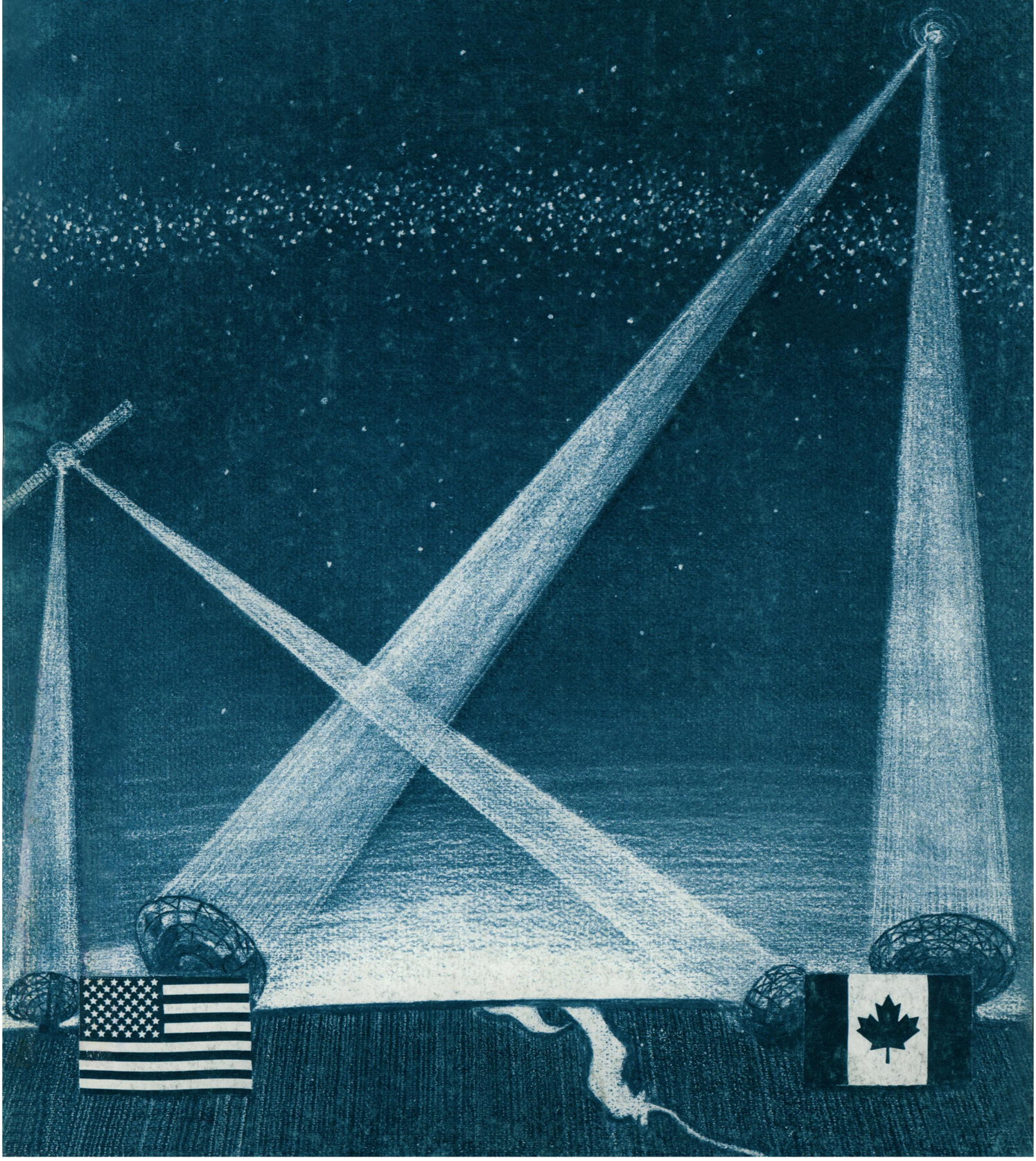
SCIENCE

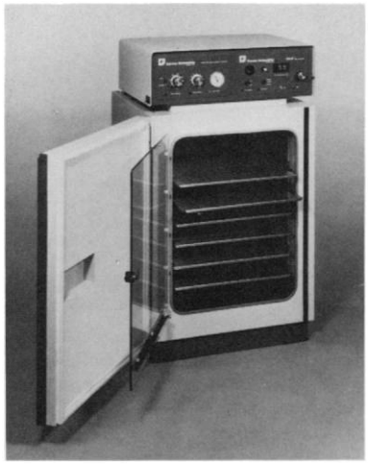
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

