



There's no question about it. For unequalled results, the Beckman DU[®]-8 is your final answer, too. How can we say that? Because with men like Dr. Kaye, a pioneer in the spectrophotometer field, we at Beckman can make an instrument like the DU-8.

It is more capable, with its microcomputer, than any other spectrophotometer.

It is more sensitive, with the most advanced optics and electronics available.

It is more versatile, with its ongoing Compuset-controlled accessory systems.

It is easier to use, with its simple keyboard language and easy interchange of accessory systems.

It is more precise, more reliable, more convenient, more advanced and more everything than any other UV-Vis spectrophotometer. Is it more spectrophotometer than you need? Not if the most *final* final answer is what you're looking for.

Any questions? Contact your local Beckman representative or write: Scientific Instruments Division, Beckman Instruments, Inc., P.O. Box C-19600, Irvine, CA 92713.

Innovation in UV since 1940.





Quality conserves energy: It lets you concentrate on results.

EXCLUSIVE Squalene [³H] Farnesyl-PP [³H]

For the study of sterol, steroid, dolichol, terpenoid, and vitamin biosynthetic pathways.

Squalene, [4,8,12,13,17,21-³H]-2-10Ci/mmol

Hexane: ethanol, 99:1 under nitrogen in sealed ampoule, in dry ice NET-645 10μ Ci 50μ Ci

Farnesyl pyrophosphate, triammonium salt,

[1,5,9- 3 H]-2-10Ci/mmol 0.15N Ammonium hydroxide under nitrogen, in foilwrapped sealed ampoule, in dry ice NET-670 10 μ Ci 50 μ Ci

Circle No. 204 on Readers' Service Card

CAMP[³²**P**] 1000-3000 Ci/mmol **8-azido-cAMP**[³**H**] Photoaffinity reagent

Adenosine 3',5'-cyclic phosphate, [³²P]-1000-3000Ci/mmol Ethanol-water 1:1 in dry ice

Ethanol: water, 1:1, in dry ice NEG-011 100μ Ci 500μ Ci

Azidoadenosine 3',5'-cyclic phosphate, ammonium salt, 8-[2-³H(N)]-10-20Ci/mmol Methanol, in dry ice NET-625 50μCi 250μCi

Circle No. 205 on Readers' Service Card



Straightforward gamma counting, more sensitive than ³H Highly specific for the estrogen receptor Low non-specific binding

lodo-3,17 β -estradiol, 16 α -[¹²⁵]-

~200Ci/mmol NEX-144L >1000Ci/mmol NEX-144 Ethanol, in dry ice 10µCi 2x10µCi 50µCi 2x50µCi Circle No. 206 on Readers' Service Card

New for RIA Enkephalin, (5-L-Leu) [¹²⁵I] Enkephalin, (5-L-Met) [¹²⁵I]

High specific activity $800-1200\mu$ Ci/ μ g Stable four weeks from production date Each lot tested for binding and displacement in a specific RIA

Enkephalin, (5-L-leucine), [tyrosy/-125]-Enkephalin, (5-L-methionine), [tyrosy/-125]-800-1200 μ Ci/ μ g

Lyophilized from sodium phosphate buffer, pH 7.5, containing gelatin and sodium azide. NEX-148 (Leu) 10μ Ci $2x10\mu$ Ci 50μ Ci $2x50\mu$ Ci NEX-149 (Met) Prepared fresh for stock on first Monday each month

Circle No. 207 on Readers' Service Card

EXCLUSIVE **3'-dA'IP** $[\alpha^{32}P]$ (Cordycepin 5'-triphosphate)

Incorporation of 3'-dATP, $[\alpha^{-32}P]$ - molecule into DNA or RNA at 3'-end prevents further polymerization

Labels DNA in terminal deoxynucleotidyl transferase catalyzed reaction

Reagent of choice for end-labeling RNA during DNA-dependent RNA transcription

Deoxyadenosine 5'-triphosphate, tetra-(triethylammonium) salt, 3'- $[\alpha^{-32}P]^{-2}$

