The technical superiority is there—as you would expect from the people who make most of the world’s ultracentrifuges. But that’s not all the new J-21B Refrigerated Centrifuge offers.

The first thing you’ll notice is the relative quiet. This 21,000 rpm centrifuge cuts down amazingly on the whine and noise you’ve had to live with before. Sound tests in a laboratory environment showed that lab personnel were subjected to only a fraction as much noise from the J-21B as from its major competitor.

Of course, the J-21B’s clean styling is immediately apparent. But the good looks have a purpose, too. This design gives you free working space on the instrument itself to load or unload rotors. Now we’ve made it stainless steel for added utility.

One thing you don’t see is the J-21B’s partial vacuum which cuts wind friction dramatically. J-21B rotors don’t have to fight their way to top speed—they get there quickly. And they get your work done faster.

For even larger volume separations, there is the remarkable JCF-Z rotor with interchangeable cores for separations by continuous flow, zonal and reorienting gradient techniques. It gives ultracentrifuge-like results, but is simpler to use.

The touches of color we added just for you to enjoy—like the quiet that surrounds this superior machine.

Brochure SB-366C describes the new J-21B. Send for your copy to Beckman Instruments, Inc., Spinco Division, 1117 California Avenue, Palo Alto, Calif. 94304.
New Econo-Filter Covers improve animal production, protect long-term experiments

Improved breeding rates; greater protection for long-term experiments; generally healthier animals. These are some of the benefits you get by using Econo-Filter Covers on your animal cages. Molded in one piece from non-woven spun polyester, they are the simplest, most effective way to protect animals against airborne infection, cross contamination and environmental stress. Econo-Filter Covers meet all published standards for porosity, air-permeability, and filtration of air-borne organisms, dust and other contaminants. They are available for all standard Econo-Cages and are reusable.

Positive Filtration. Econo-Filter Covers effectively remove air-borne contaminants without inhibiting the proper exchange of air. They can measurably reduce the incidence of contamination and diseases such as infantile diarrhea. This means that now both short-term and long-term programs can maintain a “clean” cage environment without instituting new lab procedures.


Increased Animal Production. Healthier animals produce stronger litters and show greater fertility. Econo-Filter Covers can make a profitable difference in production by promoting more successful breeding while, at the same time, reducing infant mortality.

Economy and Efficiency. Few filter systems of equal efficiency are as economical as Econo-Filter Covers. They are reusable; withstanding normal sterilization cycles in both steam and gas autoclaves. One-piece Econo-Filter Covers can be installed without special attachments or adapters.

What do you want? Healthier animals; increased animal production; or more protection for long-term experiments. You get them all with Econo-Filter Covers. For all the facts, contact your Econo-Cage/Econo-Filter Distributor or write the Scientific Division, Maryland Plastics, Inc., 9 East 37th Street, New York, New York 10016.
Here are Some New (and old) Problem Solvers from Varian, the Multi-Product, Quality Instrument Company.

Varian instruments are helping life scientists shed light on a variety of problems in their research — instruments with the well-known brand names Cary®, Aerograph®, Anaspect, MAT, Techtron, and Varian®.

From UV-Vis through GC and LC to NMR, EPR or AA — you have a wide selection from which to choose the tools best suited to your needs. And a Varian expert will help you pick the best possible combination of instruments plus back-up assistance so you can focus on life science problems, not hardware problems.

Here are some of the kinds of problems in which Varian instruments can help the life science lab. There are others. Ask us about them.

**Protein difference spectroscopy needs the Cary 118's accuracy**

With difference spectroscopy the life scientist has a valuable probe for investigating the structure of protein macromolecules. It is a very sensitive method for detecting small, discrete changes in a sample which could not be observed with standard absorption procedures, where strong overlapping bands obscure many weaker peaks.

To measure these small absorbance changes, the scientist must have a good spectrophotometer. Because of its unmatched photometric accuracy, the Cary 118 Spectrophotometer is the ideal instrument for difference measurements (at 0.1 abs the accuracy is 0.00035 abs). Such performance is necessary, since even
very small errors can sometimes lead to incorrect interpretation of the spectrum.

In practical terms the 118's exceptional performance frees the scientist from concern about the quality of the data. He knows that any peaks recorded on the spectrum result from sample absorption, and not from an instrument artifact.

To obtain further information about the Cary 118's capabilities for difference spectroscopy, kinetics, determining concentration in small-volume samples, quantitative analyses, or even recording derivative spectra, circle Reader Service No. 12.

The Cary 17 Spectrophotometer

With the Cary 17 changing absorbance ranges makes a mountain out of a mole hill

Often when recording a UV-Vis spectrum, a particular wavelength region of interest may produce only a small hump on the spectrum, because it requires less sample preparation because no sample dilution is necessary to bring absorbance values on scale.