21 October 1977, Volume 198, No. 4314



NEW! Forma's CH/P System Incubators

For the most accurate automatic CO_2 control on the market.



The CH/P System adds a new dimension to solid-state electronic CO_2 control.

- Direct digital CO_2 setpoint to within 0.1% over a full 0 - 20% range.
- Direct digital display of both setpoint and chamber readout on one easy-to-read L.E.D. indicator.
- CO_2 deviation alarm provides an audible and visual warning if CO_2 tension drifts more than 1% from setpoint.

CH/P System Digital CO_2 Controllers are now available on all Forma Automatic Water-Jacketed Incubators. Portable units also available.

Model 3157

For the most accurate automatic CO_2 control on the market.

Forma Scientific

BOX 649 • MARIETTA, OHIO 45750 • AREA CODE 614/373-4763
TELEX 24-5394 • TOLL FREE IN-WATS SERVICE 800-848-9730 AREAS 1, 2 & 3

Circle No. 28 on Readers' Service Card

IF YOU THINK IT DOESN'T MAKE MUCH DIFFERENCE
WHERE YOU BUY YOUR LIFE INSURANCE...

please look at this cost comparison for $50,000 5-Year Renewable Term Policies issued by TIAA and the ten largest U.S. life insurance companies!

20-Year Average Annual Costs* for $50,000 5-Year Renewable Term Policies

	Policies Issued To Men			Policies Issued To Women		
	Issue age 25	Issue age 35	Issue age 45	Issue age 25	Issue age 35	Issue age 45
TIAA	**$102.50**	**$213.50**	**$497.00**	**$ 81.50**	**$142.50**	**$316.50**
10 Largest U.S. Companies:						
Aetna	216.00	352.00	814.00	210.00	301.00	644.50
Connecticut General	223.00	378.50	816.50	204.00	313.00	673.00
Equitable	187.00	343.50	754.00	163.50	297.50	677.50
John Hancock	200.50	344.00	750.00	192.00	307.50	659.00
Massachusetts Mutual	196.00	337.50	737.00	184.50	313.00	683.00
Metropolitan	188.50	347.00	779.50	162.50	267.00	565.00
New York Life	189.00	337.50	751.00	171.00	281.00	602.00
Northwestern Mutual	163.00	300.00	684.00	147.00	264.00	592.00
Prudential	164.00	300.00	592.00	146.00	242.00	462.00
Travelers	200.50	360.50	820.00	182.00	281.00	603.00
Mean Cost for 10 Companies	**192.75**	**340.05**	**749.80**	**176.25**	**286.70**	**616.10**

*Based on 1977 premium rates and dividend scales, adjusted for interest (4%) to recognize the time value of money; dividends not guaranteed.

You can see from these figures that owners of TIAA policies enjoy substantial cost advantages over persons insured by the country's largest commercial life insurance companies—companies that sell one in every three policies purchased by Americans each year. As a staff member (either full-time or part-time) of a nonprofit educational institution you are one of the limited group that qualifies for TIAA and the big savings this eligibility can bring.

To give you an idea of savings possible, the figures show that, as compared to TIAA:

the mean cost for $50,000 5-Year Renewable Term policies issued to 35-year old men by the ten largest companies is 59% higher, a dollar difference favoring TIAA, adding up to more than $2,500 over the next 20 years; even the company in the group that appears to offer the best bargain demands a cost 40% higher than TIAA's;

the mean cost for $50,000 policies issued to 35-year old women by the ten companies is double that of TIAA, indicating savings close to $2,900 for the person choosing TIAA; for the most attractive commercial policy shown, women will pay 70% more over the years than for a TIAA policy giving them the same benefits.

