LOW-COST ULTRAMICROTOMY

Low-cost ultramicrotomy for electron microscopy depends on being able to choose the right instrument for each particular task. LKB offer a COMPLETE range of ultramicrotomy instruments for you to choose from. The economical LKB-Huxley ultramicrotome allows you to cut good quality sections for electron microscopy at low cost. Its simple and easily-learned controls make it ideal for training as well as research. For ultrathin sectioning of your more difficult specimens, the Universal Ultrotome III gives you a wider range of variable parameters than any other ultramicrotome on the market today.

LKB Instruments Inc.
12221 Parklawn Drive, Rockville MD. 20852
11744 Wilshire Blvd., Los Angeles Calif. 90025
8600 West Irving Park Road, Chicago Ill. 60634
200 North Broadway, Hicksville N.Y. 11801

Circle No. 23 on Readers' Service Card
Stereo IV is designed for research. And for photography. But some researchers need to draw.

Another example of the versatility of the zoom Stereo IV. The zoom Stereo IV is the most versatile stereomicroscope ever made—truly an instrument designed for the scientist. For instance, with the drawing attachment shown below, the entomologist, dissecting microscopist, geneticist or geologist can trace accurate pictures of objects where the depth of field exceeds that which can be obtained photographically. And the physicist or electronic engineer can superimpose diagrams over the microscopic image for a direct comparison with a microcircuit.

Simultaneous viewing and photography, too. With the use of the unique Zeiss beam splitter and camera attachments, Stereo IV is also great for photography—the most severe critic of any optical system. Attach the camera, and you are insured of photomicrographs with great definition, evenly illuminated, sharp from edge to edge. With camera and drawing attachment, you can retrieve any information your eye can see. And, since Zeiss optics are the world's greatest optics, you can see more through Stereo IV.

Send for 24-page brochure. The complete line of all five Zeiss Stereomicroscopes is described in a new 24-page booklet. If you're looking for a stereomicroscope designed for the scientist, chances are you'll find there what you need for your particular requirements.


Nationwide service.
The new Heath/Schlumberger 721 Programmable Cell UV-Visible Ratio-Recording Spectrophotometer has baseline flatness of .0005A; photometric precision better than ±0.001A, better than 0.1 nm resolution, outstanding scan rate/resolution ratio, less than 0.01% stray light, less than 0.001A zero drift, programmability...and it gets there in an entirely new way.

Compare it with any recording spectrophotometer made by anyone, at any price. Write Dept. 560-19 for our free 18-page brochure which describes the new 721 system and the new 707 conventional double-beam system.

We're the group to watch in spectrophotometry

Heath / Schlumberger
Scientific Instruments
Benton Harbor,
Michigan 49022

*Limited only by cell matching

Circle No. 4 on Readers' Service Card
For laboratories weighing costs as well as samples, a precision top-loader for only $395.

Today more than ever before, cost is a major consideration when purchasing new laboratory equipment. If your lab needs a modern, efficient top-loading balance, the Sartorius 1104 is your best answer from every standpoint, including price.

The 1104 is a precision-made torsion balance with 1,000 g capacity/0.1 g accuracy, ideally suited for a wide variety of student, research and industrial applications. Design-wise, it incorporates many advanced features: all-digital readout, full-range optical scale, built-in mechanical taring, readings in less than 3 seconds, no beam oscillation, and no weights to handle or dial in. A non-fatiguing torsion band system eliminates the need for knife edges.

At only $395, there is no better balance buy than the 1104. Greater accuracy, if needed, is available with the Sartorius 1106 (200 g capacity/0.015 g accuracy) at $430.

To find out more about these models, send for our free balance catalog. Just write: Sartorius Division, Brinkmann Instruments, Cantague Road, Westbury, New York 11590.

Circle No. B on Readers' Service Card

sartorius balances
The best way to measure pH?

Perhaps you place portability first in a pH meter. Look no further than our Model PBL, with its rugged case, taut-hand meter, solid-state circuitry. Reads accurately to ±0.1 pH. Battery-operated, of course. Or plug it into an AC power source. Recorder output, Karl Fischer titration, and much more. A lot more than you'd expect in a portable meter at $240.

Maybe you'd like portability plus an expanded scale. Then you'd like the PBX. Full-scale expansion of as little as 0.7 pH. Accuracy, ±0.005 pH. Ready, too, for measurement of e.m.f. and activities of mono- or divalent ions. Ideal for determining specific-ion pollutants in streams and waterways. Battery-operated or AC-powered. Full-range adaptability. The PBX. The price—$395.

Are accuracy, sensitivity, and a large scale important to you? Consider our Model LS—the "laboratory standard." Accurate to ±0.05 pH (with a repeatability of ±0.01 pH). Ultra-stable solid-state circuitry. Big, easy-to-read scale at just the right angle. With buffer adjust, Karl Fischer polarizing output, manual or optional automatic temperature compensation, recorder output. The LS, priced at $375.

You might be looking for accuracy and sensitivity and a large, expanded scale. Our Model LSX fills the bill. Accurate to ±0.005 pH in full-scale expansion of 0.7 pH unit. Which you read on a 7½-inch scale. High-precision measurements of pH, e.m.f., and mono- or divalent ion activities. Maximum sensitivity and stability. High input impedance. A variety of built-in input/output adapters. The name: LSX. The price: $450.

Won't settle for anything less than direct, digital display? You and our Model DR should find each other. It has a digital counter (plus a graduated scale) for continuous measurements to 0.001 pH. Accurate to ±0.01 pH. Accommodates all electrodes. Lets you use manual or automatic temperature compensation. Solid-state circuitry. The price? $625.