To demonstrate the advantages of changing absorbance ranges, these spectra of oxidized cytochrome C reduced with ascorbic acid were recorded on the Cary 17. Spectrum A (0-0.5 abs range) fully resolves the Soret band at 415 nm, but shows little detail on the peaks at the longer wavelengths. The expanded presentation in Spectrum B (0-0.1 abs range) gives better detail of the a and b bands at 550 and 520 nm.

the sample's absorption is not very great in that area. In such a situation, changing the absorbance range expands the chart scale and makes it possible to see more spectral detail. With the Cary 17 Spectrophotometer, switching absorbance ranges is convenient and rapid. The instrument is equipped with a universal absorbance/ %T slidewire so that any of eight absorbance ranges or a 0-100 %T range may be selected. This feature, along with the coupled wavelength scan and chart drive, makes it easy to back up the chart and rescan a particular area using expanded scale to increase the sensitivity of the recording. A small, smooth hump becomes a detailed peak.

A second advantage of the range change capability is that absorbance bands with widely divergent molar absorptivities can be recorded on the same chart, a more convenient presentation for most purposes. Too,

The Techtron 635 Spectrophotometer simplifies kinetics

Enzyme kinetics involve a lot of sample handling problems. They're a major concern in this type of measurement. With the Varian Techtron 635K Spectrophotometer we’ve solved many of them.

To do this we designed the instrument on a modular concept so the scientist can select the system best suited to his work, and purchase it at a moderate cost.

For analyzing numerous samples, for instance, an Auto-5 cell programmer with dual sample/reference turrets can be included in the system. Also, there are thermostatable cell holders, a temperature readout module, wavelength programmer, and other accessories, all designed to make kinetics studies easier.

Another step we’ve taken to simplify kinetics is to incorporate push-button controls on the instrument. You just punch a button to set operating parameters.

To obtain more information, circle Reader Service No. 14.
Spin labeling biological membranes: What For and What With

First, the What For.
Here's a list of literature references, all of which deal with the use of nitroxide spin labels and EPR (ESR) to study biological membranes:

Biosynthetically spin labeled mitochondria subjected to EPR analysis contained at least two incorporated spin labels with different degrees of constraint.


Incorporation of spin-labeled compounds into membranes by using a protein carrier or, for experiments with micelles or liposomes, by agitation or sonication of the aqueous suspension should prove to be more valuable in the future as a probe of the membranes of living cells.


The orientation properties of spin labels were used to show that the phospholipid regions of both nerve and erythrocyte membranes strongly resemble lipid bilayers with phospholipids being more tightly packed in erythrocytes than in nerve fibers.


The spin label attached to cytochrome C in submitochondrial membranes underwent reversible changes in mobility when the metabolic state of the submitochondrial particles was altered.


They're all available in your local technical library.

Now, the What With.

Varian EPR systems, of course. The EM-500, E-4, E-Line—the finest EPR systems available anywhere. For literature, write on your letterhead indicating the systems of interest.

For E-Line information only, circle Reader Service No. 15.

The high field NMR analysis of living cell components

Transfer RNA plays a vital role in protein synthesis in the living cell, selecting a specific amino acid and attaching it to the growing protein amino acid sequence at the point specified by the genetic code of the ribosomal DNA. Now, high field NMR, by helping to provide detailed knowledge about t-RNA's conformation in aqueous solution, offers a promise of better understanding the exact way in which t-RNA accomplishes its function.

Recent work involving a Varian superconducting NMR system has shown that high field proton NMR studies in H2O allow observation of the number and type of hydrogen bonds involved in Watson-Crick base pairing in yeast phenylalanine t-RNA whose integrated intensity can be interpreted in terms of the number of base pairs, and whose shift values reflect the type of bases paired. These data have been used to confirm the clover-leaf model for the secondary structure of t-RNA and may even throw additional light on the tertiary structure believed to be responsible for the specificity of action of these vitally important molecules.

The renowned and well-established HR-220 series of Superconducting NMR Spectrometers has been upgraded to the HR-300, the instrument that provided this data. Now an improved version of the HR-300 is available, Varian’s SC-300.

For more detailed information, circle Reader Service No. 16.

REFERENCES:
3. 2,2-dimethyl-2-silapentane-5-sulfonate.
Temperature control, particulate type
a form heat superior

Acids; Digital Integrator

and ability

The one

Our operating flexibility.

Our system
dual and ceuticals
gets

drug, toxicology,
is
temperature programming.

Its

efficiently

metal all the

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Here's

metal-sensitive compounds.

Ease

Doing standard

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any

methodology as

U-columns

has universal

on-column

and

GC

maximum

the

dead

GC

the

the 2100, with

just

circle Reader Service No. 17.

New rare earth ³H detector
improves GC sensitivity
for pesticides

Varian's new EC detector both

produces and exceeds the best performance characteristics of present ³H and ⁶⁵Ni detectors. And perhaps best of all, they can be removed, cleaned,

and returned to the GC in less than

30 minutes! Since they can be heated to 325°C, contamination is minimized. Sensitivity for Lindane is better than 0.2 picograms of Lindane when eluted in 5 minutes or less, and dynamic range exceeds 1000:1. The unit fits the standard universal detector base on most Varian Aerograph gas chromatographs.

For details circle Reader Service No. 18.