You can get all the facts about a TIAA 5-Year Renewable Term policy that can help secure the future for your family by contacting the TIAA LIFE INSURANCE ADVISORY CENTER. Either telephone collect 212-490-9000 and ask for one of the Insurance Counselors

Alan L. Fox, C.L.U. Joan Scott, C.L.U. Kenneth Sawyer Robert Cassidy

Or mail this coupon. In either case there are no strings attached and no one will call on you.

Life Insurance Advisory Center
TEACHERS INSURANCE & ANNUITY ASSOCIATION
730 Third Avenue, New York, N.Y. 10017

Li

Yes—I'd like to know more about TIAA 5-Year Renewable Term Insurance policies. Please send personal illustrations for my age.

Name and Title _____ Date of Birth _____

Address _____

City, State, Zip _____

Nonprofit Employer (College, University, Private School, Etc.) _____

If your spouse is also eligible according to the rules described, please provide:

Spouse's Name _____ Date of Birth _____

Eligibility for TIAA is extended to employees of colleges, universities, private schools, and certain other nonprofit educational or scientific institutions, and to the employee's spouse when more than half of their earned income is from an eligible institution.

TIAA *The College World's Insurance Association*

21 October 1977

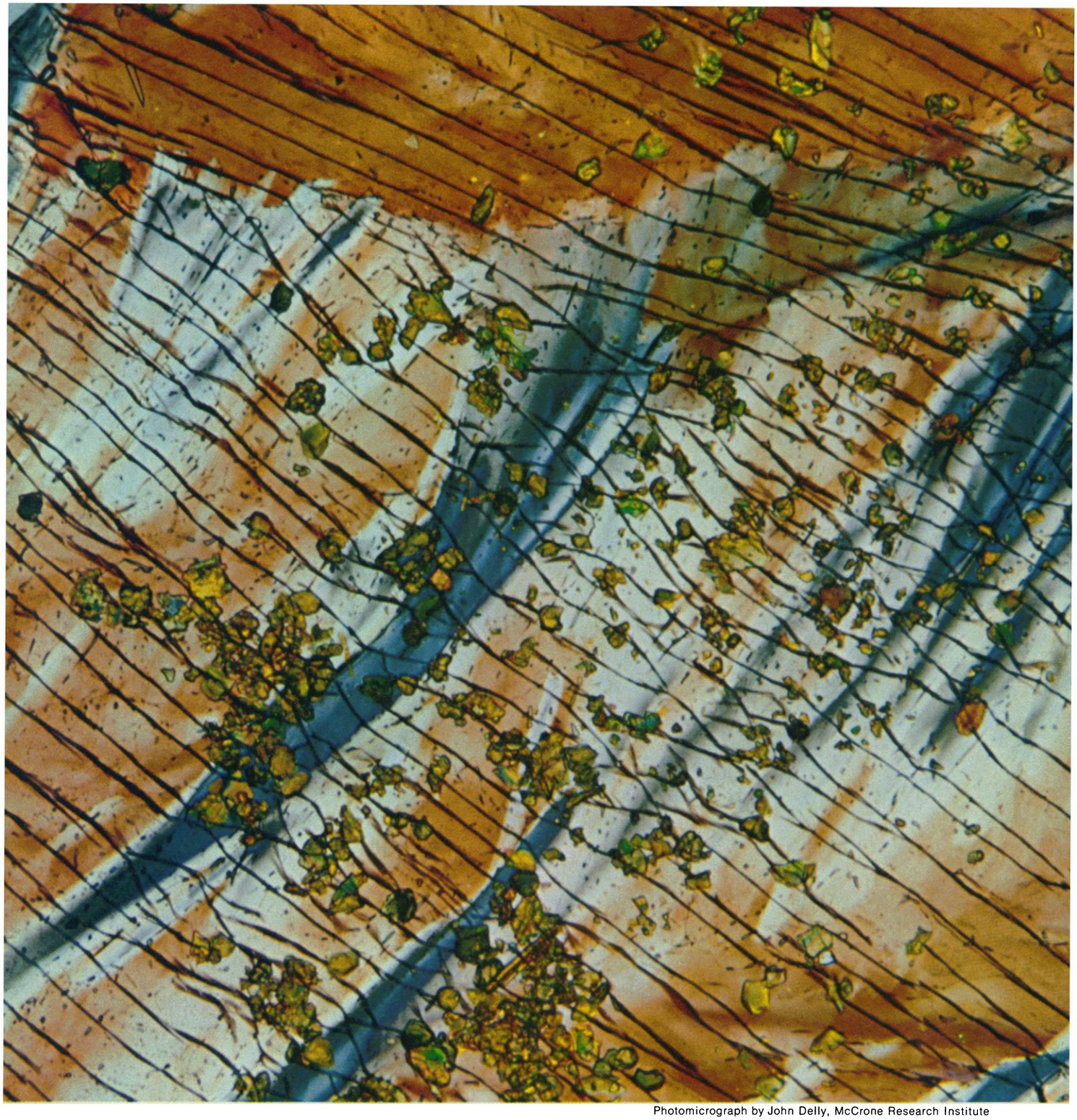
Volume 198, No. 4314

SCIENCE

SCIENCE is published weekly, except the last week in December, but with an extra issue on the third Tuesday in September, by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with **The Scientific Monthly®**. Second-class postage paid at Washington, D.C., and additional entry. Member rates on request. Annual subscriptions $60; foreign postage: Canada $10; other surface $13; air-surface via Amsterdam $30. Single copies $2 (back issues $3) except **Guide to