Or true-electronic, digital, direct
Circle No. 19 on Readers’ Service Card

Reading may be your idea of perfection. Realized in our Model NX. Big, bright, luminescent numerals. No more parallax errors or interpolations. Readable to four significant figures (the decimal point is always in the right place, automatically). Responds instantly to rapidly changing inputs. With long-life display tubes, plug-in circuit boards. Price $595.

Look over the many faces of pH measurement with the help of your Sargent-Welch representative. Then arrange for a demonstration. Or write to us for details.

SARGENT-WELCH

Our 6AH Amino Acid Analyzer comes in a tabletop model. Their 121 is more like a table sized design.

Select from 8 buffers with our 6AH. Select from 4 with the 121.

Our 6AH sensitivity is rated at 5 nanomoles/2 mm and 1 nanomole/6 mm. The 121 rates 4 nanomoles/6 mm and 2 nanomoles/12 mm. Hmmmm.

But wait. The 6AH has a dual plunger buffer pump design. The 121 is equipped with a single plunger.

Our 6AH accommodates 12 samples at a time or 36 with accessories. Theirs holds 72. But do you need 72? Ever?

The 6AH has a built-in stream splitting device. This is an option on the 121.

Both the 6AH and 121 have automatic temperature controls. This makes us both even.

There are 2 water baths in the 6AH design. There’s 1 in the 121.

The 6AH consumes 2/3 less ninhydrin reagent than the 121.

The 6AH features a standard dual beam detector. The 121 has a single beam detector. We shine again.

Both the 6AH and 121 will take on over-lapping runs.

The 6AH is teamed up with a JEOL integrator. The 121 is matched with an Infotronics model. This service is no match at all.

Standard hydrolyzate analysis: 6/4 hours on both instruments. Accelerated hydrolyzate: 12/2 hours on both. Physiological fluids: 2.6/9 hours on the 6AH and 2/11 hours on the 121. Close, but look at the $ and sense of it all.

This impartial analysis* was brought to you by the people with more information on the 6AH Amino Acid Analyzer, The Automated Analyzer Division, JEOL, 235 Birchwood Ave., Cranford, N.J. 07016. Tel. (201) 272-8820.

*Based on current catalog information exclusive of digital integrator.


Circle No. 16 on Readers’ Service Card
tunable
UV
265-340 nm

First... from the leader in tunable lasers

chromatix
The first tunable UV laser in the range from 265-340 nm!

If your experiment has been limited for lack of a tunable UV laser, here is the research tool you’ve been waiting for. Chromatix’s new System 15 combines our proven non-linear optics techniques with the best in dye laser technology to bring you the most versatile unit on the market today.

Not only do you get tunable UV in the range from 265 to 340 nm, but with the same device, you also get a tunable dye laser covering the visible range from 530 to 680 nm.

This new product is part of the Chromatix building block approach to tunable lasers. System 15 is made up of two modular components, the Model 1000 Laser and the Model 1050 UV/VIS Dye Laser. This approach assures real dollar value for your instrumentation investment by guarding against obsolescence. In fact, if you are already using a Chromatix laser, you can now have tunable UV by simply adding on the new Model 1050 UV/VIS Dye Laser.

For a real hands-on demonstration and a chance to actually operate this exciting new product, stop in and see us at one of the following shows: APS, January 31-February 2, San Francisco; Pittsburgh Conference, March 6-10, Cleveland; FASEB, April 12-16, Atlantic City; International Quantum Electronics Conference, May 8-11, Montreal. Or contact us at the address below. Complete specifications and prices are yours for the asking.

Chromatix ...for the control of light

1145 Terra Bella Avenue / Mountain View, California 94040 / (415) 969-1070
New Econo Pre-bedded™ Disposable Cage System saves time, eliminates waste.

Eliminate the time-wasting, messy chore of filling cages. With the new Econo Pre-Bedded Disposable Mouse Cages. From factory-sealing of the bedding in each individual cage to the final disposal we've made this the most convenient, economical cage system ever developed.

We started with the cages. Our standard clear polystyrene Disposable Mouse Cages. They are 11½” x 7½” x 5” deep with 10% more floor area than other cages of this type, are designed with stacking lugs, and meet all published cage standards.

Then we developed a feature unique to Econo Pre-Bedded Cages. The bedding is factory-sealed in each individual cage with a special removeable seal that eliminates waste and spillage.

Econo Pre-Bedded Cages are supplied with either our standard bedding or the bedding of your choice. The standard bedding is our regular corn cob bedding that provides superior absorbency, has minimal moisture content, and is virtually dust-free.

If you are looking for economy and convenience, and want to save time while eliminating waste, find out about the new Econo Pre-bedded Disposable Cage System. And for more information on our complete line of plastic cages and accessories, contact your Econo-Cage Distributor; or, write the Scientific Division, Maryland Plastics, Inc., 9 East 37th Street, New York, N. Y. 10016.

Econo Pre-bedded Cages with the unique factory seal require minimal storage space when nested. Part No. E-0214.

Econo Disposable Cages are also available separately without bedding. Part No. E-0210.

Econo-Bed — virtually dust-free, high-absorbency, minimal-moisture regular corn cob bedding available in 50 lb. bags. Part No. E-2140.
Yours from Corning with our 2-year guarantee on pH meters.

Not just one year. Two. So you get a free year.

If anything goes wrong with a Corning pH instrument within 24 months of delivery to you, and it's our fault, we'll take care of it. All you must do is return the guarantee-registration card when you buy the instrument, and have it serviced only by Corning or authorized Corning Scientific Instrument dealers.

