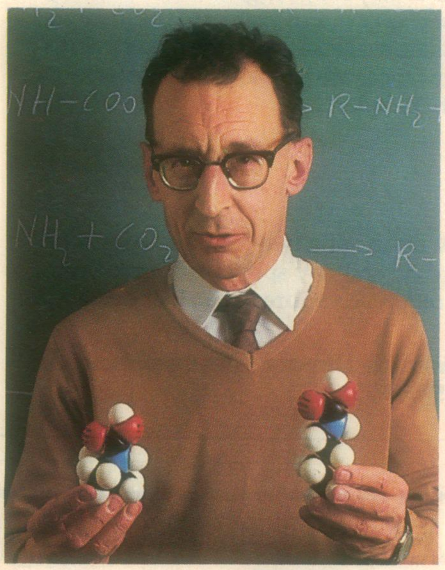
COVER

Toad (*Scaphiopus multiplicatus*) being fed upon by a concealed mud-dwelling fly larva (*Tabanus punctifer*) that has seized it from beneath. The usual toad-eats-fly paradigm is here strikingly reversed. See page 515. [Thomas Eisner and Stephen Nowicki, Cornell University, Ithaca, New York 14853]

How Exxon developed can double the productivity

Guido Sartori's work on hindered amines may impact an entire industry.



Removing impurities such as carbon dioxide and hydrogen sulfide from natural, refinery, and synthesis gases is an expensive, energy-consuming process.

But at Exxon Research and Engineering Company a new chemistry discovery, and cross functional teamwork, have led to the development of a new technology–one that significantly decreases the cost and increases the capacity of commercial gas treating processes.

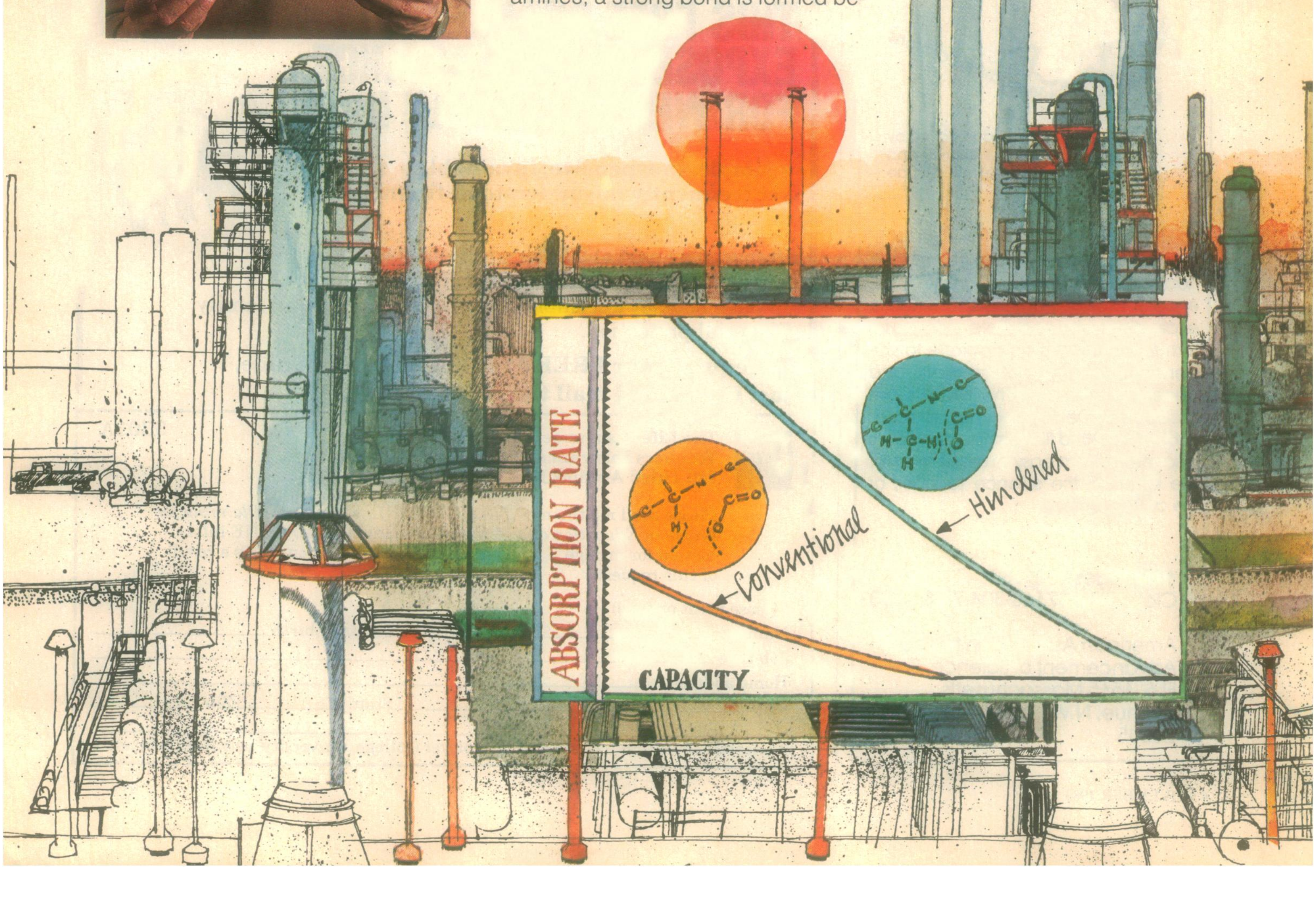
Research Led to a Discovery

Guido Sartori, a chemist in Exxon Research and Engineering Company, had been conducting research on amines–organic nitrogen-containing molecules–to increase both the absorption rate and capacity of gas treating solutions.

