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SCIENCE

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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.

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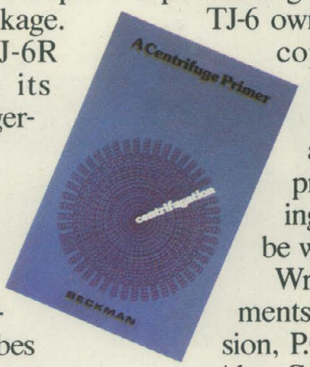

If you're thinking about a tabletop centrifuge, be sure to ask a TJ-6 owner. And send for a copy of our equally popular Centrifuge Primer with the abc's of centrifuge principles and operating tips. No lab should be without either one.

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

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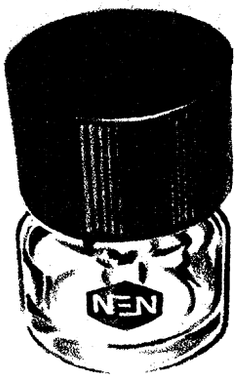
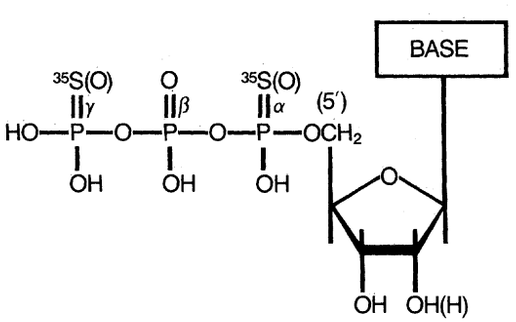


How to break the ^{32}P habit and regain control of your schedule.

^{35}S-Nucleotides
ATPγS GTPγS dATPαS ATPαS

The traditional probe for nucleic acid studies has been ^{32}P, one good reason being its high initial specific activity. However, within a short time that advantage dissipates because of ^{32}P's short half life, and the benefits of using ^{35}S in the first place become very persuasive.

To take advantage of these benefits, NEN has developed ^{35}S-nucleotides for nucleic acid studies. Primarily they introduce versatility and convenience compared to ^{32}P. They also reduce waste and involve the user with less radiation exposure.

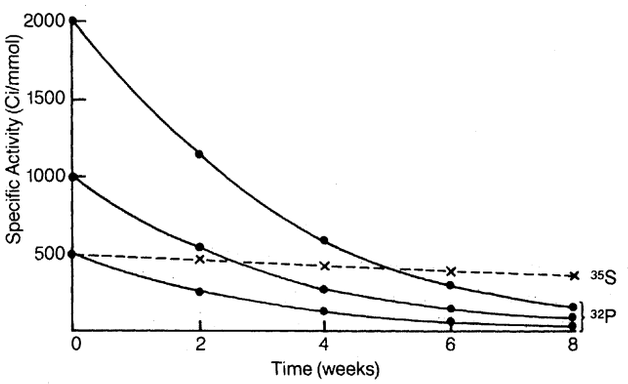


Biological activity—These nucleotides have phosphate replaced by ^{35}S-thiophosphate in the α or γ position. They are biologically active and each may be substituted freely for its natural analog with a variety of enzymes (DNA or RNA polymerase, protein kinase, etc.). However, these compounds and probes prepared from them are resistant to phosphatases and nucleases at the point of thiophosphate substitution, making possible new experiments and techniques.

Longer lived probes—Since ^{35}S has six times the half life of ^{32}P (87 vs. 14 days), you'll need to make your labeled probes much less often, leaving yourself more time for research. Also there'll be less waste and less expense.

High specific activity—All ^{35}S-nucleotides are available from NEN at specific activities approaching 500Ci/mmol. Even more important, the useful specific activity will be maintained longer by nucleic acids and proteins because of ^{35}S's longer half life (see diagram).

Freedom from production schedules—NEN's ^{35}S-nucleotides are always available from stock. No more planning your work around somebody else's production schedule.



Economy—You'll pay no more for the ^{35}S compounds than for their ^{32}P equivalents. When you count this saving in with the time- and waste-saving advantages described above, you get a powerful argument for making the switch.

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NEG-027 15-60Ci/mmol
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NEG-030H 250-500Ci/mmol
NEG-030 15-60Ci/mmol
Adenosine 5′-(α-thio) triphosphate, [^{35}S]-
NEG-033H 250-500Ci/mmol
Deoxyadenosine 5′-(α-thio) triphosphate, [^{35}S]-
NEG-034H 250-500Ci/mmol

All compounds are shipped in ethanol: 20mM tricine (pH 7.6), 20mM dithiothreitol, 1:1, in dry ice

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Tropical bromeliads festoon tree limbs 40 meters above the lowland rainforest floor of La Selva, Costa Rica. Epiphytic plants derive support from host trees in many rainforest tree canopies. Mountain-climbing techniques provide canopy access that has revealed surprising interactions between epiphytes and host trees in temperate and tropical forest ecosystems. See page 1023. [Nalini Nadkarni, University of Washington, Seattle 98195]

The fraction collector that turns science fiction into science

Just a few years ago no one would have believed that a fraction collector like SuperRac could exist. Most researchers were used to their constant-volume and constant-time collectors – with level-sensors at best.