Steroids separation,
one of many performed easily and precisely
with Aerograph Liquid Chromatographs

Whether your separations involve steroids or other biochemicals, you'll have no concerns about being equipment-limited with Varian Aerograph liquid chromatograph systems; they provide capability to perform any LC separation with precision and speed. Our UV and RI detectors are second to none in sensitivity; our pumps deliver flowrates that are easily set, precisely regulated, and repro-

Conditions: Varian MicroPak® Si-10

column, 50 cm x 2.1 mm i.d.; mobile phase, heptane (70), THF (30), acetic acid (1); sample 0.5 mg; flowrate 126 ml/hr; pressure 950 psi; RI detector; attenuation 16. Chromatogram courtesy Dr. R.P. Lanzilotta, Syntex Research.

ducible to ±0.1%; columns and related hardware offer state-of-the-art efficiency and capacity. All these let you perform rapid separations, even with diastereomers of heat labile biochemicals.

If you have questions about an LC system to meet your specific needs, we'd like to help. Outline your requirements to us and our experts will offer recommendations promptly.

If it's just descriptive literature you want now, circle Reader Service No. 19.
Good back-up is that invisible specification that’s necessary to bring out the best from your analytical tools. Here are the extras you get with every Varian product.

Applications
Chemists in our Field Applications Laboratories can help you select the right instrument and the most feasible method of solving your analytical problems.

U.S. Field Application Laboratories are located in Houston, Texas; Springfield, New Jersey; Park Ridge, Illinois; and Los Altos, California—as well as in key locations in Europe, the Far East, and other parts of the world.

Also, applications chemists in our Palo Alto headquarters are working constantly to improve and develop analytical methodology in areas of wide scientific interest.

Local Instrument Division sales offices have available a supply of printed technical information from the laboratories: applications notes, methodology books, reprints—all aimed toward increasing the utility of your Varian instrument.

R and D
Behind closed doors scientists and engineers are working on developments leading to the new generations of instruments and accessories. In fact, in just the past year, Varian has introduced a number of new instruments and accessories, and Varian Instrument Division scientists and engineers have been awarded over three dozen new patents.

The Instrument Division has a commitment to continual R and D in the area of analytical instrumentation.

Workshops, Seminars, Scientific Meetings, Customer Training Courses
Varian has a long history of sponsoring and participating in scientific gatherings throughout the world. Regular programs of GC, LC, NMR, EPR, AA, and Raman workshops have reached thousands of scientists in recent years—and are continuing to do so. Here’s a recent schedule of activities with, where appropriate, contacts for more information for those interested in attending.

Calendar of Events
For more information, contact your local Varian Instrument Division sales office unless otherwise indicated.

UV-Vis Life Science Seminars
Special life science training seminars entitled “How to Get the Best Answers from Your Spectrophotometer” will be held during the month of May in Boston, New York City, Washington DC, Atlanta, Houston, Chicago, Seattle, San Francisco, Los Angeles. Watch for announcements of specific dates.

Gas Chromatography Courses
April 16-18, 1973: Houston, Texas
May 16-18, 1973: Springfield, N.J.

Liquid Chromatography Courses
February 14-16, 1973: Chicago, Illinois
May 9-11, 1973: Houston, Texas

Mass Spectrometer Meetings
May 18-19, 1973: Varian MAT Instrument Owners Meeting, Palo Alto, California

NMR Workshops
April 4-6, 1973: One-day T-60A Workshops, Springfield, New Jersey

Exhibits/Scientific Meetings
Varian instruments on exhibit

March 5-8, 1973: Pittsburgh Conference, Cleveland, Ohio, USA
March 6-10, 1973: Medex 73, Basel, Switzerland
March 11-20, 1973: Leipzig Spring Fair, Leipzig, Germany
April 4-15, 1973: Electro Mash 73, Moscow, USSR
April 11-18, 1973: Mesucora/Exp. de Physique, Paris, France
April 16-20, 1973: FASEB, Atlantic City, New Jersey, USA
May 7-12, 1973: Interlabor, Zagreb, Yugoslavia
May 18-24, 1973: TV-Symposium, Montreux, Switzerland

Service
The best service is no service at all. Since there’s no such thing as a perfect instrument, we do the next best thing: design instruments for the most reliability at a given price tag, then back that up with trained Service Engineers in 15 locations in the U.S. and many additional locations throughout the rest of the world.

Your orders for spare parts and supplies are shipped on either a normal or emergency basis, depending on need. And we’re improving our turnaround time continually.

On those occasions when you have instrument difficulty, you can call your local Varian Service Engineer and perhaps even get the help you want over the telephone—all part of the responsive service that we’re making even better.

Varian Associates
Instrument Division
611 Hansen Way
Palo Alto, California 94303

And Varian Back-Up Adds Extra Value.
"Babe" had a great year in 1927......so did biology.

Volume 1 of BIOLOGICAL ABSTRACTS, in 1927, was quite an achievement. It contained 14,506 abstracts of biological literature and represented the start of what would become the greatest information service in the life sciences.

Last year BIOLOGICAL ABSTRACTS (and its companion publication BIO-RESEARCH INDEX) reported on more than one-quarter million papers from publications originating in over 90 countries. An excess of 680 subject sections covering the wide diversity of the life sciences, comprise each issue.

In sharp contrast to the modest beginning of Volume 1, in 1972 BIOLOGICAL ABSTRACT's new microfilm edition offered 20,000 abstracts on just one 4” microfilm cartridge! Now more than 2.5 million abstracts are in the microfilm collection.