We've put the longest guarantee on the longest line. Choose from 12 pH instruments. Analog or digital. Portable to expanded-scale research.

The free year is yours from the same people who guarantee pH and reference electrodes for six months. In writing.

Call your dealer for a demonstration. Or contact us, Corning Glass Works, Scientific Instruments, Medfield, Mass. 02052.

For instant response—data or demonstration—call 800-225-3850 toll-free!
Nuclear magnetic resonance (NMR) spectroscopy has made significant contributions in structural and conformational studies of complex organic molecules, natural products, steroids, proteins, medicinals, drug metabolites, and other biomolecules. However, obtaining spectra like those of adenosine-5'-triphosphate (ATP) shown on these pages, has been so formidable a task that it was seldom attempted. Now, Varian's XL-100, NV-14, HA-100, HR-220 and HR-300 NMR Spectrometers with Fourier transform accessories make these studies possible on a routine basis. The greatly increased sensitivity and speed of analysis lets you work with smaller samples than previously possible; lets you measure compounds that you couldn't measure before; improves capability for NMR measurements of less sensitive nuclei such as $^{13}$C, $^{14}$N, $^{31}$P, and others; and lets you make direct measurement of time-dependent NMR phenomena.

Fourier transform spectroscopy takes advantage of the ability of digital computers to gather, store and transform data at a fantastic rate. Powerful radio-frequency pulses excite all nuclei of the selected species simultaneously and the resulting interferograms are accumulated until an adequate signal-to-noise ratio is obtained. The computer then performs a fast Fourier transformation to the frequency domain. Simultaneous acquisition of the entire spectrum instead of successive acquisition of frequency swept spectra can give more than a 10-fold sensitivity enhancement or a savings of greater than 100-fold in time. The computer also normalizes and references the spectrum and prints out the intensities and chemical shifts of the observable peaks.

The adjacent three spectra of three different nuclei in ATP were all obtained with a Varian XL-100 NMR Spectrometer with Fourier transform accessory.

For more information on Fourier transform NMR, contact your local Varian representative or Varian Associates, Analytical Instrument Division, 611 Hansen Way, Palo Alto, California 94303.

$^{13}$C The natural abundance $^{13}$C spectrum was obtained using 400 pulses at 0.8-second intervals. The peaks are assigned following Dorman and Roberts. Of particular interest are the doublets due to C-4' and C-5' arising from spin-spin coupling of these carbon atoms to the alpha-phosphorus, characteristic of 5'-nucleotides. The ribose carbon atoms all fall between 66 and ppm* and are almost independent of pH, while the adenine carbons, with the exception of C-5, fall between 143 and 151 ppm and are strongly pH dependent. The 118.8 ppm shift of C-5 reflects the markedly higher electron density at this position. From pH dependence it is tempting to conclude that protonation is favored at N-9, but this is not consistent with the proton N* pH dependence. Further studies over a range of concentric and related molecules might be expected to clarify this point and to throw further light on the structure of dimers and polymers formed by parallel stacking of nucleic acid bases.

*relative to TMS, using Dioxane = 67.4 ppm
The \(^{1}H\) spectrum of 0.0036 M ATP at left required 4000 pulses of 1.0-second intervals, yet clearly shows the signals from individual protons on the ribose and adenine rings. The unique shift of H-1' arises from C-1' being bonded to both O and N. Spin-spin coupling to H-2' splits this resonance into a doublet. Tentative assignments for H-2 and H-8 were made by Jardetsky and Jardetsky\(^{11}\) from studies of adenine and adenosine, and the pH dependence of these peaks was measured. It was found that H-2 is much more shifted to lower field in going from high to low pH than either H-8 or H-1', and this was interpreted as indicative of protonation of the pyrimidine portion of the ring rather than the imidazole nitrogens. The apparent discrepancy between the conclusions drawn from the \(^{1}H\) and \(^{13}C\) NMR spectra of ATP regarding the site of protonation poses an interesting problem which could lead to a better understanding of \(^{13}C\) chemical shifts in aromatic molecules and to a more precise determination of which nitrogen is most susceptible to protonation. A further interesting problem is raised by the marked difference in breadth of the H-2 and H-8 resonances. Broadening of H-8 could arise from any dynamic process which would affect the chemical shift of H-8, such as protonation and dissociation, forming or breaking hydrogen bonds, or hindered internal molecular motion. Fourier transform spectroscopy would permit systematic studies of the effect of concentration and pH in these dilute solutions.

---

\(^{31}P\) The \(^{31}P\) spectrum illustrates the speed with which an interpretable spectrum can be obtained from a dilute solution, using the Fourier transform technique. Only 500 pulses at 1.0-second intervals were required. The spin coupling between the \(^{31}P\) nuclei makes the assignment of the spectrum straightforward, since the \(\beta\)-phosphorus is coupled to both \(\alpha\) and \(\gamma\) and is therefore a triplet. The \(\alpha\) and \(\gamma\) peaks are both doublets, but long-range couplings to the 5' and 4' protons result in further splitting of the peaks. \(\alpha\) and Hughes\(^{19}\) report that the \(\alpha\) and \(\gamma\) peaks coincide until the last proton sizes, whereupon the \(\gamma\) peak moves to lower fields following the titration curve. They also report\(^{20}\) that Mg\(^{2+}\), Zn\(^{2+}\), and Ca\(^{2+}\) complex with the \(\beta\) and \(\gamma\) phosphate groups as determined from the \(^{31}P\) shifts as a function of ion concentration. On the other hand, Cu\(^{2+}\) was found to complex solely with \(\alpha\) and \(\beta\) phosphate groups as deduced from line broadening at 10\(^{-3}\)M for the paramagnetic Cu\(^{2+}\) ions.