When impurities, such as CO_2, come in contact with conventional amines, a strong bond is formed between the CO_2 and the nitrogen atom of the amine. This strong bond ties up a disproportionate amount of useful amine. Sartori theorized that both the absorption rate and capacity of the amine would be improved if the bond at the nitrogen site could be weakened. Continuing research revealed the advantages of a whole new class of amines, which he called hindered amines.

Observing Molecular Behavior

Sartori and others began a comprehensive evaluation of the discovery, utilizing the company's advanced analytical capabilities. To understand the behavior of hindered amines, and to monitor reactions, Sartori employed the results of carbon-13 nuclear magnetic resonance spectroscopy, a



new molecules that
of gas treating plants.

state-of-the-art technique not previously used for this purpose.

Further research confirmed the hindered amines' capability to substantially increase the rate and capacity of carbon dioxide absorption through the formation of low stability bonds. Low stability was achieved by placing a bulky substituent next to the nitrogen sites, thereby hindering bond formation with CO_2. Building on this new understanding, he synthesized new molecules to meet the performance requirements for specific applications.

Integrated Innovation

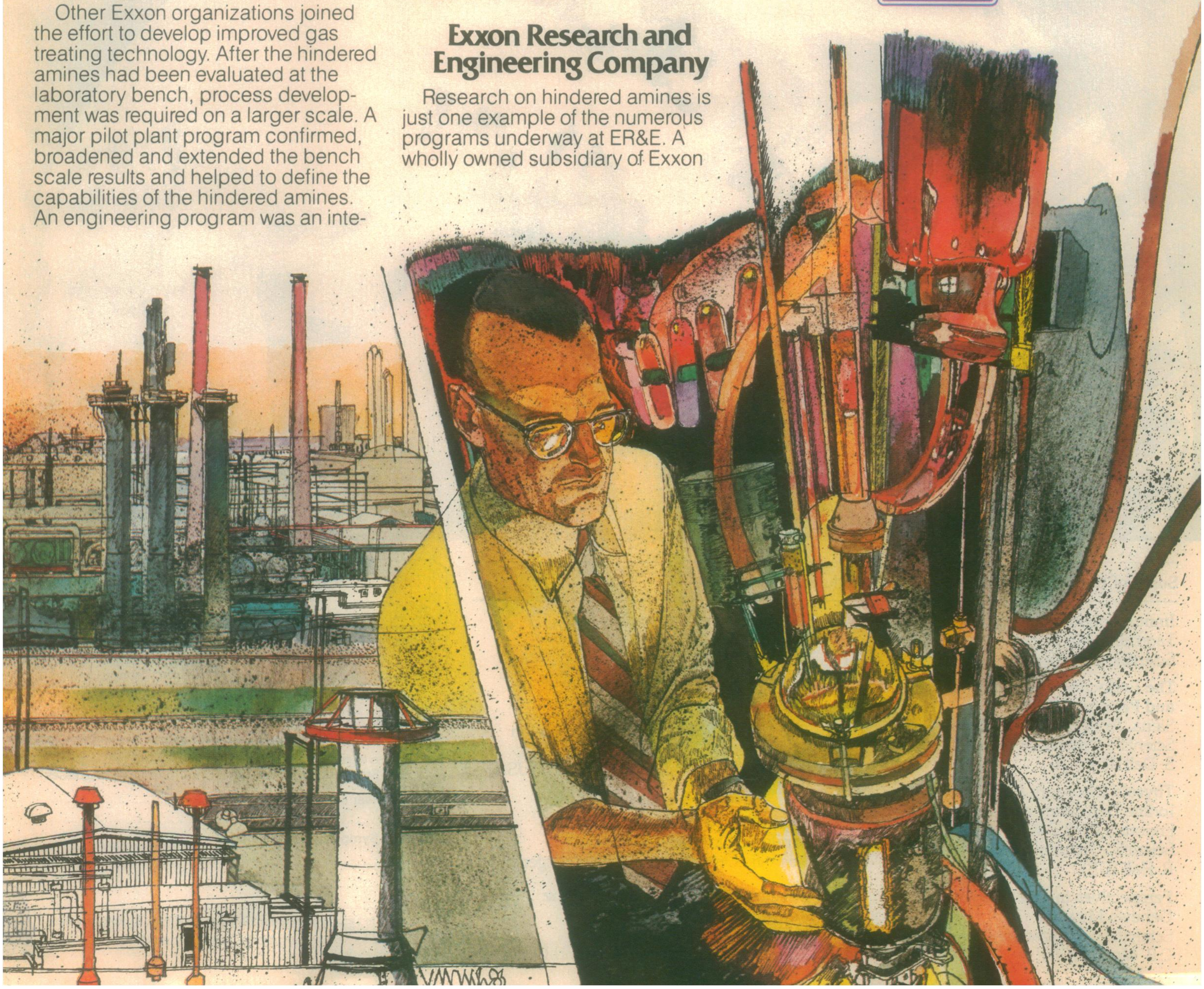
Other Exxon organizations joined the effort to develop improved gas treating technology. After the hindered amines had been evaluated at the laboratory bench, process development was required on a larger scale. A major pilot plant program confirmed, broadened and extended the bench scale results and helped to define the capabilities of the hindered amines. An engineering program was an integral part of the research and development required to convert these laboratory discoveries into commercially feasible technologies. Capacity increases of 50% have been achieved commercially using this technology with no added facilities.