The broad spectrum of coverage and service for the life sciences has grown to include semi-annual indexes of abstracted and bibliographic material, a preview on magnetic tape of forthcoming issues, specialized custom search services based on computerized storage of current and past materials, and a whole new series reaching highly specialized disciplines such as mycology, entomology, pollution, cancer, ecology, and drug addiction.

This is what BIOSIS is all about. We collect, translate and abstract literature published in every corner of the world. And combining professional and technical skills with sophisticated equipment, we keep scientists continually informed.

This is an Insulin A-Chain after a 12 step degradation. The instrument that provided the analysis was our 6AH Amino Acid Analyzer. Peaks like this are just part of the performance on the 6AH and our 47K Sequence Analyzer.

**Highest sensitivity.** The 6AH matches unmatched sensitivity and automatic operation. It’s rated at 5 nanomoles/2 mm and 1 nanomole/10 mm. It automatically accommodates 12 samples or 36 with accessories. You can employ either single or dual column methodology for protein hydrolyzate research and for work with physiological fluids. And like the 6AH, the integrator we feature is a product of JEOL design and manufacture.

Our 47K should be part of your work if your work includes short peptide or long protein analysis. The patented design of the overflow reaction cup system makes this research possible. The automatic fractionation of residual peptides and dual fraction collectors make both Edman and Dansyl subtractive methods routine.

**Top support.** More than routine is JEOL service that comes with every instrument. It’s the equal of the instruments in refinement, speed and accuracy. Our service stands ahead of others and behind our 47K and 6AH. All are at the top of their field, individually or working together.

Learn more from the Automated Analyzer Division, JEOL, 235 Birchwood Ave., Cranford, N.J. 07016. Tel. (201) 272-8820.
Some things are changing for the better.

And now, Model 30: the world's most powerful and versatile calculator.

I BRIDGE THE GAP BETWEEN TRADITIONAL CALCULATORS AND MINI-COMPUTERS--
BECAUSE I USE A STANDARD LANGUAGE, HP BASIC-- AND WHEN YOU TURN ME

AS YOU CAN SEE, I HAVE ALPHA-NUMERIC KEYBOARD AND DISPLAY AND A
QUIET PRINTER MATCHES MY OUTPUT SPEED.

IF AFTER READING THIS LITTLE GENERALITY YOU ARE REALLY INTERESTED
IN HOW I CAN HELP YOU--JUST ASK THE PEOPLE WHO MADE ME POSSIBLE
SEND MORE DETAILED INFORMATION.
Many people know us as an instrument manufacturer: we make more than 2,000 products for measurement, test and analysis. Others know us as a computer company: more than 10,000 own our calculators and computers. We prefer to think that our business is to serve your measurement and computation needs.

A way to manage airport noise.

Aircraft engine noise — from more and bigger planes taking off and landing more frequently — is now a bona fide environmental problem. As the volume of air traffic grows and our population expands to surround previously remote airport areas, the need for effective noise control is essential.

The ideal solution is to stop this noise at its source by designing quieter engines, or by retrofitting the world's current fleets with noise-suppressing engine nacelles, but this will take time to implement.

Until then, many airports are finding an interim solution by developing noise abatement techniques for landing and take-off operations. To help establish and validate these techniques, some major airports with acute noise problems are using HP Aircraft Noise Monitoring systems. These systems operate automatically and around the clock. Special microphones monitor noise from different locations in the airport vicinity. This information is relayed to a central location where the data is continuously analyzed and reported so that airport operations can immediately advise pilots of noise irregularities and violations.

HP noise monitoring systems are now operating at international airports in Los Angeles, Sydney, Geneva, Zurich and Stuttgart (and soon, in London and Manchester).

If you have any relationship to this issue of airport noise, we'd be happy to send you information on our system. The noise won't go away, but our system will help make it more manageable.

A typical noise violation report generated by HP’s noise monitoring system.

<table>
<thead>
<tr>
<th>DATE</th>
<th>TIME</th>
<th>NMS</th>
<th>RANGE</th>
<th>SETNL</th>
<th>MNL</th>
<th>LIMIT</th>
<th>SENEL</th>
<th>COMMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/23/72</td>
<td>08:13:25</td>
<td>4</td>
<td>60</td>
<td>65</td>
<td>102.5</td>
<td>105</td>
<td>114.7</td>
<td>Flight 82/47</td>
</tr>
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<td>7</td>
<td>60</td>
<td>65</td>
<td>104.8</td>
<td>105</td>
<td>113.2</td>
<td></td>
</tr>
<tr>
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<td>6</td>
<td>60</td>
<td>65</td>
<td>97.7</td>
<td>100</td>
<td>114.3</td>
<td></td>
</tr>
<tr>
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<td>12</td>
<td>80</td>
<td>65</td>
<td>121.8</td>
<td>105</td>
<td>116.4</td>
<td></td>
</tr>
</tbody>
</table>

You can detect the real cause and true effect of vibrations and noise.

A trained ear can pinpoint the pitch of a pure note within a few cycles per second. But, given a complex mixture of sounds or other types of signals — like an automobile vibration, or an underwater sound — it takes more than a trained ear to identify the basic frequencies that make up the mixture. Scientists and engineers find it highly useful, and sometimes essential, to trace or identify a low frequency signal through a mechanical structure. And they often need this information on the spot — in real-time as an event is taking place.