500-1000Ci/mmol Ethanol:water, 1:1, in dry ice NEG-026 500µCi 1mCi

Circle No. 208 on Readers' Service Card

Not for use in humans or clinical diagnosis



New England Nuclear

549 Albany Street, Boston, Mass. 02118 Call toll-free: 800-225-1572 (In Massachusetts and International: 617-482-9595)

NEN Chemicals GmbH: D-6072 Dreieich, W. Germany, Postfach 401240, Telephone: (06103) 85034, Telex: 4-17993 NEN D **NEN Canada Ltd.,** 2453 46th Avenue, Lachine, Que. H8T 3C9, Telephone: 514-636-4971, Telex: 05-821808 ISSN 0036-8075

25 July 1980 Volume 209, No. 4455

N



LETTERS	Alcohol or Humus?: <i>H. Jenny</i> ; Mathematical "Invasion": <i>J. Alperin</i> and <i>S. Mac Lane</i> ; Keeler's Gap: <i>D. E. Osterbrock</i>	444
EDITORIAL	Regulation and the Universities: <i>D. Kennedy</i>	449
ARTICLES	Water Revisited: F. H. Stillinger The Phylogeny of Prokaryotes: G. E. Fox et al. Seabed Minerals and the Law of the Sea: V. E. McKelvey	451 457 464
EWS AND COMMENT	Making the Multiuniversity More Multiethnic	473 474 475 476 479 481
RESEARCH NEWS	Changing Global Sea Levels as a Geologic Index	483
BOOK REVIEWS	The Evolution of Culture in Animals, <i>reviewed by R. H. Wiley</i> ; Vertebrate Ecology in the Northern Neotropics, <i>B. K. McNab</i> ; Prehistoric Hunters of the High Andes, <i>T. F. Lynch</i> ; Wave Instabilities in Space Plasmas, <i>D. T. Farley</i> ; Books Received	487

OARD OF DIRECTORS	KENNETH E. BOULDING Retiring President, Chairman	FREDERICK MOSTELI President	.ER D. ALL Preside	AN BROMLEY ent-Elect	ELOISE MARTIN	E. CLARK M. CUMMINGS	RENÉE NANCIE	C. FOX L. GONZALEZ
HAIRMEN AND ECRETARIES OF	MATHEMATICS (A) Herbert B. Keller Ronald Graham	PHYSICS (B) William M. Fair Rolf M. Sinclair	bank	CHEMIS H. S. Guto William L.	FRY (C) owsky Jolly		ASTRONOMY (I Tobias Owen Donat G. Wentze)) H
	PSYCHOLOGY (J) Lloyd G. Humphreys Meredith P. Crawford	SOCIAL AND ECONOMIC Kingsley Davis Gillian Lindt	SCIENCES (K)	HISTORY AND PH Brooke Hindle Diana L. Hall	IILOSOPHY OF	SCIENCE (L)	ENGINEERING (M H. Norman Abrams Donald E. Marlowe) on
	EDUCATION (Q) Joseph D. Novak Roger G. Olstad	DENTISTRY (R) Robert J. Genco Harold M. Fullmer	PHARMACEUTIC David A. Knapp Robert A. Wiley	CAL SCIENCES (S)	INFORMAT Henry M. Ki Madeline M	ION, COMPUTI ssman . Henderson	NG, AND COMMU	NICATION (T)
IVISIONS	ALA	SKA DIVISION		PACIFIC DIVISION	•	SOUTHWEST	ERN AND ROCKY	MOUNTAIN DIVISION
	E. Lee Gorsuch President	T. Neil Davis Executive Secretary	Beatrice M.	Sweeney Ala	In E. Leviton	Sam Shu	shan	M. Michelle Balcomb

EIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with The Scientific Monthly@. Copyright © 1980 by the American Association for >Advancement of Science. Domestic individual membership and subscription (51 issues): \$38. Domestic institutional subscription (51 issues): \$76. Foreign postage extra: Canada \$14, other (surface mail) 7, air-surface via Amsterdam \$45. First class. airmail, school-year, and student rates on request. Single copies \$1.50 (\$2 by mail); back issues \$2.50 (\$3 by mail); classroom rates on request. Change of dress: allow 6 weeks, giving old and new addresses and seven-digit account number. Postmaster: Send Form 3579 to Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Science is lexed in the Reader's Guide to Periodical Literature and in several specialized indexes.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