Many were resigned to a compromise between resolution and the efficient use of collection vessels.

SuperRac will change all that.

To begin with, SuperRac has built-in slope detection. Unlike a simple level sensor, it cuts peaks at their true beginnings and ends. You can even collect unresolved peaks in well-resolved fractions . . . and you never need to worry about baseline drift.

SuperRac also diverts uninteresting eluate to a waste trough – via a valve – so you use fewer test tubes.

SuperRac's memory stores five different collection procedures that you can recall at the touch of a button. It has nine time windows allowing you to limit collection to interesting parts of your chromatogram.

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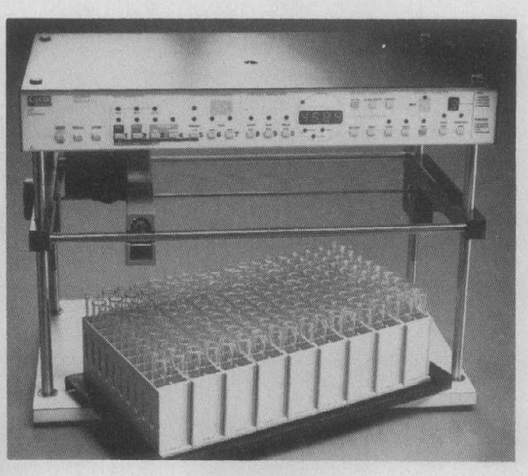

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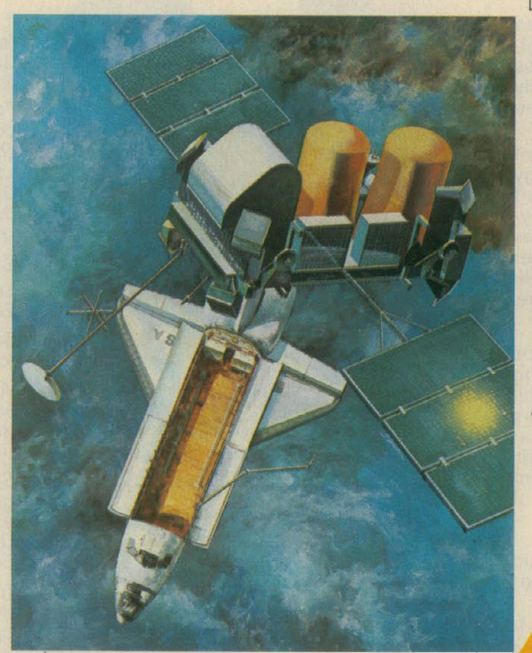
Our national power and prestige will get a boost in 1987 when this 24,000-lb. Gamma-Ray Observatory is launched into orbit to open a new era in astronomy and a new window on the universe.

Only Shuttle can lift the large and heavy instruments needed to catch gamma rays. Their measurements will help answer key questions raised by observations made at other wavelengths.

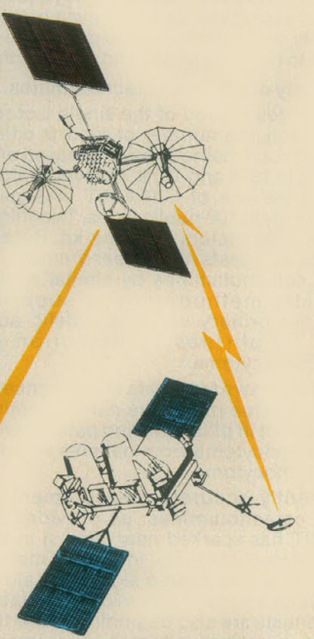
Gamma rays are the least explored, highest energy form of electromagnetic radiation. Tens of millions times more energetic than visible light, they contain clues about the most powerful processes raging inside supernovae, quasars, pulsars, neutron stars, black holes, and exploding galaxies.

Unlike other radiation, gamma rays reflect directly the nuclear processes underway in the cores of such exotic and powerful objects. So our considerable knowledge of nuclear physics can be applied in the field of nuclear astrophysics to learn more about the interaction and creation of energy and matter.



Speeding across space, gamma rays retain the time, direction, and energy characteristics imposed when they were created long ago and far away. As messengers of creation, they tell of the origins of the universe and the evolution of our own galaxy.

The rewards of this quest are new knowledge with its practical applications and a better understanding of the universe and our astrophysical roots.



The NASA Goddard Space Flight Center manages the Gamma-Ray Observatory program and will receive its scientific data via the TRW-developed system of Tracking and Data Relay Satellites and ground station.

How are you measuring catecholamines?

If you're using your own methodology, discover how CAT-A-KIT™ may save you time and money.

In 1973 Passon and Peuler described an innovative single isotope assay for norepinephrine and epinephrine. Requiring less than one ml of plasma, the assay accurately measured these catecholamines in less time and with greater sensitivity than before.