It is now possible to bring real-time signal analysis to the lower frequencies of vibration and sound with computers and the fast Fourier transform: HP’s Fourier Analyzer.

Here are a few practical examples of how it can be used.

• Testing mechanical components such as axles, differentials, and motors to assure their quality.
• Monitoring machines (power turbines, pumps, power tools) to determine when maintenance work should be done — before a breakdown.
• Analyzing structures, i.e., buildings, bridges, vehicle frames, airplane wings for improvement in design and resistance to failure.

If you think you have a problem that might yield to the HP Fourier Analyzer, ask for a free brochure.

For more information on the products described in these pages, fill out the coupon or write to: Hewlett-Packard, 1507 Page Mill Road, Palo Alto, California 94304.

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HP sales, service and support in 172 cities in 65 countries.

Please send me information on the following:
( ) HP Model 30 Calculator
( ) HP Aircraft Noise Monitoring System
( ) HP Fourier Analyzer

Name ____________________________
Company __________________________
Address ____________________________
City ____________________________ State ________ Zip _______

00223
INTRODUCING

THE TWO NEWEST

PLUG-IN ADDITIONS

TO THE VERSATILE NICOLET 1070 SIGNAL AVERAGING SYSTEM

For a wide range of applications the Nicolet 1070 System is the most versatile signal averager available today. The key to its flexibility lies in its ability to accept data and/or program instructions either from plug-in modules or from a remote source such as a general purpose computer. Twenty-three plug-ins are presently offered. The two newest ones are pictured and described below.

Features of the 1070 System include CRT numerical display of memory contents, smoothing and differentiation of averaged data, integration, data transfer and normalization, addition or subtraction of constants 1024 or 4096 word memory, and a wide variety of peripheral input/output devices.

Model SD-71B Plug-in. This plug-in offers 12 bits vertical resolution (one part in 4096) at sampling rates up to 100 kHz. For those applications that require many thousands of sweeps it incorporates a systematic noise reduction scheme so that more sweeps are possible without the adverse effect of coherent noise. To minimize the amount of noise that lies outside the frequency range being studied, an input filter is provided with 11 cutoff frequencies.

Model SW-71B Plug-in. Because of its four-digit thumbwheel selectors for dwell time (sampling interval), the SW-71B can match any sweep time to four-digit accuracy. It also incorporates an address reset capability so that it is not necessary to sweep the full number of addresses in the 1070 memory. Pen readout speeds can be selected from the four-digit thumbwheel switches or can be dependent on the Y-axis rate of change for X-Y plotter readout.

For information on these two plug-ins, a new magnetic tape interface, or the entire 1070 System, please write or call collect.

NICOLET INSTRUMENT CORPORATION

5225 Verona Road, Madison, Wisconsin 53711
Phone 608/271-3333  TWX: 910-286-2713

In Europe: Nicolet Instrument GmbH, Goerdelers Strasse 48, D-605 Offenbach am Main, West Germany, 0611/852028, Telex: 841/4185411

Circle No. 1 on Readers' Service Card
A student microscope should be rugged, durable, tamper-proof, and optically flawless. The Nikon CL Classic is all of that, and more. From top to bottom, it's designed for classroom use. Furthermore, the emphasis is on simplicity. Widefield 10x eyepieces, easily manipulated high-resolution objectives, bright even illumination and built-in solid state light intensity control—all guarantee trouble-free, simple operation for the student microscopist.

It's priced right, too—without any sacrifice of optical quality or workmanship. You'll find it fits easily into the institution budget. What's more, the CL Classic will accept a variety of accessories, giving you the versatility of an advanced microscope when you need it.

It's optically exceptional. The high quality, high resolution optics meet the matchless standards that Nikon requires of all its microscopes. Comes with four achromat, color coded objectives, mounted on a four-place multiple ball-bearing nosepiece, 4x, 10x and retractable 40x and 100x (oil immersion.) Also has an n.a. 1.25 condenser in rack and pinion focusing mount.

It's tamper-proof. Nikon designers have solved the problem of tampering, pilferage and accidental loss by locking in the eyepieces, body tube, condenser and objectives in a special way and giving you the key.

It's damage-proof. Damage to specimens, slides and objectives is virtually impossible because of the jam-proof, slip-clutch safety feature in the harmonic drive focusing mechanism. The unusually smooth and sensitive, pre-set focusing controls will not break down even when forced.

It's rugged and durable. The stand is full-sized, broad-based, sturdy and resistant to chemicals. This makes for maximum stability and protection against the rigors of daily classroom use.

Student or teacher, the Nikon CL Classic is the ideal classroom microscope. Prove it to yourself. Arrange for a free demonstration. Call or write: Nikon, Inc., Instrument Division, Ehrenreich Photo-Optical Industries, Inc. 623 Stewart Avenue, Garden City, N.Y. 11530.
Why we think Brush recorders are your best choices.

CLEANEDEST TRACES. When you say hello to your Brush Recorder, you say good-bye to smudging, smearing, skipping and puddling traces. The reason: pressurized inking that forces a crisp, clean trace not just onto, but into the paper. Our pens never need priming, even after long periods of not being used.