REPORTS	Volcanic Contribution of Chlorine to the Stratosphere: More Significant to Ozone Than Previously Estimated?: D. A. Johnston	491
	N-Formylmethionyl Peptide Receptors on Equine Leukocytes Initiate Secretion but Not Chemotaxis: R. Snyderman and M. C. Pike	493
	Ion Pairing Techniques: Compatibility with On-Line Liquid Chromatography- Mass Spectrometry: D. P. Kirby, P. Vouros, B. L. Karger	495
	Human Hepatocellular Carcinoma Cell Lines Secrete the Major Plasma Proteins and Hepatitis B Surface Antigen: B. B. Knowles, C. C. Howe, D. P. Aden	497
	Cerebral Regional Oxygen Consumption and Supply in Anesthetized Cat: E. Buchweitz, A. K. Sinha, H. R. Weiss	499
	Multiple Mating-Type Specificities in the Flax Rust Melampsora lini: G. J. Lawrence	501
	Limitations of Metabolic Activation Systems Used with in vitro Tests for Carcinogens: C. A. H. Bigger et al.	503
	Cell Variants Showing Differential Susceptibility to Ultraviolet Light-Induced Transformation: T. Kakunaga and J. D. Crow.	505
	(-)Pentobarbital Opens Ion Channels of Long Duration in Cultured Mouse Spinal Neurons: D. A. Mathers and J. L. Barker	507
	DDT Contamination at Wheeler National Wildlife Refuge: T. J. O'Shea, W. J. Fleming III, E. Cromartie	509
	Calcium Regulation During Stimulus-Secretion Coupling: Continuous Measurement of Intracellular Calcium Activities: J. O'Doherty et al.	510
	Initiation of Sulfate Activation: A Variation in C ₄ Photosynthesis Plants: B. C. Gerwick, S. B. Ku, C. C. Black	513
	Carcinogenic Activity of Particulate Nickel Compounds Is Proportional to Their Cellular Uptake: <i>M. Costa</i> and <i>H. H. Mollenhauer</i>	515
	Developmental Potential of Somatic Nuclei Transplanted into Meiotic Oocytes of Rana pipiens: N. J. Hoffner and M. A. DiBerardino	517
	Biochemical Analysis of Human T Lymphocyte Differentiation Antigens T4 and T5: C. Terhorst et al.	520
	Excitatory and Inhibitory Effects of Serotonin on Sensorimotor Reactivity Measured with Acoustic Startle: M. Davis, D. I. Astrachan, E. Kass	521
	Female Mate Choice in a Neotropical Frog: M. J. Ryan	523

JOHN C. SAWHILL HARRIET ZUCKERMAN WILLIAM T. GOLDEN WILLIAM D. CAREY Treasurer Executive Office

GEOLOGY AND GEOGRAPHY (E) Doris Maikin Curtis Ramon E. Bisque MEDICAL SCIENCES (N) Philip K. Bondy Leah M. Lowenstein STATISTICS (U) Oscar Kempthorne Ezra Glaser

WANNA J. HARRISON RUSSELL W. PETERSON

BIOLOGICAL SCIENCES (G) Thomas Eisner Walter Chavin AGRICULTURE (O) Roger L. Mitchell Coyt T. Wilson ATMOSPHERIC AND HYDROSPHERIC GENERAL (X) SCIENCES (W) Vera Kistiakowsky Edward S. Epstein S. Fred Singer Glenn R. Hilst

ANTHROPOLOGY (H) Edward I. Fry Priscilla Reining INDUSTRIAL SCIENCE (P) John D. Capian Robert L. Stern

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

COVER

Augustine Volcano, Alaska. The chlorine output of some explosive volcanoes exceeds earlier estimates of volcanic impact on the stratosphere by 20 to 40 times or more. See page 491. [D. A. Johnston, U.S. Geological Survey, Menlo Park, California]

Give it 60 seconds and almost anything that's dry.

The Brinkmann Centrifugal Grinding Mill is designed to quickly break down to a uniform, specific particle-size range most dry materials up to 6.0 Mohs in hardness.

In just 60 seconds, the Mill will reduce 50 g plastic sheet to $100 \mu m$, 50 g corn to 50 μm , or 120 g limestone to 20 μm particles. By selecting the appropriate combination of stainless steel rotor and screen (6-tooth, 12-tooth and 24-tooth rotors, also 24-tooth tungsten carbide rotor; screens with mesh sizes from 0.08 to 6 mm), a desired particle size range down to 40 microns or smaller can be achieved with a wide variety of substances, including minerals, foods, plant fibers, animal tissue, pharmaceuticals and synthetic materials.