Peuler and Johnson's novel refinement of the assay in 1977 made the methodology practical and led to the development of CAT-A-KIT™ (Catecholamines Radioenzymatic Assay Kit [^{3}H]).* Today the kit requires even less assay time, provides even greater sensitivity, and can determine dopamine in addition to norepinephrine and epinephrine.

Superiority of plasma catecholamines.

Since the description of the single isotope modification, the number of reports citing the use of such methods has increased dramatically. In 1978 and 1979, 75 investigators reported the use of CAT-A-KIT or similar methodology in 100 publications. Two-thirds of these investigators used the kit. Recent evidence suggests that measurement of plasma catecholamines by similar radioenzymatic methodology is superior to 24-hour urinary vanillylmandelic acid or metanephrines in detection of pheochromocytoma.[1]

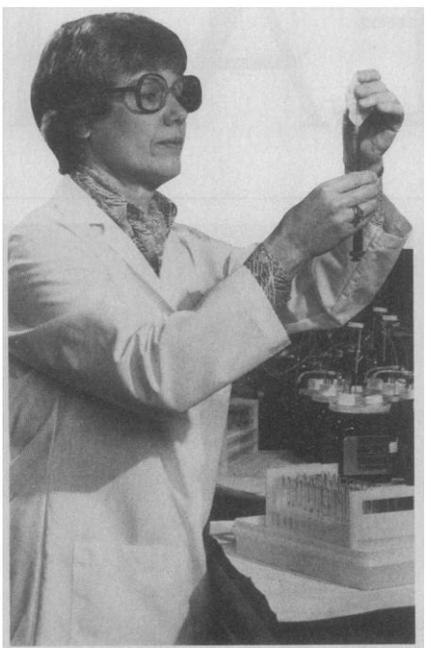
Figure 1, redrawn from data in Reference 1, shows the value of plasma catecholamine measurement in differentiating patients with pheochromocytoma from patients without pheochromocytoma.

Consistently accurate measurement of plasma catecholamines, as provided by CAT-A-KIT, has sparked new interest in the study of catecholamines in human metabolism. The kit has been a significant aid in research on mental depression and diabetes. Scientists are also beginning to use the kit as an investigative tool in other important research areas: hypoglycemia, peptic ulcer disease, hypertension, thyroid disease, and pituitary disorders.

Growing numbers of investigators are discovering CAT-A-KIT's consistency, convenience, and quality control—three good reasons why it has successfully stood the test of time.

The assay procedure is multistep but straightforward, and qualified personnel can perform it without difficulty. If problems do arise, back-up people from Upjohn can offer guidance or training in the use of the kit.

Strict quality control and ongoing personal service help explain why CAT-A-KIT has logged years of reliable performance in the field.



Rose Kupiecki, Technical Service Representative

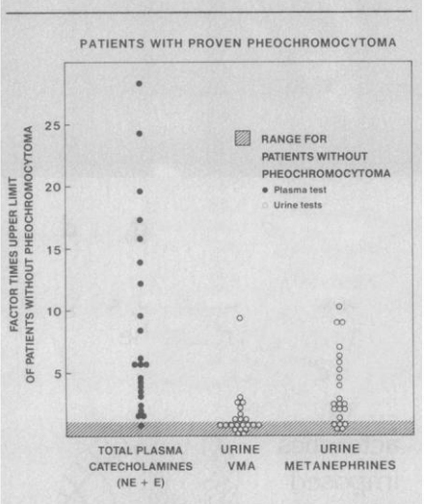


Figure 1. Redrawn from data in Reference 1.

Cost effective.

With sufficient test volume, the measurement of plasma catecholamines with CAT-A-KIT can be as economical and as reliable as methodology adapted from the literature. When reagent and labor costs are considered, many users have found the dollar difference between CAT-A-KIT and their own methodology insignificant, especially when considering the reproducibility and convenience of the kit.

If you're using your own methodology and reagents to measure catecholamines, try CAT-A-KIT and compare the cost. Write or call for a personal cost analysis.

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Test Control—Each kit contains a vial of Control Plasma (with values), which provides a check to insure the test is being performed properly.

How Upjohn Diagnostics can help.

Preparation of the reagents is one of the most critical and time-consuming steps in a catecholamines assay. Let us remove the burden of reagent preparation with CAT-A-KIT, the only kit of this methodology and sensitivity commercially available. The kit consists of nine separate reagents and is accompanied by a Procedure Instruction Manual—a step-by-step illustrated guide to performing the test.

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*Patent pending

[1]Bravo, E. L., *et al.:* Circulating and urinary catecholamines in pheochromocytoma. *N. Engl. J. Med., 301:* 682-686 (1979).