Scientific Instruments** $6. School year subscriptions: 9 months $45; 10 months $50. Provide 6 weeks' notice for change of address, giving new and old addresses and postal codes. Send a recent address label, including your 7-digit account number. **Postmaster: Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005.** ***Science*** is indexed in the **Reader's Guide to Periodical Literature.**

COVER

Schematic impression of the Satellite Very-Long-Baseline Interferometer System. Two radio telescopes at widely separated locations are interconnected by a communications satellite, to permit real-time correlation of radio waves received at the two instruments from cosmic sources. See page 289 [Artwork by J. W. Johnson, professor emeritus, San Jose State University, San Jose, California]



Photomicrograph by John Delly, McCrone Research Institute

Take a closer look at EASTMAN Organic Chemicals.

(protein, polypeptide, and other reagents)

This beehive of interacting crystals is a photomicrograph (enlarged 378X) of EASTMAN Chemical 192, p-Nitrophenol. It's one of our many products for protein and polypeptide synthesis and analysis, including: amino acids; coupling-, deblocking-, protein-modifying-, sequenation-, visualization-, and gas-liquid chromatography reagents; polymeric supports; and thin-layer chromatography products.

Look into them—or into our many other chemicals for electrophoresis; liquid scintillation counting; and dyes, stains, and indicators. All available only through nearby dealers.

For details, quotes, and a free poster of this photomicrograph, see your dealer. (For larger than lab quantities, call (716) 458-4080. Eastman Organic Chemicals, Eastman Kodak Company, Rochester, N.Y. 14650.)

Kodak

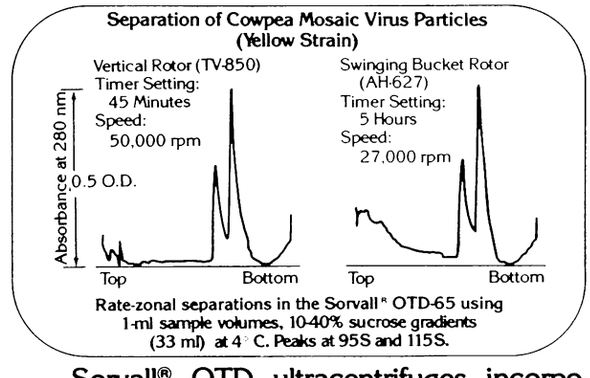
Worth a close look.