The Grinding Mill is equipped with a powerful dual-speed motor (20,000/10,000 rpm), a 60 min. timer, and is easy to empty and clean. It will pulverize volumes from 3 to 500 cc, even volumes as large as 5 liters using the accessory collection chamber. To facilitate rapid introduction of large amounts of sample, a vibrating feeder is available.

For literature, write: Brinkmann Instruments, Inc., Subsidiary of Sybron Corporation, Cantiague Road, Westbury, N.Y. 11590, or call 516/334-7500. In Canada: Brinkmann Instruments (Canada), Ltd.

Brinkmann Centrifugal Grinding Mill

SYBRON | Brinkmann

FOR TODAY'S FACULTY AND COLLEGE STAFF MEMBERS* FROM 18 TO 80.

Whether you're thinking retirement or not, review the plan that provides for cash withdrawal (without surrender charge) and /or a lifetime income.

TIAA-CREF Supplemental Retirement Annuities (SRAs) offer you substantial flexibility including cash withdrawal <u>and/or</u> lifetime retirement income. You can even reduce your income taxes now!

You can begin contributions to an SRA at any age and begin benefits at any age up to age 71 unless you are still employed (then you can delay beginning benefits until age 80). For example, you could start contributions at age 25, and choose to begin benefits or withdraw cash at age 34, 40 or 50, regardless of your employment status.

Get your money at any time.

You can receive benefits as a lifetime income or over a fixed period of from 2 to 10 years. What's more, if you need it (even while employed by your current employer), you can withdraw all the money you have accumulated by surrendering your contracts. Or, you can withdraw \$1,000 or more every six months. There is never a cash surrender charge.

Contributions are tax-deferred, so you pay less income taxes now.

The federal income tax on your contributions is deferred until they are paid to you as benefits. So, you pay less tax now.

Changing employers? Take SRAs with you.

Since you own your Supplemental Retirement Annuities, you take them with you if you leave your current employer. You can make contributions through any institution that makes Supplemental Retirement Annuities available to staff members. Contributions can be as little as \$25 a month.

Full information.

Complete and mail the coupon for an SRA Information Kit today. You'll get full details about all the advantages SRAs have to offer, why this plan suits so many financial situations and age groups and how much you may contribute to the plan.

*TIAA-CREF provides annuities and other services for employees of colleges, universities, private schools and certain other nonprofit tax-exempt educational and research institutions.

HELP YOURSELF TO A BRIGHTER FINANCIAL FUTURE ... SEND FOR A FREE INFORMATION KIT.



Meet HP's new System 45C color graphics computing center. It plugs into the wall--not into another computer.



Engineering Design

Scientific Research and Analysis

High resolution and 4913 bright, crisp colors give you a realistic, lifelike display of your design. A light pen lets you work interactively with color images.



Complex Data Presentation



Management Graphics

Imagine what you could do with a powerful, easy to use graphics system that sits on your desk and is not dependent on another computer. A desktop computer that combines outstanding color graphics and the computational power to handle complex problems. All built into a compact, functionally-integrated unit, and all under your own individual control.

Based on HP's proven Series 45 desktop computers, System 45C is much more than a display. It's a color graphics processing system with significant computational abilities. You get to your solutions faster through new developments in graphics language extensions to BASIC. Solving tough problems with an outstanding color graphics system, up to 449K bytes of user-available read/write memory, and highperformance I/O is a rewarding experience when it's done the HP desktop system way — under your total control, and at your own pace. To learn more about the graphics capabilities of HP desktop computers, and to request literature or a demonstration of the new System 45C, please turn the page.



Scientists and engineers computer systems powerful

Why?

The Power of HP Graphics. Today's Hewlett-Packard desktop systems offer an impressive array of powerful graphics capabilities to help you analyze data more thoroughly and solve complex problems more quickly. With both full-color and monochromatic displays, and a broad range of HP input, output and storage peripherals, it's easy to tailor a graphics system to match your needs. And, you'll realize benefits that reach well beyond the power of display graphics. HP systems today give you powerful computing capabilities with user-available memory to 449K bytes, high-performance I/O, data base management and mass memory options to 120M bytes. Whether you're computing, optimizing a design or acquiring data from instruments, HP graphics systems put big computer power under your individual control.