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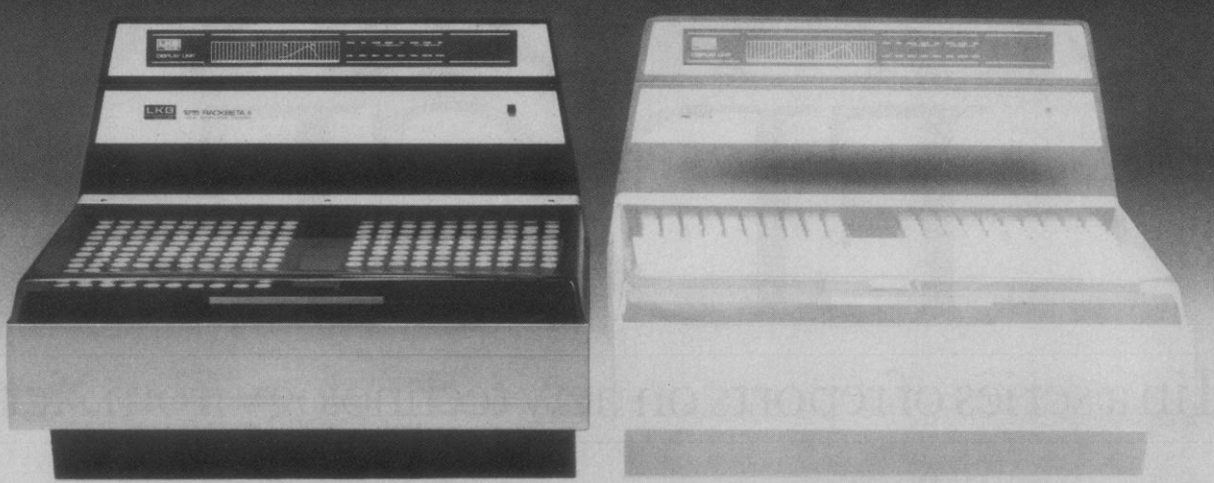

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THE LEADING EDGE

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

About a year ago, Xerox introduced the Ethernet network—a pioneering new development that makes it possible to link different office machines into a single network that's reliable, flexible and easily expandable.

The following are some notes explaining the technological underpinnings of this development. They are contributed by Xerox research scientist David Boggs.

The Ethernet system was designed to meet several rather ambitious objectives.

First, it had to allow many users within a given organization to access the same data. Next, it had to allow the organization the economies that come from resource sharing; that is, if several people could share the same information processing equipment, it would cut down on the amount and expense of hardware needed. In addition, the resulting network had to be flexible; users had to be able to change components easily so the network could grow smoothly as new capability was needed. Finally, it had to have maximum reliability—a system based on the notion of shared information would look pretty silly if users couldn't get at the information because the network was broken.

Collision Detection

The Ethernet network uses a coaxial cable to connect various pieces of information equipment. Information travels over the cable in packets which are sent from one machine to another.

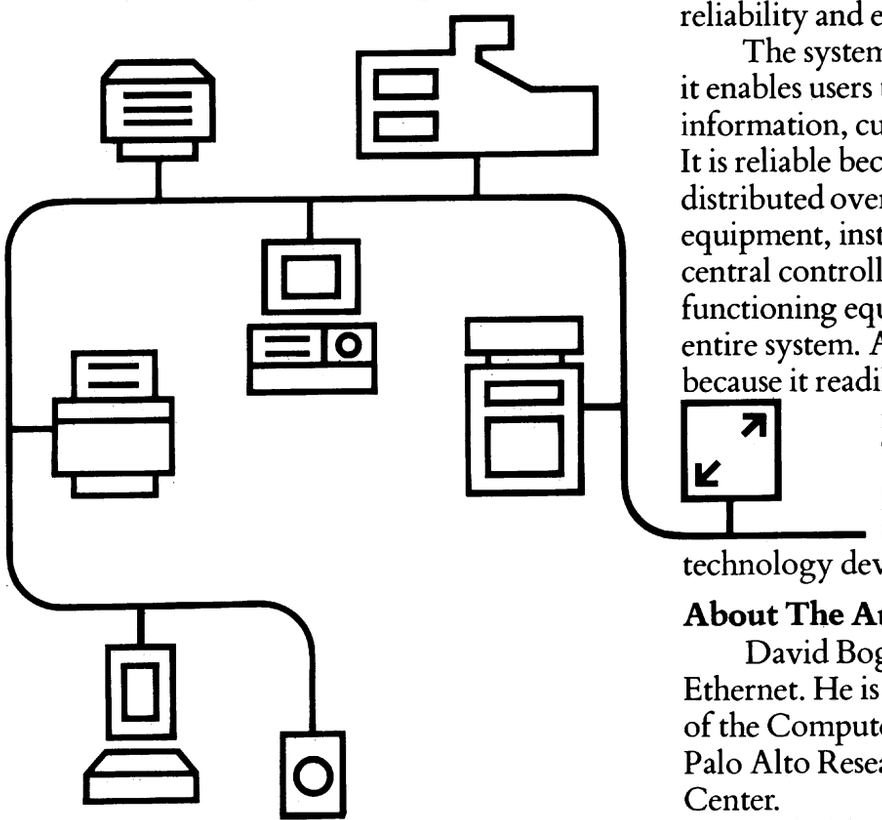
A key problem in any system of this type is how to control access to the cable: what are the rules determining when a piece of equipment can talk? Ethernet's method resembles the unwritten rules used by people at a party to decide who gets to tell the next story.