ACCURACY. Another plus for the Brush Recorders is our Metrisite® non-contact servo-loop feedback device. A system so accurate it enforces pen positioning at better than 99 1/2% linearity.

LOW MAINTENANCE. We've carefully designed each instrument to require minimal care. For example, our Metrisite system eliminates bothersome maintenance problems. Like dirty pots, wear, cleaning. The Metrisite also eliminates slide wires and all the maintenance problems that go with them.

Besides, we put every instrument through quality control checks that simply don't forgive mistakes. Electronics are all solid-state in the recorders. And most models come in either portable or rack-mounted versions. All of them are compatible with our wide range of signal conditioners, so you can get the exact signal conditioners to suit your requirements.

If you'd like to know more about Brush Recorders, contact your nearest Gould Sales Engineer or Representative. Or write for detailed performance information and specifications. Gould Inc., Instrument Systems Division, 3631 Perkins Avenue, Cleveland, Ohio 44114 or Rue Van Bœckel 38, Brussels 1140, Belgium.
**GENERAL PURPOSE**

**BRUSH 222** • 2-CHANNEL. Portable battery operated version of popular Brush 220 recorder. Internal recharge. 30Hz frequency response. Sensitivity 1mV/div. to 500V f.s.

**BRUSH 440** • 4-CHANNEL. Designed for maximum versatility at low cost per channel. 40Hz frequency response.

**BRUSH 260** • 6-CHANNEL. High precision and maximum operator convenience. Built-in preamps. 1mV/div. to 500V f.s. sensitivity.

**BRUSH 481** • 8-CHANNEL. Our newest 1mV/div. to 500V f.s. sensitivity. Model 480 available without preamps.

**HIGH PERFORMANCE**

**BRUSH 250 SINGLE CHANNEL.** Fastest, most versatile strip-chart recorder anywhere. Useful response to 100Hz. Detachable chart paper magazine.

**BRUSH 240** • 4-CHANNEL. Frequency response to 55Hz on 40mm and 35Hz on 80mm channels.

**BRUSH 200** • 8-CHANNEL. The world's standard for high performance recorders. Tailored to your specific requirements.

**SPECIAL PURPOSE**

**BRUSH 2300 LIGHTBEAM OSCILLOGRAPH.** Dual tungsten filament optical oscillograph. From 1 to 16 channels. To 1000Hz response.

**BRUSH 816** • 8-CHANNEL HI-SPEED MULTIPoint Scans and displays up to 8 channels. Data is recorded at a rate adjustable from 2 seconds per point to 16 points per second.

**BRUSH 511 DIGITAL PLOTTER.** Absolute coordinate plotter. Non-cumulative errors. No permanent offsets due to transmission line disturbances. 99.85% linearity.

Worthington's high-purity blood fractions.

Human blood has several fractions of intense interest to immunologists and clinical researchers. Responding to this interest, we turned certain of our more sophisticated purification techniques to the problem and came up with a selected group of products obtained from human blood. Six of these—Alpha-1-antitrypsin, Carbonic anhydrase B and C, Gamma globulin G heavy and light chains, and Plasminogen—are offered commercially for the first time. Others, Gamma globulin G and Albumin, are offered in purities and homogeneities surpassing all other preparations previously available. Pictured above are crystalline Fc fragments from pooled human gamma globulin.

Such purification is achieved through the use of such advanced techniques as ion exchange gel permeation and affinity chromatography, expertise we have gained through years of preparing high-purity research enzymes.

The blood fractions are fully characterized through disc gel electrophoresis, ultra-centrifugation, and amino acid and immunochemical analysis. Together, they provide the researcher with new tools for investigations in such dynamic fields as immunology and blood component therapy.

Prices and specifications are listed in the current Worthington Research Products catalog, available on request.

Circle No. 3 on Readers' Service Card
ZEISS instruments for the researcher and the laboratory

EM 9 S-2 Electron Microscope
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As the full report referenced in our article shows, present knowledge concerning these factors is consistent with our strategic recommendation to permit, as an emergency measure, the seeding of some hurricanes threatening a coastal area.

It is possible to conduct a decision analysis to determine the value of research on hurricane steering. However, our discussions with meteorologists have indicated that while the ability to steer hurricanes would be valuable, this ability is unlikely to result from a research program. Consequently, it is not clear that the decision analysis of steering research would demonstrate that the research has a high value.

On the question of loss of life, we found that, given the effective hurricane warnings provided by the U.S. Weather Service, the expected number of lives lost in a present-day hurricane is relatively small. If these lives are valued for decision-making purposes in a range from $100,000 to $300,000 each, they constitute an expected loss of only about one-tenth the expected property damage for the hurricane. Furthermore, since storms that damage less property also tend to kill fewer people, the case for removing the prohibition against seeding is only strengthened by including human loss.

We direct our commentary on Kates's letter to the three hypotheses he suggests for the nature of decision analysis.

Hypothesis H3 is that decision analysis systematically excludes significant aspects of the problem because they are uncertain or improbable. Anyone familiar with decision analysis knows that its procedures involve not excluding, but discovering and emphasizing, significant aspects of the problem. In fact, decision analysis is uniquely concerned with assessing probabilities and their implications. Kates presents no evidence that our recommendations would be changed by additional analysis of any of the factors he mentions.