An Interactive System. Your data can be entered in a number of ways. You can use the desktop computer's interactive keyboard. Or, if you're



working with drawings, photographs, maps and other graphic material, the HP Digitizer enables you to transfer this data to the computer. System 45C's Light Pen provides a natural way to let you move and construct objects on the system's CRT screen.

Results the Way You Want Them. Your HP graphics system will let you choose the way you want your results presented. You can display your solutions on the desktop computer's CRT screen,

and the image can be dumped onto the



find today's desktop graphics tools.

desktop's built-in printer. Your output can be in the form of color plots or overhead color transparencies, made by an HP four color plotter. These can be useful in group presentations. Printed results, including letter quality output, can also be obtained from HP printers. When your system is assembled to give you the graphic results you want, HP's high-performance language and industry standard I/O will ensure smooth interaction among all the components.

Advanced Graphics Language.

To simplify your development of computational graphics, we've formulated a graphics language extension of HP Enhanced BASIC. With up to 70 commands, our graphics language eliminates numerous statements and hours of programming, letting you quickly manipulate monochromatic and color images from simple charts and diagrams to complex geometrical figures.

Extended Capabilities.

The power and versatility of your desktop system can be extended through two new HP capabilities. Data Comm allows desktops to communicate with larger mainrames in High Speed Asynchronous or Bisynchronous modes. With this capacity, the desktop becomes a very powerful and fully integrated work station in a large computer system. Technical Data Base Management provides HP's award-winning IMAGE facilities that let you access information in the system without writing applications programs. DBM also includes a powerful adaptation of the QUERY inquiry program.

A Choice — and Two New Systems.

We build a broad range of desktop computers, with one just right for your graphics applications. The new System 45C offers powerful color graphics and up to 449K bytes of computational power.



System 45B provides monochromatic graphics (including 3-D) and large read/ write memory capacity. The new HP-85 is a modestly priced professional desktop computer with integrated graphics, CRT and printer. All three of these systems can be used with HP peripherals.

A Growth Path.

As your needs expand, HP desktop computers can communicate with the HP 1000 family of realtime computer systems over data links. For dedicated graphics applications that require a multi-

require a multiuser, multi-terminal system, the HP 1000 Model 45 includes a graphics terminal and versatile graphics/ 1000 software. The multi-programming power of an HP 1000 can be teamed with the graphics devices described above, and can also control up to four full-color

graphics display systems. **For more information.** Call 800-821-3777, extension 303, toll-free day or night (Alaska and Hawaii included). In Missouri, call 800-892-7655, extension 303. Or write 3404 E. Harmony Road, Fort Collins, Colorado 80525.

For a demonstration. Call the HP regional office nearest you: East 201/ 265-5000; West 213/970-7500; Midwest 312/255-9800; South 404/955-1500; Canada 416/678-9430. ««







Monoclonal antibody specific to Human T cell antigen is now available.

Immunochemical techniques for identifying and isolating lymphocyte subpopulations are generally preferred over other methods. Antibody mediated procedures offer more precise cell differentiation and greater procedural convenience.

Antibodies directed against B cell surface immunoglobulins are available as conventional antiserum, but prior to the development of monoclonal antibodies, no equivalent immunochemical markers for T cells have been commercially available. Now Hybritech the leading company in hybridoma technology announces the immediate availability of a monoclonal antibody specific for a surface antigen on all human T cells.*

Monoclonal antibody to human T cells creates new research opportunities.

Hybritech's new monoclonal antibody will greatly enhance research applications requiring precise differentiation of Human T cell populations.

Identification of T cell Leukemia and lymphoma Assay of peripheral lymphocyte subpopulations Separation of T cells using immunoadsorbents Investigation of T cell function

Hybritech antibody to human T cells offers superior performance.

For research programs requiring identification or isolation of T cells, Hybritech's antibody satisfies the most important criteria.

- **Specificity** Identification, localization and isolation of all human T cells with no cross-reactivity to normal B cells
- **Quantitation** Inclusion of T cells that generally are missed by rosetting techniques.
- **Cytotoxicity** Elimination of T cells in lymphocyte preparations
- **Diagnosis** Detection of acute and chronic leukemias and lymphomas of thymic origin **Reproducibility** — Standardization of results with monoclonal antibody

Learn more about this new immunochemical reagent and how it can enhance your research program by contacting Hybritech, the leaders in hybridoma technology.

✓ Immunofluorescence of Human T cells following incubation with Hybritech's T cell specific antibody and rhodamine conjugated horse anti-mouse antibody.