While someone is speaking, everyone else waits. When the current speaker stops, those who want to say something pause, and then launch into their speeches. If they *collide* with each other (hear someone else talking, too), they all stop and wait to start up again. Eventually one pauses the shortest time and starts talking so soon that everyone else hears him and waits.

When a piece of equipment wants to use the Ethernet cable, it listens first to hear if any other station is talking. When it hears silence on the cable, the station starts talking, but it also listens. If it hears other stations sending too, it stops, as do the other stations. Then it waits a

random amount of time, on the order of microseconds, and tries again. The more times a station collides, the longer, on the average, it waits before trying again.

In the technical literature, this technique is called carrier-sense multiple-access with collision detection. It is a modification of a method developed by researchers at the University of Hawaii and further refined by my colleague Dr. Robert Metcalfe. As long as the interval during which stations elbow each other for control of the cable is short relative to the interval during which the winner uses the cable, it is very efficient. Just as important, it requires no central



control—there is no distinguished station to break or become overloaded.

The System

With the foregoing problems solved, Ethernet was ready for introduction. It consists of a few relatively simple components:

Ether. This is the cable referred to earlier. Since it consists of just copper and plastic, its reliability is high and its cost is low.

Transceivers. These are small boxes that insert and extract bits of information as they pass by on the cable.

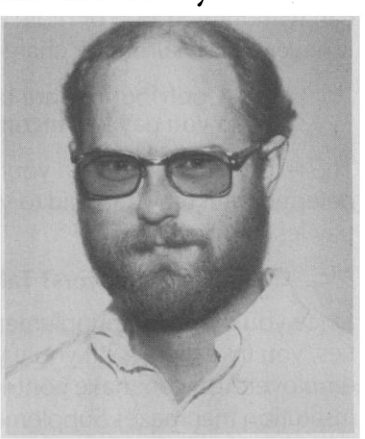
Controllers. These are large scale integrated circuit chips which enable all sorts of equipment, from communicating typewriters to mainframe computers, regardless of the manufacturer, to connect to the Ethernet.

The resulting system is not only fast (transmitting millions of bits of information per second), it's essentially modular in design. It's largely because of this modularity that Ethernet succeeds in meeting its objectives of economy, reliability and expandability.

The system is economical simply because it enables users to share both equipment and information, cutting down on hardware costs. It is reliable because control of the system is distributed over many pieces of communicating equipment, instead of being vested in a single central controller where a single piece of malfunctioning equipment can immobilize an entire system. And Ethernet is expandable because it readily accepts new pieces of information processing equipment. This enables an organization to plug in new machines gradually, as its needs dictate, or as technology develops new and better ones.

About The Author

David Boggs is one of the inventors of Ethernet. He is a member of the research staff of the Computer Science Laboratory at Xerox's Palo Alto Research Center.



He holds a Bachelor's degree in Electrical Engineering from Princeton University and a Master's degree from Stanford University, where he is currently pursuing a Ph.D.

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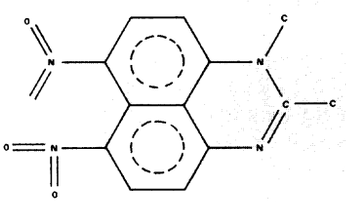

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Biochemical Markers

The article "Biochemical markers identify mental states" by Thomas H. Maugh II (Research News, 2 Oct., p. 39) is overstated. While the catecholamine hypothesis of affective disorders (depression and mania) may have some heuristic value for research, it has by no means produced biochemical measures generally useful in the diagnosis and treatment of these disorders. The significance of urinary 3-methoxy-4-hydroxyphenylglycol (MHPG), a metabolite of brain norepinephrine, in diagnosing and treating affective disorders has become increasingly controversial after the initial excitement generated by the early reports, and the connection if any between urinary MHPG and affective state is poorly understood. Lithium's ability to prevent the recurrence of both mania and depression suggests neurochemical processes common to both poles of affective disorder, and this would conflict with the notion of the catecholamine hypothesis that depression is associated with a deficiency and mania with an excess of brain catecholamines.

The article also states that platelet monoamine oxidase may be "a good marker in schizophrenia." Monoamine oxidase levels may have nothing to do with schizophrenia, being related rather to other factors including treatment with neuroleptic medication (*1*).

There is, however, a good laboratory measure in psychiatry not mentioned in the article. The dexamethasone suppression test (*2*) identifies a significant proportion of patients with major (endogenous) depression. These patients have elevated basal blood cortisol levels that are not effectively suppressed by feedback inhibition when challenged with a test dose of dexamethasone.

FALIES A. MUNAS
Department of Psychiatry and Behavioral Sciences, University of Health Sciences/Chicago Medical School, North Chicago, Illinois 60064

References

1. F. Owen, R. Bourne, T. J. Crow, E. C. Johnstone, A. R. Bailey, H. I. Hershon, *Arch. Gen. Psychiatry* **33**, 1370 (1976); M. Chojnacki, P. Kralik, R. H. Allen, B. T. Ho, J. C. Schoolar, R. C. Smith, *Am. J. Psychiatry* **138**, 838 (1981).
2. B. J. Carroll *et al.*, *Arch. Gen. Psychiatry* **38**, 15 (1981).