---

RESEARCH IN THE ANTARCTIC

BIOLGICAL STUDIES
GLACIOLOGY
SNOW MEASUREMENTS
CLIMATE AND ATMOSPHERE
OCEANOGRAPHY
CONJUGATE PHENOMENA
AURORAL STUDIES
GONDWANALAND AND CONTINENTAL DRIFT

The first single-volume report of the extensive research conducted in the Antarctic since the International Geophysical Year

Edited by Louis O. Quam
Director of the Office of Polar Programs of the National Science Foundation

700 pages, hundreds of illustrations and tables, a comprehensive index, 52" x 48" full color wall map of Antarctica

Member's price (with check accompanying order): $19.95
Regular price: $24.95

Orders to the Publication Sales Office,
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
1515 Massachusetts Avenue, N.W., Washington, D.C. 20005
Today. It's still JEOL accomplishments vs. competition's good intentions. Everyone knows a full range of accessories makes a good scanning electron microscope an even more valuable investment. Provided the accessories are really available. JEOL's are. Take our JSM-U3. As you read this ad, 37% of all U3 owners have added our energy dispersive x-ray analyzers. 75% are using our TV scan. 10% are now heating specimens under test to 450° or 1100°C. 10% can apply stress to 10 kg or 200 kg. 25% are using a transmitted electron detector. And all enjoy the extraordinary reliability, 100 angstrom guaranteed resolution, universal goniometer stage, state-of-the-art 2 lens optical system, and automatic vacuum control that are proven U3 features. To find out more about the ways JEOL accessories make your investment more productive, visit one of our demonstration centers and give the JSM-U3 a good workout yourself. Or just watch one of the TV tapes we've prepared on our dynamic accessories. Either way, you'll discover there's more to JEOL than promises, promises. JEOL delivers. JEOL, 477 Riverside Ave., Medford, Mass. 02155, Tel. (617) 396-6021.

New self-maintaining column now permits routine 100 angstrom resolution guaranteed in your lab.
NICOLET OFFERS...
NEW PLUG-INS FOR YOUR
SIGNAL AVERAGING PROBLEMS

... problems like averaging ultrafast transients, simultaneously counting pulses from four sources, averaging signals occurring before a trigger, and averaging with respect to non-linear independent variables.

**SD-78** High Speed Buffer Interface plug-in interfaces the 1070 System to a Biomation transient recorder which accumulates data at rates up to 100MHz (10 nanoseconds per point). Up to 2048 data points are then transferred to the 1070 memory where the signals from each sweep are averaged. Applications include pulsed NMR, radar, fluorescence decay studies, high speed reaction kinetics, explosion monitoring, and shock tube tests.

**SH-73** Four Input Multichannel Window Discriminator/Scaler plug-in simultaneously counts pulses from one, two or four separate signal sources at pulse rates up to 10 MHz. Typical applications include: generation of post-stimulus time histograms in neurophysiology where each input counts single cell nerve firings per unit time; and, counting radioactivity from multiple detectors at different energy levels in nuclear medicine isotope uptake studies.

**SW-78** Signal Delay Sweep Control plug-in permits inspection of a portion of a signal which occurs prior to the trigger. A typical use is inspection of an ECG where the R-wave is the trigger but the preceding P-wave is also of interest. Another application is in NMR spectroscopy where the start of the spectrometer sweep does not remain time-locked with respect to the irradiation energy.

**SW-79** Parametric Sweep Control plug-in permits signal averaging in those applications where the independent variable changes at an unknown or nonlinear rate with respect to time. The averager's address advance is controlled by monotonic amplitude changes in the independent variable. Typical applications include averaging temperature as a function of pressure, voltage as a function of current, or absorbed energy as a function of magnetic field intensity.

NICOLET INSTRUMENT CORPORATION

NII 5225 Verona Road, Madison, Wisconsin 53711
Phone 608/271-3333 TWX 910-286-2713
(formerly Fabri-Tek Instruments, Inc.)

Sales and Service: In Canada by Aeearn & Soper Ltd., Toronto, Montreal, Vancouver, and Ottawa. • In Europe by Nicolet Instrument GmbH, 6000 Frankfurt am Main, Eschersheimer Landstr. 34, West Germany 0611/551883, Telex: 841-416169. Represented by Technimation in Amsterdam, Brussels, London, Paris. • In Japan by Niss0 Koheki Company Ltd., Tokyo.
A strain for every effort.

Here's living proof that we can lend a strain of our own to any research effort.

Our CD outbred albino is a proven standout in toxicology, endocrinology and pharmacology.

A one-of-a-kind performer, our CDF Fischer 344 is noted for homozygosity. It delivers near identical physiological data again and again and again.

Our other inbred, the CD Wistar/Lewis, is perfect for adjuvant arthritic and other inflammatory studies. It's a uniquely sensitive research model and COBS® like all the rest.

Write or call for information on any or all of our three rat strains. We'll be happy to tell you more. In fact, it's no strain at all.

Charles River BREEDING LABORATORIES, INC. WILMINGTON, MASSACHUSETTS 01887

Circle No. 1 on Readers' Service Card
The Brush Recorder: performance that's made its mark.

Whether it's all-purpose or high-performance recorders, Brush has an answer for you. Ten different recorders. A choice of 1, 2, 3, 4, 6, or 8 analog channels.

And all the Brush recorders feature a pressurized-ink writing system. (Standard on all but the 816 Recorder.) The pressurized ink system sees to it that the ink goes into the paper. Not onto it. So traces are always clear, crisp, smudgeproof and uniform. And you never have to worry about clogging, skipping, or priming.