Hypothesis H2 is that decision analysis might be misused. We agree that anything from hammers to medicine may be misused, but we find no logical argument that they should be unused. Moreover, Kates presents no evidence that our hurricane analysis has been or will be misused.

Hypothesis H1 is that decision analysis might be used for amoral purposes. Presuming that amoral means immoral, we can only reiterate that the fact that hammers and medicine can be instruments of crime is no argument for
discontinuing their production. Kates presents no evidence that our analysis has been or will be used for immoral purposes.

But Kates's hypotheses do not form a collectively exhaustive set. We would like to include a fourth hypothesis, H4: Decision analysis is a rational method for displaying and balancing the important uncertain, complex, and dynamic factors that surround a decision. We leave it to others to judge whether this hypothesis is supported by our work.

ROBERT LEMLICH
Department of Chemical and Nuclear Engineering, University of Cincinnati, Cincinnati, Ohio 45221

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References


I gladly accept Robert Lemlich’s correction. I have also learned from Rolf A. Haugen of Pergamon Press that An Introduction to Equilibrium Thermodynamics by Bernard Morrill has just been published—with a chapter on Jaynes formalism. Apart from this, Joel H. Hildebrand writes me that, after spending the academic year 1906–07 with Nernst in Berlin, he independently derived the Gibbs-Duhem equation (not mentioned in Nernst’s book). He concludes now that, “There is great reward from getting answers out of one’s head instead of from a book.”

WITOLD BROSTOW
Département de Chimie,
Université de Montréal,
Montréal 101, Québec, Canada

23 FEBRUARY 1973
GME
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Briefly, the first list of threatened species—those deemed on the brink of extinction and subject to the strictest controls—tentatively includes the following:

- **Birds**: 34 species, among them peregrine falcons; 14 parrots and parakeets, mostly from Latin America and the Caribbean; rock fowl; 7 exotic pheasants.
- **Mammals**: 51 genera and species, including the spotted cats; all lemurs; gibbons, orangutans, several monkeys, and the mountain gorilla; the fur-bearing vicuna; wild cattle except bison; bowhead, right, blue, and humpback whales; marine and tropical otters; 4 species of rhinoceros; 3 species of tapirs; and the Amazonian manatee.
- **Reptiles**: 33 species and genera, including 7 crocodilians; the Galapagos tortoise; 3 species of marine turtles; and the much maligned Komodo dragon.
- **Mollusks**: include 24 species of rare clams and one, emerald green, snail.
- **Plants**: the National Orchid of Colombia; welwitschia; and 3 species of cycad.

The second tentative list, of animals and plants to be accorded less strict control, includes all owls; Mexico's quetzal bird; the fin whale; chimpanzees; the remaining gorillas; the gray wolf; the Atlantic salmon; the American alligator; the polar bear; 3 more sea turtles; and the Gila monster of the American Southwest and its Mexican relative, the beaded lizard.

Considered for inclusion on one list or the other, but deleted, were several animals of commercial significance. Among them were sturgeon that support a diminishing Soviet caviar industry; kangaroos, whose meat and hide are the objects in trade for a sizable business, subject now to regulation by the Australian government and a ban on importation in the United States; and the sperm and sei whales, which, along with the finback, have come to bear the brunt of Japanese and Soviet whaling. Also absent and apparently not considered for protection are several rare and dazzling tropical butterflies whose fate lately has been to end up in alarming numbers of American homes, mounted in plastic and displayed as chic bric-a-brac.

The inclusion of whales in the proposed agreement is an improvement over the 1971 draft, and it raises the possibility of leasing the rapacious fleets of Japan and the Soviet Union where the International Whaling Commission—the only regulatory body extant—has largely failed. The protection of the endangered species convention may, on the other hand, be of less practical value to whales than meets the eye. Two of the three main species preyed upon by whalers are not being considered for protection. Moreover, some U.S. officials consider it unlikely that any new wildlife secretariat would be so bold as to press for fewer import permits than the IWC's killing quotas would imply. Between international regulators, polities usually prevail; it is more likely that the wildlife secretariat would be satisfied with whatever number of permits the IWC's controversial—and, by almost universal agreement among conservationists, inordinately large—quotas require.

In any case, U.S. negotiators feel no compulsion, as one participant puts it, "to fall on our swords" for the sake of particular species. Compromises will be made, for the objective now is to build a legal ark for sorts of the earth's threatened flora and fauna; the passenger list can always be revised later, or so this strategy goes.

—Robert Gillette

## APPOINTMENTS

**James L. Liverman**, professor of biomedical sciences, University of Tennessee, to director, division of biomedical and environmental research, U.S. Atomic Energy Commission.

**William M. Kays**, chairman, mechanical engineering department, Stanford University, to dean, School of Engineering at the university.

**Chandler A. Stetson**, chairman, pathology department, New York University, to dean, College of Medicine, University of Florida.

**Carl F. Long**, professor of engineering, Dartmouth College, to dean, School of Engineering at the college.

**William J. Mellman**, director, Genetics Clinic, Children's Hospital of Philadelphia, to chairman, genetics department and **Harry Wollman**, professor of pharmacology to chairman, anesthesia department.