Maugh appears to clearly imply that the identification of biochemical bases for mental conditions was given its major impetus during the late 1960's by Schildkraut and Maas. If one refers to the papers presented at a symposium held in 1957 (*1*), one finds the types of hypotheses and experimental work referred to in Maugh's article.

Drug treatments for mental illness have been with us for the better part of two decades, and yet we still have drugs that seem to function with the subtlety of a sledgehammer. They can hype up the depressed and slow down the manic. However, the types of delicate perturbations of cognition and mood that would truly be a boon to psychiatry still elude the psychopharmacologists.

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References

1. M. Rinkel and H. Denber, Eds., *Chemical Concepts of Psychosis* (McDowell, Obolensky, New York, 1958).

Tesla's Contributions

Eliot Marshall's brief article about Nikola Tesla (News and Comment, 30 Oct., p.523) contains several errors. The first alternating current generators were invented shortly after the discovery of electromagnetic induction in 1830–31, almost a half century before Tesla began to seriously study electricity. Alternating current generators had already been in commercial use in Europe for a decade when Tesla patented his polyphase alternating current motors and the generation-transmission system to make them work. This system was first applied on a large scale at Niagara Falls, but many other hydroelectric plants of various types were by then in existence.

Also, the corporation founded by George (not Edward) Westinghouse in 1888 hired Tesla for a year as consultant (he was never a partner) and bought some 40 Tesla patents that gradually proved invincible in the courts. In 1896, Westinghouse and General Electric settled 300 patent infringement suits pending between them with a cross-licensing (not a "swap") agreement that made General Electric senior partner in an electrical equipment duopoly: this elegant anticompetitive arrangement finally fell afoul of the Sherman Act in 1911, but both firms were by then well entrenched.

Last, Marshall is mistaken in reporting that Tesla never acknowledged the work of James Clerk Maxwell. Tesla did maintain for years that Hertz's work had not provided "experimental verification of the poetic conceptions of Maxwell," but he conceded his error in a 1911 address to the National Electric Light Association. Tesla's stubborness was legend—

his fixation on earth conduction of electric power led him to view Hertz waves as transmission losses—but few radio pioneers owed their success to sound theory. Modern extremely low frequency (ELF) research has actually confirmed Tesla's claim that the entire earth can resonate electrically, a principle useful for submarine communication. ELF transmitters do provide some free power, but only to local farmers in the disconcerting form of "electrified" fencing.

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Engineering Education

The problems described by John Walsh (News and Comment, 25 Sept., p. 1479) are pervasive within engineering education. Large class loads, poor equipment, increased administrative demands, declining support services, and the paucity of American Ph.D. candidates are common sources of stress. Unfortunately, Walsh does not discuss what might be the most crucial crisis of all.

In our effort to manage the problems mentioned, we are ceasing to be a scholarly community. The time spent in the library for independent, scholarly study has been sacrificed in order to hustle grants, complete contracts, conduct consulting, and manage the overflow of students. Sustained interdisciplinary dialog is eliminated in order to manage specialized technical and administrative tasks. Independent inquiry is given up in order to meet the specific assignments of contracts, grants, consulting, administration, and overloaded classes. In short, faculty are becoming functionaries, not just within engineering but throughout higher education.

The unique attractiveness of higher education has always been the excitement of belonging to a scholarly community. Few people ever went into higher education for the money. Few students pursue a Ph.D. because it is "cost-effective." A livable income is of course needed, but, beyond that, the freedom and excitement of scholarly work within a supportive environment has been the essential attraction. We have lost that attraction, and it should be of no surprise to us when our best and most creative students go elsewhere.