Another plus for the Brush Recorders is our Metrisite® non-contact servo-loop feedback device. A system so accurate it ensures pen positioning at better than 99½% linearity.

And the Metrisite system also takes care
Fast, versatile strip-chart recorder. Frequency response is flat ±2% f.s. from d-c to 10Hz on a full 4½" span. Useable response to 100Hz. Accepts all Brush plug-in preamps. Sensitivity ±2.5V f.s. Detachable chart paper magazine, 12 pushbutton selectable chart speeds from 5 in/sec. to 1/10 of an inch/min. (or 8 days of continuous recording.) Portable or rack mounted.

Designed for versatility, maximum resolution, and precision. Modular design permits use of interchangeable preamps. Rack, cabinet or cart mounted. Frequency response to 55Hz on 40mm and 35Hz on 80mm channels. 2 event markers. 12 pushbutton chart speeds from 0.05 to 200mm/sec. Sensitivity +2.5V.

The world's standard for high performance direct writing recorders. The Brush 200 can be tailored to your specific requirements through a broad range of modular sub-systems. Choose rack or roll-around cabinets. Vertical or horizontal oscillographs and a wide range of penmotor and 80 and 40mm channel width combinations. 2 event markers. Frequency response 55Hz f.s. Useable response to 200Hz. 12 pushbutton chart speeds from 0.05 to 200mm/sec.

BRUSH 280 2-channel

Lets you analyze precise recorded data with accuracy and resolution never before possible in medium-frequency recorders. Double width 80mm channels and 2 event markers. 35Hz response f.s. Built-in preamps provide a measurement range from 0.5mV/div. to 500V f.s. 12 pushbutton selectable chart speeds from 0.05 to 200mm/sec. Portable or cart mounted.

A rugged, low-priced recorder. 99.85% linearity. Pressurized ink writing plus electrostatic hold-down. Built-in preamps with a sensitivity range from 100mV/div. to 10V/div. 40 inches-per-minute writing speed. Portable or rack-mounted.

BRUSH INSTRUMENTS

Gould

of bothersome maintenance problems. Like dirty pots, wear, cleaning. The Metrisite also eliminates slide wires and all the maintenance problems they cause.

Electronics are all solid-state. And most models come in either portable or rack-mounted versions. And all of them are compatible with our range of signal conditioners. A range wide enough to let you select the conditioning best suited for your measurements.

The Brush Recorders. If you'd like to know more about them, let us know. Contact your nearest Brush Sales Engineer or Representative. Or write for detailed performance information and specifications. Gould Inc., Instrument Systems Division, 3631 Perkins Avenue, Cleveland, Ohio 44114.
There are two dozen huge computer systems in the Advanced Research Projects Agency network.

Over half of them are DECsystem-10s. Our Supercomputer. MIT has two. So does Utah. Then there's Harvard, BBN, Carnegie, Case, SRI, Stanford and Rand.

Which should give you some idea of how popular our DECsystem-10 really is.

In the ARPA network, DECsystem-10's are doing state-of-the-art research into weather forecasting, econometric studies, resource management, computer sciences, and much more. Everyone shares their computer and expertise with everyone else. Everyone comes out ahead.

Additional DECsystem-10's will be a part of ARPA's mammoth ILLIAC IV number crunching complex now being installed at NASA-Ames Research Center in California. They'll handle all communications while at the same time managing up to a trillion bits of file storage. Once ILLIAC IV is in gear, ARPA members will be able to do in hours jobs so big that they wouldn't even attempt to do them now.

ARPA is one of the biggest brain trusts ever assembled. If half of its members have a DECsystem-10, you really ought to know about it.

Write for the literature that explains why 62 of the leading universities and research institutions in the country have selected DECsystem-10's. (Hint: It does computation and timesharing at half the cost of other systems -- without sacrificing throughput.)

DECsystem-10 Scientific Group, Digital Equipment Corporation, 146 Main St., Maynard, Mass. 01754. (617) 897-5111.
Turkey Anatomy

In his sarcastic letter (24 Sept., p. 1191) concerning the publication by the Atomic Energy Commission of the Atlas of the Domestic Turkey (Meleagris gallopavo): Myology and Osteology by E. B. Harvey et al., Abrahamson's major complaint appears to be against the utilization of appropriated funds to support a study which, in his opinion, has no place in the work of the AEC. The implication in the letter that the study was undertaken in its entirety by the AEC is highly misleading. In a portion of the preface to the atlas which Abrahamson chose to ignore, the authors clearly indicated that the research was financed by private contributions and by small grants from agencies not affiliated with the AEC, and that only the "final steps necessary to the publication" and the actual costs of publication were absorbed by the AEC.

Perhaps the greater question, however, is the validity of Abrahamson's complaint that poultry anatomy studies do not belong within the AEC's "mission." That irradiation produces pathological effects is axiomatic. Pathological conditions—in any animal—can be recognized only by comparison with the "normal" conditions. The intended function of the atlas was to describe the "normal" condition of the domestic turkey. It is important, for economic reasons, to understand the effects of radiation on domestic and wild animal populations. The first step in any such study is to ascertain the normal condition, including the range of variation and the naturally occurring abnormalities. This information is, in our opinion, not yet available in sufficient detail for any species of domesticated birds to provide the foundation for investigation of radiation effects.

The growth and development of the poultry industry is economically important not only in this country but in developing countries. In one of his quips Abrahamson refers to the "nearly 100 million domestic turkeys" produced annually to provide food for the American consumer. What he does not mention is the economic loss that results because large numbers of these birds never reach the processors owing to pathological conditions about which little is known.