**Peter Suedfeld**, chairman, psychology department, University College, Rutgers University, to head, psychology department, University of British Columbia.

**Debas Mukerjee**, director of basic research in pathology, University of Texas Medical Branch, Galveston, to director, Intermountain Cancer Institute.

**John E. Eisch**, chairman, chemistry department, Catholic University, to chairman, chemistry department, State University of New York, Binghamton.
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Edited by Benjamin Kissin and Henri Begleiter
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—Quarterly Review of Biology

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analysis (Odum) I found more than usually impenetrable, and the discussion of steady states and chemical stability (Pytkowicz) is very preliminary: the CO₂ juggernaut (Machta) rolls on.

What would it take to change the chemistry of the oceans? This collection of papers gives a very valuable summary of the current status of our attempts to answer this question. It is interesting to note that little attention is paid to estuarine processes, which probably account for a large part of the action.

JOHN M. EDMOND
Department of Earth and Planetary Sciences, Massachusetts Institute of Technology, Cambridge

Biological Assessment


In his introduction Meredith Jones states that the primary objective of this symposium is to summarize knowledge of the Panamic biota. Approximately half the 24 contributors attempt to do this for different aspects of the biota. They generally conclude that the reptiles and amphibians, birds, mammals, corals, and some echinoderms are reasonably well known and that the mollusks decapods, fishes, and terrestrial flora are poorly understood. These are, of course, relative evaluations since the various authors are not necessarily applying equivalent criteria to their systematic specialty and some are reviewing much larger taxa than others. For example, Neal Weber does not attempt to estimate the numbers of insects in Panama whereas Alexander Wetmore can place the number of bird species at 865 (10 percent of all the world species) with a reasonable degree of precision.

Sylvia Earle (marine plants), James Porter (corals), Lawrence Abele (decapods), and Richard Chesher (echinoderms) provide the most complete and useful summaries of their groups. Some authors compare the Atlantic and Pacific affinities of their groups and some provide estimates of what the final numbers of species described from Panama will be. As a working document this symposium would have been more valuable if all the authors had adhered to a uniform policy of presenting numbers of known species, estimates of total species, and Atlantic-Pacific comparisons when relevant. Many groups of organisms are not covered in this volume, presumably because no expert was available or there just wasn't enough information to be worth summarizing.

In addition to papers on the flora and fauna there are a succinct historical review of the isthmus, the canal, and the Panama–United States treaty situation; two papers on the physical characteristics of the proposed sea-level canal; and two excellent ecological reviews—the coastal zones by Peter Glynn, and of the human ecology of the indigenous populations of eastern Panama by Reina Torres de Arauz. Although a few of the papers are trivial, most of the authors adequately assess the current knowledge in their fields. Several authors depart from their charge and speculate on the biological implications of a sea-level canal. In this regard the symposium might have profited by including a population geneticist and a theoretical ecologist. The views of a parasitologist would also seem worthwhile to broadly establishing possible biological interactions. Two papers represent background reports of recent study groups (William Newman) and surveys (Gilbert Voss) of the isthmian region. These make poignantly reading as the authors describe their frustrations in attempting to obtain recognition for their institutions or committee report. Newman provides a fascinating discussion of the trials and tribulations of the National Academy committee report, which he and other members of the committee (CERIC) felt was largely neglected by the Atlantic-Pacific Inter-oceanic Canal Study Commission (see P. M. Booffe, Science 171, 355–58 [1971]).

The participants almost unanimously call for more collections and more research in the isthmian region to overcome the relatively poor state of our knowledge for most groups of isthmian organisms. This situation could have been at least partially remedied had a small part of the Canal Study Commission's $22-million appropriation been spent on a more detailed biological survey. Biologists have often been criticized for their lack of agreement on the implications of the proposed sea-level canal. These scientists are not expected to make the decision on whether or not a canal should be built, but it is they who are best able to evaluate the ecological costs. This can be done intelligently, however, only if adequate long-term support for their research is available. No one expected the engineers to recommend a site for a new canal without rather lavish funding for accumulation of new data pertaining to their assignment; it is unfair to expect precision from biologists with much less complete data. Perhaps biologists involved in funding studies of national environmental issues are not yet up to situations complicated by international overtones and the lack of pork-barrel considerations.

IRA RUBINOFF
Smithsonian Tropical Research Institute, Balboa. Canal Zone

Books Received


Cell Surface Alteration as a Result of Malignant Transformation. II. Papers by Jaro Ankerst and others. MSS Information Corp., New York, 1972, 240 pp., illus. $15.

The Death-Life Law of Nature. Raymond Westbury Maxwell, Jr. Published by the author, Box 13897, Baden Station, St. Louis, Mo. 63147, xii, 400 pp.

Design in the Built Environment. R. Fraser Reekie. Crane Russak, New York, 1972, xii, 142 pp., illus. $10.50.


The Earth and Human Affairs. National Academy of Sciences Committee on Geological Sciences. Canfield (Harper and Row), New York, 1972, xiv, 142 pp., illus. Cloth, $3.95; paper, $1.95.

Echocardiography. Harvey Feigenbaum with the assistance of Sonia Chang. Lea and Febiger, Philadelphia, 1972, xiv, 240 pp., illus. $11.


Generalized Functions and Fourier

(Continued on page 834)