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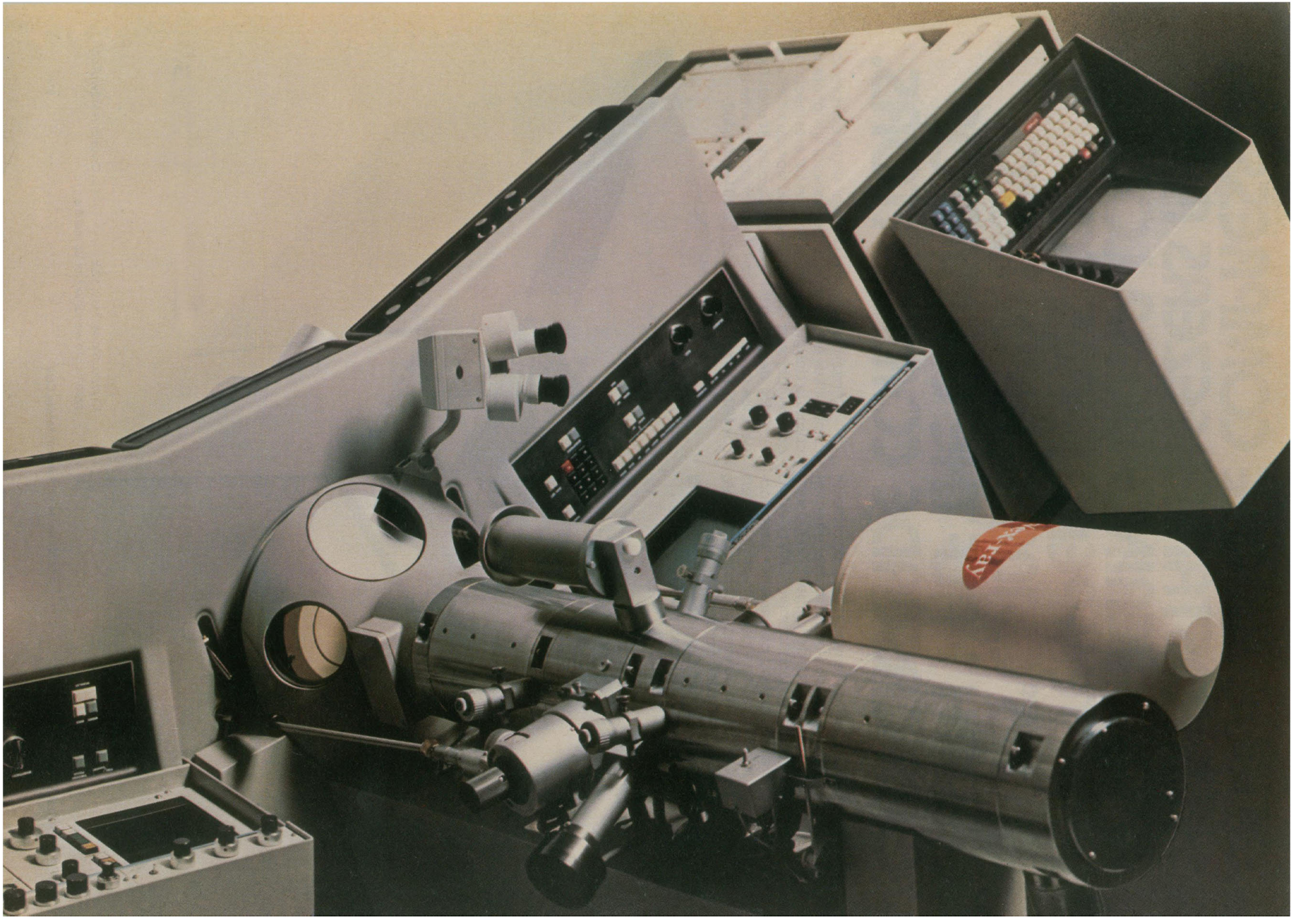

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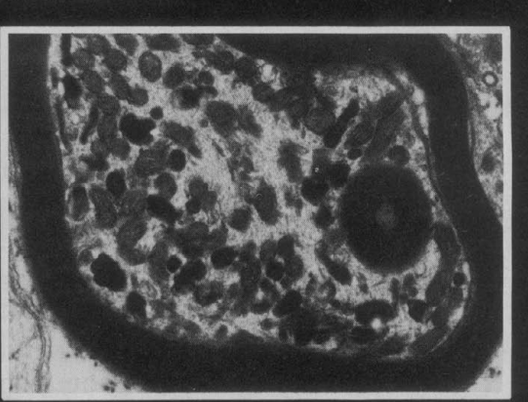

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Biology and the Congressional Fellows Program

What constitutes effective social action? More than a decade has passed since a group of biologists at Cornell University, including faculty and students, contemplated that question during a time of growing environmental awareness and concern. As the contagious enthusiasm of a young and powerful political movement spurred groups into action throughout the nation, the Cornellians searched for that unique contribution that a scientific community might provide, and chose to offer a program by which biologists themselves were put into service. They decided to select and support young biology Ph.D.'s who would work on the staffs of congressional committees that were writing environmental legislation. From this effort, as from similar ones initiated elsewhere, grew programs that we see today.

The most prominent of these is the AAAS Congressional Fellows Program, which has evolved into a vehicle that each year allows a select group of scientists and engineers, sponsored by diverse professional societies, to contribute their talents to government and, in return, gain governmental experience.

Such admittedly political but clearly nonpartisan programs continue to provide trusted technical information and advice to decision-makers. One need only look at the 2 October issue of *Science* to appreciate the growth of the program. In 1973 there were only seven Congressional Fellows. There are now 34, sponsored by some 20 national organizations, including the AAAS, the American Chemical Society, American Geological Institute, American Geophysical Union, American Psychological Association, and several of the leading engineering societies. There is breadth to this roster of sponsors, which spans much of the spectrum of the American scientific community. But does it cover the spectrum in full? Examination of actual numbers reveals one disconcerting imbalance. Considering the pervasive and potential usefulness of the work of biologists in our lives, it is surprising that there should be only four biological societies that sponsor Fellows. And none of these societies are from that branch of the discipline that concerns itself primarily with whole-organism biology and ecology, in which the potential application of current research findings is so high.