The utilization of domestic fowl in AEC research is not new; the reader can be referred to the bibliographies given in studies by Quisenberry and Atkinson (1) and Lucas and Denington (2), in which effects of body irradiation on reproductive performance and blood composition in domestic chickens were studied.

Abrahamson's comments constitute a specious review of the atlas. Since the volume has not received regular treatment in the book review section of Science, Abrahamson's comments are the only ones on the work which many readers of Science will see. It is poor taste to select such a work as a vehicle for a humorous exercise or for the purpose of emphasizing a personal disagreement with the policies of a particular agency. When such disagreement exists, it would seem proper to us that the target for complaint should be the policy and not, as in this instance, the research which was thought to be the result of that policy.

ROBERT D. KLEMM

WALTER J. BOCK
Department of Biological Sciences, Columbia University, New York 10027

References

Newton, the Politician

In his illuminating article "Reflections on the decline of science in America and on some of its causes" (2 July, p. 27) Arnold Thackray makes a slip when he writes of Isaac Newton's "movement from Cambridge professor . . . to minor state functionary." Presumably he is thinking of Newton's tenure as Warden of the Mint; although not generally realized, this was an instance of a scientist making a political contribution of great importance.

Macaulay deals fully with the matter in chapters 21 and 22 of his History of England (1). "The silver coin, which was then the standard coin of the realm, was in a state at which the boldest and most enlightened statesmen stood aghast." Continual clipping of minute pieces of silver from the irregular edges of the hammered coins greatly reduced their weight. "At length in the
In the autumn of 1695 it could hardly be said that the country possessed, for practical purposes, any measure of the value of commodities. . . . On a market day, the clamours, the reproaches, the taunts, the curses, were incessant. . . . Never had there been an occasion which more urgently required both practical and speculative abilities.” These abilities were displayed in the plans to overcome the crisis that were formulated by the politicians Somers and Montague and the philosophers Locke and Newton.

The old currency was recalled and replaced with new currency; the then novel process of minting the coins’ edges was used. Until the new coins were issued, commerce was forced to creep along largely by credit and barter. At that juncture, Montague appointed Newton to be Warden of the Mint, an office that had previously been a sinecure. Under Newton’s vigorous leadership, coin production leaped to almost ten times what the old officers of the Mint had considered an excellent level. During this time, Newton wrote that he did not love to be “teased by foreigners about mathematical things, or to be thought by our own people to be trifling away my time about them, when I am about the King’s business.”

Perhaps there is a lesson for our times in this cooperation between politicians and intellectuals to solve a pressing social problem.

Lee A. Segel
Department of Applied Mathematics,
Weizmann Institute of Science,
Rehovot, Israel

Reference

Information Systems

Although John H. Schneider (23 July, p. 300) makes some valid points in his article on selective dissemination of information (SDI) systems, particularly when he points out that scientists should be encouraged to use the process more, I feel that he has unfairly downgraded the usefulness of keyboard searching.

I am a subscriber to an SDI system that matches titles of journal articles against a keyword profile. When I took the output of the last year and subjected it to the sort of analysis that Schneider used, I received 1314 references on information science (at least as broad a topic as cancer research), of which 54 percent would fall into his “useful” or “definite” use categories. Therefore, in the same amount of time (12 months) I received approximately the same number of references (1314) as his subjects (1386), with exactly the same percentage of usefulness, using a keyword search of titles of articles. Schneider’s conclusion, that classification indexing is (in some way) better than keyword indexing, is thus open to question.

The cost involved, the time needed, and the professional expertise required both to create the hierarchical classifications and to index articles make the system proposed by Schneider impractical, except perhaps for narrow disciplines. The adoption of this system on a large scale would result in a sizable delay in the appearance of articles on the SDI tape services and an increase in the cost of such services, perhaps greater than the $200 per year target figure Schneider suggests.

R. M. McMullen
Communication Data and Library Services, Canada Department of Communications, Ottawa, Ontario

McMullen’s position as chief of Communications Data and Library Services probably requires that he maintain a broad overview of the entire information field. This may explain why he found 709 out of 1314 references on information science to be either “very useful” or of “definite” use. I regret that my study did not include such omnivorous users of information. Instead, the participants in my test situation were the principal investigators of research grants who were working on very narrow, specific fields of research. The purpose of my experiment was to exactly identify these research areas as categories in a classification so that each scientist could be matched precisely with documents useful to his specific research effort. Under these circumstances, I believe the criteria for ranking “usefulness” by the participants in my study were much more selective than those used by McMullen, and a comparison of his personal experience with the results I presented has little validity.

At no point in my article did I make a blanket statement that “classification indexing is better than keyword indexing.” Instead, I tried to present the advantages and disadvantages of both types of systems. Clearly an SDI system based on automated indexing of key-
14 reasons why you should read

INTELLECTUAL DIGEST

1. A report on the most implausible war correspondent in history—the pacifist George Bernard Shaw in Belgium during World War I. (Journey To Heartbreak)

2. The discovery by a geologist that the South Pole was once in the Sahara Desert. (Natural History)

3. An English scholar exposes the "real" Christ and says that the Church created Him and "has invented ever new Christs for every new age." (Spectator)


5. A lawyer-penologist talks about what will have to replace our disastrous prison system. (After Conviction: A New Review of the American Correction System)


7. Why is Frantz Fanon, a black prophet who died 10 years ago, a key to the Black Power movement in the U.S.? (Saturday Review)

8. Where in the whole world can you find the best example of the theory and practice of No-Work? (Hudson Review)

9. Gore Vidal attacks the fallacy of the male imperative and asks why the male ego can't accept the female challenge to its dominance. (N.Y. Review of Books)

10. In "The Souring of George Sauer" the ex-N.Y. Jets star offers some unexpected thoughts on aggression and authoritarianism in football. (Institute for the Study of Sport and Society)

11. A California psychologist bucks the tide and speaks up for the benefits of poor communication. (Psychoanalytic Review)

12. How to tackle a disease with all the weapons of science, and find that success may bring a whole new set of problems. (Smithsonian)

13. Arnold Toynbee looks at man's development for an answer to today's question: Is Religion Superfluous? (Surviving the Future)

14. Was Ho Chi Minh a bad poet? Read the arguments, pro and con, and decide for yourself as Intellectual Digest presents the Chinese original and two clashing translations.