Circle No. 203 on Readers' Service Card



At the present time, Hybritech antibodies are not designed or intended for either

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of mi-nority or conflicting points of view, rather than by pub-lishing only material on which a consensus has been reached. Accordingly, all articles published in Science including editorials, news and comment, and book reviews-are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Editorial Board

1980: RICHARD E. BALZHISER, WALLACE S. BROECK-ER, CLEMENT L. MARKERT, FRANK W. PUTNAM, BRY-ANT W. ROSSITER, VERA C. RUBIN, MAXINE F. SINGER, PAUL E. WAGGONER, F. KARL WILLENBROCK 1981: Peter Bell, Bryce Crawford, Jr., E. Peter Geiduschek, Emil W. Haury, Sally Gregory Kohlstedt, Mancur Olson, Peter H. Raven, Wil-liam P. Slichter, Frederic G. Worden

Publisher

WILLIAM D. CAREY

Editor

PHILIP H. ABELSON

Editorial Staff

Managing Editor Robert V. Ormes Assistant Managing Editor JOHN E. RINGLE

Business Manager HANS NUSSBAUM **Production Editor** ELLEN E. MURPHY

News Editor: BARBARA J. CULLITON News and Comment: WILLIAM J. BROAD, LUTHER J. CARTER, CONSTANCE HOLDEN, ELIOT MARSHALL, DEBORAH SHAPLEY, R. JEFFREY SMITH, NICHOLAS WADE, JOHN WALSH. Editorial Assistant, SCHERRAINE Маск

Research News: BEVERLY KARPLUS HARTLINE, RICHARD A. KERR, GINA BARI KOLATA, JEAN L. MARX, THOMAS H. MAUGH II, ARTHUR L. ROBINSON.

Editorial Assistant, FANNIE GROOM Consulting Editor: Allen L. HAMMOND Associate Editor: Eleanore Butz, Mary Dorf-MAN, Sylvia Eberhart, Ruth Kulstad Assistant Editors: CAITILIN GORDON, STEPHEN KEP-

PLE, LOIS SCHMITT Book Reviews: KATHERINE LIVINGSTON, Editor; LINDA HEISERMAN, JANET KEGG

Letters: CHRISTINE KARLIK

Copy Editor: Isabella Bouldin Production: Nancy Hartnagel, John Baker; Ya 1 Swigart, Holly Bishop, Eleanor Warner; MARY MCDANIEL, JEAN ROCKWOOD, LEAH RYAN, SHARON RYAN

Covers, Reprints, and Permissions: GRAYCE FINGER. Editor; CORRINE HARRIS, MARGARET LLOY Guide to Scientific Instruments: RICHARD G. SOMMER

Guiae to Scientific Instruments: KICHARD G. SOMMER Assistant to the Editors: JACK R. ALSIP Membership Recruitment: GWENDOLYN HUDDLE Member and Subscription Records: ANN RAGLAND EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Area code 202. General Editorial Office, 467-4350; Book Reviews, 467-4367; Guide to Scientific Instruments, 467-4480; News and Comment, 467-4430; Reprints and Permissions, 467-4483; Research News, 467-4321. Cable: Advancesci, Washington. For "Instructions for Contributors," write the editorial office or see page xi, *Science*, 27 June 1980.

BUSINESS CORRESPONDENCE: Area Code 202. Membership and Subscriptions: 467-4417.

Advertising Representatives

Director: EARL J. SCHERAGO Production Manager: GINA REILLY Advertising Sales Manager: RICHARD L. CHARLES Marketing Manager: HERBERT L. BURKLUND

Sales: NEW YORK, N.Y. 10036: Steve Hamburger, 1515 Sales: NEW YORK, N.Y. 10036: Steve Hamburger, 1515 Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHI-CAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Mich-igan Ave. (312-337-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581).

ADVERTISING CORRESPONDENCE: Tenth floor, 1515 Broadway, New York, N.Y. 10036. Phone: 212-730-1050.

Regulation and the Universities

It is no news that a sharp political contest is under way between the proponents of federal responsibility for such social objectives as equality of opportunity and public health, and those who believe that the regulatory apparatus for meeting that responsibility imposes unacceptable costs on other, equally valid goals. Perhaps it is not even news that the universities, once securely counted in the constituency for intervention, are now complaining about it. But it certainly is news when spokesmen for the nation's academic scientists claim that the universities are in league with the federal regulators-having been required, one presumes, to pay off a Faustian bargain the universities made in return for federal patronage.