We feel that this shortcoming should be remedied. There is in our judgment an increased rather than decreased need for biologists in legislative circles. Where issues are highly technical and clouded with ambiguity, where powerful economic interests argue against each other regarding the validity of interpretation of scientific data, and where the search for confident, deterministic answers to uncertain, stochastic questions reflects an understanding of science that remains naive, the input of the biologist continues to be essential.

While times have changed from the days of activist large-scale environmental reform, the legacy of that period is still very much with us. And while there has been a shift in approach, from simplistic idealism to concerned pragmatism, this shift has in no way lessened the potential usefulness of the biologist in government.

Organizations of biologists could make a lasting contribution to society by furthering programs that support the involvement of biologists in the legislative process. The Congressional Fellows Program provides an established means toward that end. We urge that an increased number of biological societies take on the sponsorship of Congressional Fellows, following the lead set by the American Society for Microbiology, the Biophysical Society, the American Society for Photobiology, and the Federation of American Societies for Experimental Biology.—THOMAS EISNER, *Jacob Gould Schurman Professor of Biology, Cornell University, Ithaca, New York 14853*, AND PETER JUTRO, *Adjunct Associate Professor of Public Policy and Management, Cornell University*

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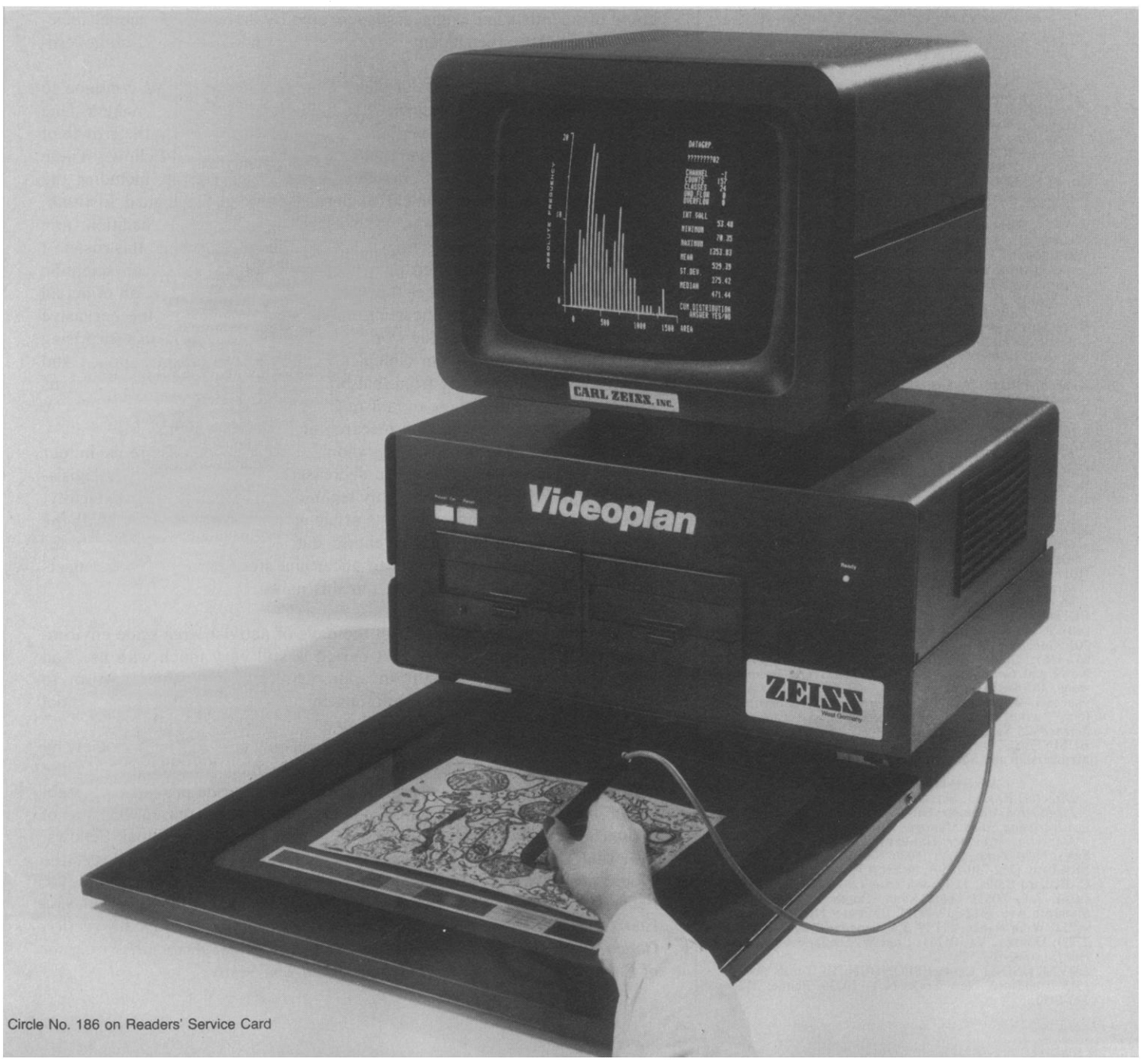

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