Density gradient spin times can Sorvall® OTD ultracentrifuges

High resolution and time savings result when the combined advantages of a Sorvall® OTD ultracentrifuge and a Sorvall® vertical rotor are used for density gradient separations.

These patented rotors* hold the tube in a fixed vertical position while tube contents are reoriented 90°. The sedimentation path length is thus reduced from the length to the width of the tube, resulting in shorter spin times. Three vertical rotors are available to suit a wide range of capacity requirements.

Typical results are shown in the rate zonal separation of cowpea mosaic virus particles using 1 ml samples. Use of a Sorvall® 8-place vertical rotor instead of a 6-place swinging bucket rotor of comparable tube volume reduced spin time more than 80% while maintaining resolution. These rotors are equally suitable for isopycnic density gradient separations.



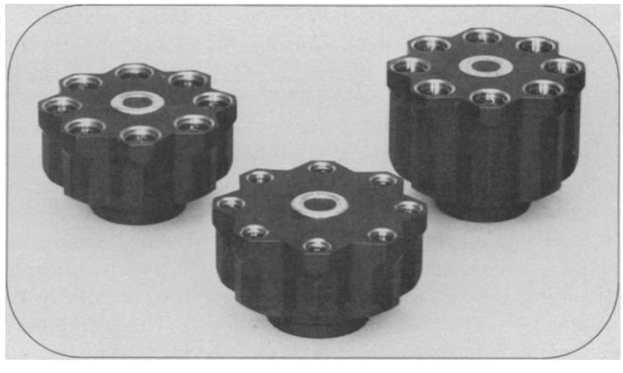
Rate-zonal separations in the Sorvall® OTD-65 using 1-ml sample volumes, 10-40% sucrose gradients (33 ml) at 4° C. Peaks at 95S and 115S.

Sorvall® OTD ultracentrifuges incorporate a unique low-friction oil turbine drive capable of providing soft starting and stopping, and smooth acceleration and deceleration. The Sorvall® Automatic Rate Controller and Reograd mode of deceleration take full advantage of this capability to avoid stirback and mixing of the gradient between 0 and 1,000 rpm.

be reduced more than 80% by with new vertical rotors.

The oil turbine drive also eliminates the maintenance and replacement of gears, belts and brushes. The many other features of OTD centrifuges include trouble-free self-contained cooling system; precise, wide-range temperature control; and automatic and manual vacuum pumping system.

For full information on Sorvall® OTD ultracentrifuges and vertical rotors, write to DuPont Instruments, Biomedical Division, Room 36005, Wilmington, DE 19898.



*U.S. Patent 3,998,383

With Sorvall® Centrifuges the spin times are changing.

DuPont Instruments

DUPONT

Circle No. 257 on Readers' Service Card

Last time, we told you that a Betamax videocommunications system could be a very profitable investment.

This time, we'll tell you how.

Let's take an example.

You're selling something. Something bigger than a breadbox. You can't carry it around.

So you carry around a Betamax videocassette. You've got color. Movement. Sound. All via the personal, effective, familiar medium of television.

Take another example.

You've got locations all over the country. You've got a new procedure to introduce. You're worried about uniformity, continuity, quality control.

So you put your training message on Betamax. Educators have already proven the effectiveness of TV as a learning device. What you see on a television screen, you remember.

And remember: production and distribution costs are far below any other quality audiovisual system.

Of course, Betamax isn't the only solution to your video needs.

For sophisticated teleproduction and editing, you'll want a Sony U-matic videocassette system.