And by mailing the coupon now, you can become a Charter Subscriber and enjoy the next 12 issues at half the regular price.

There has never been a magazine like INTELLECTUAL DIGEST before. Our editors read the most significant magazines and journals in the world, and select the articles most important to the thinking layman. INTELLECTUAL DIGEST culls from all fields: science, sociology, literature, politics, art, medicine, history, even zoology. Our only requirement is that every article be thought-provoking, important, informative — and lively.

Many articles are published in full. And when we do "digest," we do so only by editing in collaboration with the author. Thus the integrity — even the complexity — of the original is retained.

In addition, three newsletters in each issue keep you up to the minute on the major disciplines of the social sciences, sciences and arts. Outstanding non-fiction books are excerpted, too — many before publication. (A few recent examples: Kate Millett's Sexual Politics, Charles E. Silberman's Crisis in the Classroom, Paul Goodman's New Reformation: Notes of a Neolithic Conservative.)

Act now for guaranteed Charter Rate

By mailing the coupon now you can become a Charter Subscriber and enjoy these special privileges:

Free examination of your first issue. Take 14 days to decide if it's the kind of magazine you'd like to keep reading. If not, write "cancel" on the bill you receive after your first issue, and owe nothing. Of course, the issue you keep...

Save 50% if you decide to subscribe. You receive the Charter Rate — that's twelve monthly issues in all for $5, instead of the regular $10 subscription price.

So act now to reserve your Charter Subscription. At the very least, you'll end up with a stimulating complimentary issue.

<table>
<thead>
<tr>
<th>INTELLECTUAL DIGEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.O. Box 2986</td>
</tr>
<tr>
<td>Boulder, Colorado 80302</td>
</tr>
<tr>
<td>Please send me my complimentary issue of INTELLECTUAL DIGEST and enter my charter half-price subscription for eleven additional issues at the rate of only $5 (a total savings of 50% on the regular $10 price.) I understand I may cancel within 14 days after receiving my complimentary issue if I am not fully satisfied.</td>
</tr>
<tr>
<td>□ Bill me □ $5 enclosed</td>
</tr>
</tbody>
</table>

| Name: | |
| Address: | |
| City: | State | Zip: |
| Name: | |
| Address: | |
| City: | State | Zip: |

Add 50¢ for Canada and $2 for Foreign. 6307
In between are 103 other radionuclides in our current stock, all described in a 28-page catalog. It's the widest line available.

That makes us the handiest source of radionuclides, but not necessarily the best. What makes us the best is our determination to ship the highest quality compounds in the safest, most convenient package. We do this by subjecting our nuclide solutions to the most rigorous quality control in the industry. Production-processing and analytical data accompany each shipment, including an X-ray or gamma spectrum if it's a photon emitter.

Ask for the catalog and keep it handy. Besides the radionuclides, it describes our custom irradiation services, gamma and beta reference source sets, radionuclide generators, and classroom isotope generators.

Leak-proof combi-vial with protective sleeve

**New England Nuclear**

575 Albany Street, Boston, Mass. 02118
Customer Service: (617) 482-9595

---

**Particle Accelerator Application**

In his article "Relevance of particle accelerators to national goals" (6 Aug., p. 490), Louis Rosen lists ways in which accelerators have been applied to the study of radiation damage processes in fast breeder reactors. We would like to call attention to another recent application of this type.

In fast breeder reactors, a significant reduction in reactor efficiency is caused by the swelling of the stainless steel cladding of fuel elements. This swelling is due to the intense fast-neutron bombardment that produces a high density of small voids inside the steel. In the light of the national objective to construct a demonstration breeder reactor by 1980, it has been necessary to mount a large research effort to study systematically the void-swelling phenomena and to develop low-swelling alloys. This work is being expedited by the use of accelerators to simulate neutron-damage effects by ion bombardment. Because heavy ions have a high cross section for producing atomic displacement, it is possible to build up, relatively quickly, a region of intense radiation damage; the structure of this damage is similar to that observed in reactor irradiations. Further, the examination of samples is facilitated by their lack of residual radioactivity.

At Argonne, if a beam of 2-μA Ni+ ions from the 4-Mv Dynamitron accelerator is used, a 1-year irradiation in Experimental Breeder Reactor-II

---

**A is for Actinium-227**

---

**Z is for Zinc-65**

Circle No. 41 on Readers' Service Card
may be simulated in 3 hours. The saving in research dollars and the flexibility afforded by this technique in the development and screening of material for breeder-reactor and fusion-reactor applications are self-evident.