Through integrated innovation–the combined efforts of the company's basic research, process development, and engineering staffs–hindered amine technologies advanced from scientific discovery through commercial use in less than three years. Further research has enabled ER&E to identify or synthesize other practical hindered amines.

Exxon Research and Engineering Company

Research on hindered amines is just one example of the numerous programs underway at ER&E. A wholly owned subsidiary of Exxon Corporation, ER&E employs some 2,000 scientists and engineers working on petroleum products and processing, synthetic fuels, pioneering science and the engineering required to develop and apply new technology in the manufacture of fuels and other products. For more information on Exxon's hindered amine technology or ER&E, write Dr. E. E. David, President, Exxon Research and Engineering Company, Room 704, P.O. Box 101, Florham Park, New Jersey 07932.

EXXON



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SCIENCE

Quality: The Competitive Strategy

In technology and innovation—long considered our trump cards in the international market—the United States is facing mounting competition from abroad. A declining percentage of high-technology exports and Japan's incursion into our semiconductor and consumer electronics markets are but two indicators of the trend. Scientists and engineers should be most troubled by our declining competitiveness. Our ability to fund R & D depends most heavily on success in selling the results of innovation—high-technology products.

Many factors contribute to the decline in the U.S. position. Among them are high interest rates and the strength of the dollar, the strained resources of our university systems, our sometimes outdated production processes, and the slowness of our public and private sectors to respond to strategies used by our international competitors. Many of these factors are related to public policy issues that must be addressed. Yet I think it important that at the same time we focus on a key factor that falls squarely within the responsibility of the private sector: the cost and quality of our products.

Historically, American industry has viewed quality improvement and cost control as separate and conflicting goals. Although this can be the case if quality improvements are made by implementing expensive test and inspection procedures, these goals need not be mutually exclusive. American companies are coming to realize that doing everything right the first time is a sound strategy for meeting our competition.

At Hewlett-Packard, for example, some years ago we analyzed in detail our methods and costs of achieving good product quality. We found that as much as 25 percent of our manufacturing assets were actually tied up in reacting to quality problems, and we decided that through pursuing quality we could achieve lower production costs and improve our competitiveness.

In the past 3 years, several experiments have been conducted to test this strategy. In our Loveland Instrument Division, aggressive goals were set to produce a voltmeter made with defect-free parts, processes, and design and to achieve just-in-time delivery. The result was that cost goals were met while, compared to the previous generation of the product, manufacturing cycle time was reduced by a factor of 10, inventory cut in half, and field failure rates cut by a factor of 3 to 5.

Our Avondale Division began its focus on quality at the design stage of a recently introduced high-performance gas chromatograph. The product requires two-thirds fewer parts and 60 percent less labor to manufacture than the one it replaced, the production cost was cut in half, and field failure rates are expected to be three to five times lower. The result is a product that is extremely competitive in terms of price and performance.

Our Japanese subsidiary, Yokagawa-Hewlett-Packard (YHP), was honored last year with the Deming Prize, Japan's highest prize for overall quality. The award recognized a 5-year program that reduced production costs by one-third and inventory by two-thirds, the length of the product development cycle by one-third, and warranty failure rates by more than half. During the 5-year period, YHP almost tripled its market penetration.

These examples show that pursuing quality is a cost-competitive strategy and that efforts to achieve quality must begin in the design phase of a product. Some of our greatest improvements have been the result of designers working closely on processes with people in manufacturing, on parts specifications with our vendors, and on applications needs with our customers.

In formulating a strategy to meet the competitive challenges we face, a logical first step is to take stock of our strengths. Science and innovation have made us leaders in high-technology markets, but we cannot remain competitive if others can duplicate our products and improve on the production process. In order to meet the challenge from abroad we must also focus on reducing the cost and improving the quality of the products we offer.—John A. Young, *President and Chief Executive Officer, Hewlett-Packard, Palo Alto, California 94303-0890*