This last case is not convincing. Most of the regulations that now trouble the universities are neither explicitly related to past federal patronage nor unique to educational institutions. They reflect congressional concern about such general problems as access for the handicapped and the safe handling of carcinogens. Because these concerns are occasionally amplified by demonstrated abuses, the universities will continue to feel their impact-along with the profit sector, which has felt it all along. But the newness of the experience sensitizes the universities to it in a way that is sharpened by frequent insensitivity on the other side-as when they receive compliance letters that begin "Your firm." The increased regulatory attention to universities, however, reflects concerns that are hardly special to the academic sector. In a troubled economy, it is natural for all payers, government included, to demand stricter accountability.

Meanwhile, social attitudes about the universities have been changing. In the mid-1950's higher education was felt to merit, because of its special social value, exemption from many obligations that fell to other sectors. Today, to labor organizers, community neighbors, and government regulators at all levels, the universities look not so much special as merely large. Harvard and Stanford are coming to be perceived, and therefore treated, like General Motors or Boeing.

This perception fits all too well with another: that all large bureaucracies are bad. Philip Abelson implied in this space on 25 April that university bureaucracies are in league with the feds to skim off research funds into administration. That view allows annoyance to overwhelm reason. University administrations are larger, but for good reasons. They are engaging in more transactions-processing more gifts, managing more scholarship funds, defending more lawsuits. They are also running bigger plants and running them better than in the 1950's, when undermanaged enterprises survived because the world was simple and the economy growing. And they are not working against the interests of scientists in the university. To accuse them of collusion with federal bureaucrats ignores, for example, the intense effort they mounted to ameliorate the recent round of A-21 revisions.

In the end, a good deal of accommodation will be needed to solve the problems of regulation and the universities. For the universities, shifts in public attitudes and the newness of the experience present special difficulties; for the regulators, there is a need to get used to a different clientele. Each party needs to recognize that the work of the other merits a strong presumption of validity. That accommodation will not be speeded by the delusion that the universities are special targets, or that their administrators are double agents.-DONALD KENNEDY, Vice President and Provost, Stanford University, Stanford, California 94305



The ultimate in radiological instrumentation -and how we relate to it.

Between their ears radiologists keep the diagnostic equipment unlikely to be surpassed in sophistication. All the innovations of all the engineers working in the field are but input devices for these units.

Ears certainly help, but eyes are the real interface to the trained brain from the cathode-ray tube where the engineers leave off. Our business is with eyes. Results take the form of ever-improving films and—no less important—information about how most wisely to select and handle our products. As might be expected, we keep in close touch with physicians who need film in their work. We do a good job of making them aware of the advantages of our films.

To make Kodak products even more useful to them, however, involves third parties. It requires close touch with people who buy comparatively little film, only enough for their development work on new diagnostic hardware.

Contact with these parties is better made earlier than later if only we can learn in time at whose door to come knocking. These engineers have much more to think about than film. To them, film is a supply item, as is the paper on which their technical reports are typed. An excellent report can be written on slightly off-color paper. With film, the engineers are fussier. When ready for their first big demonstrations, most look for a film with a good spectral-sensitivity match to the phosphor on the display tube.

There is more to be considered than that. Between the output of the electronic circuitry and the image from which medical judgments will be made when the films are viewed stands all the complexity of *our* art and trade. We do not try to convince anybody that one perfect film can be right for all the kinds of electronic images. Instead, we offer five films for CRT imaging in medical instrumentation.* We hardly expect the selection to be made from an advertisement.

We do suspect there are engineers who right now can save themselves from having to settle for slightly unsatisfactory compromises. These people are not so numerous that we can't talk to each of them in detail. Arrangements are made by phoning (716) 724-4741 and asking for Bob Thomson, or by writing him at Eastman Kodak Company, Department 816-B, Rochester, N.Y. 14650.

*All five are orthochromatic and all can be processed in 90 seconds: 1) KODAK Gray Tone Imaging Film, 2) KODAK Ortho M Film SO-140, 3) KODAK MIN-R Film, 4) KODAK NMB Film, and 5) KODAK NMC Film.

© Eastman Kodak Company, 1980



A 100-year start on tomorrow