A. TAYLOR  
K. MERKLE  
Argonne National Laboratory,  
Argonne, Illinois 60439

Labeling of Blood-Typing Serums

I heartily agree with the remarks made by Austern and by Ross (Letters, 9 July, p. 105) about the abuse of eponyms in scientific terminology, and I would like to point out one subtle method of getting workers in a field to use pseudoscientific terminology. The method is to print the terms to be popularized on the labels of scientific products. This method has proved highly successful in the case of the C-D-E coded notations for human Rh-Hr blood types. Blood bankers are constantly being confronted with labels on vials of blood-typing sera which carry these symbols, usually in parentheses after the correct scientific symbol. Because of the attractive simplicity of the C-D-E symbols, the worker often adopts the fallacious C-D-E symbols and ignores the correct Rh-Hr symbols, even though the Rh-Hr symbols are given priority on the label.

Manufacturers were required to place the C-D-E symbols on the labels of their Rh-Hr antiserums by the Division of Biologics Standards of the National Institutes of Health after a meeting on Rh-Hr nomenclature held more than 20 years ago. However, in the intervening decades tremendous advances (1) have been made in the knowledge and understanding of the Rh-Hr blood types. The labeling of Rh-Hr antiserums should be modernized to take these advances into account. Despite repeated requests to hold a meeting on the labeling of blood-typing sera, so that this matter can be brought up to date, the Division of Biologics Standards continues to adhere to its original regulations.

A. S. WIEENER  
Department of Forensic Medicine,  
New York University College of Medicine, New York 10016

Reference

The best from two disciplines
Classimat®
Automatic Image Analysis

Ernst Leitz, GmbH... world-renowned leader in precision optics and optics-related equipment has joined forces with Fernseh, GmbH, one of the world's foremost designers and suppliers of advanced television electronics... to produce this precision automatic image analyst. The innovative and technical abilities of both Leitz and Fernseh engineers are combined to provide an instrument of the highest standard and capability.

This remarkable instrument opens many new, exciting avenues of exploration in both physical and biological research and analysis. Micro- or macroscopic images are analyzed with respect to number, area, diameter and size class (up to 19) of specific image elements by a digitally processing television system.

The CLASSIMAT offers many unique features... among the most outstanding innovations are:

Calibrated and therefore exactly reproducible gray level differentiation, unaffected by individual decisions of the observer.

Precision stepping stage fully programmable in increments of 10 um.
On-line computer to derive parameters from point count and linear analyses.
Highest resolution of detection limited only by the resolution of Leitz Optics.

Write for our brochure describing this highly developed optical-electronic system in full detail.

Leitz® E. Leitz, Inc., Rockleigh, N. J. 07647

Circle No. 11 on Readers' Service Card
Bausch & Lomb has been completely successful in cancelling out inflation effects while bringing you new Academic Microscopes with outstanding advantages such as...

- Flat field optical system for sharpest images edge-to-edge
- Wide field eyepieces for longer eye relief and increased usable field of view
- Low position coaxial coarse and fine adjustments for greater comfort and convenience
- Exclusive Harmonic Drive with continuous fine adjustment
- Choice of built-in base illuminators
- Interpupillary distance adjustment with constant tube length
- Choice of plain, glide or ball-bearing mechanical stage with low position coaxial controls
- Choice of reversible binocular or monocular head. Monocular takes a teacher’s observation eyepiece.
- Focusable rack and pinion substage with removable 1.30 N.A.
- Abbe condenser with iris diaphragm in 360° full ring mount

Send for our new catalog 31-2366 and we’ll tell you more.

More Great News! There’s a new Academic 256 line with the famous DynaZoom® stand, at prices that help meet today’s tight budgets. Just write for our new catalog 31-2283 and free demonstration offer.

New Bausch & Lomb Microscopes

WITH FEATURES FOR THE 70’S...

AT PRICES FROM THE 60’S

BAUSCH & LOMB

SCIENTIFIC INSTRUMENT DIVISION

77401 Bausch Street, Rochester, N. Y. 14602

Circle No. 15 on Readers’ Service Card
Because this electrode is unaffected by color, turbidity, or suspended solids, it eliminates time-consuming, preliminary distillations. You can read the ammonia levels directly from the log scale on all Orion Specific Ion Meters — or from a calibration curve if a pH/mv meter is used. (The electrode can be used with any expanded-scale pH meter.)

In addition to measuring dissolved ammonia, you can measure ammonium ion (by adding base to convert ammonium to ammonia), nitrate (by adding a strong reducing agent to the sample, and organic nitrogen (after Kjeldahl digestion). And note this: No reference electrode is required. It's built right into the electrode!

For fast, on-the-spot measurements of ammonia, this new Orion electrode is the answer. Ask us for details.

H-5724X Ammonia Electrode, Model 95-10, supplied in a vinyl-covered steel storage box with accessories. Price $295.00

Pictured with the ammonia electrode is Orion's Model 701 Electronic Display pH/mv Meter — a general-purpose instrument that will accept practically every specific ion electrode on the market. It's extremely versatile... covers the entire pH range with 0.01 pH precision. The 2 pH unit expanded-scale range gives 0.001 pH precision; the expanded mv range (+200 to -200), 0.1 mv precision. Cost? Only $750.00. Ask us for a descriptive brochure.

### BOOK REVIEWS

(Continued from page 292)


**ESI.** Curriculum Guide. R. A. McConnell. Simon and Schuster, New York, 1971. 128 pp., illus. Cloth. $5.95; paper, $1.95.


**High Temperature Oxides. Part 4, Refractory Glasses, Glass-Ceramics, and...**


**The Iron Horse.** Henry B. Comstock. Crowell, New York, 1971. viii, 228 pp., illus. $17.50.


**Library Problems in Science and Technology.** James M. Matarazzo. Bowker,


Oceanography. Readings from Scientific American. Introductions by J. Robert...