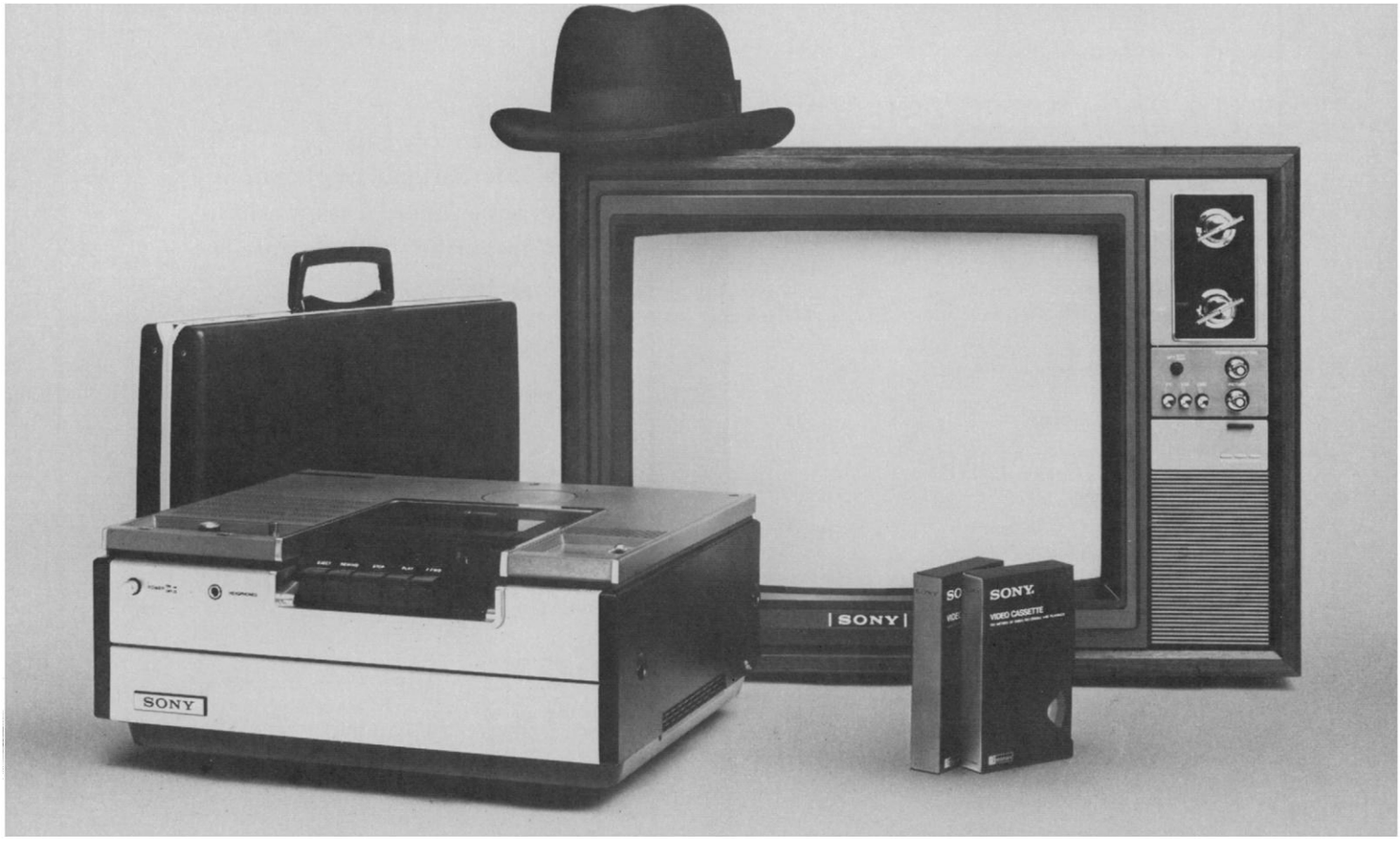
Or for simple audiovisual systems without wide distribution, you'll want Sony ½" reel-to-reel video equipment.

Betamax, U-matic, and ½" open-reel Sony systems are all in use daily, by profit-oriented companies around the world.

So you see, entertainment might be our trump card.

But business is definitely our long suit.

THE GRAY FLANNEL BETAMAX.



SONY.

9 West 57th Street
New York, N.Y. 10019

Circle No. 144 on Readers' Service Card

Products shown are
SLP-100 Betamax Videocassette Player;
CVM-2150 Color Monitor.

Institution periodically review government economic policy. A similar independent institute should be established to serve as a "watchdog" of the government's projects and programs affecting the national scientific and health research effort.

DAVID E. LILIENFELD
Johns Hopkins University, Baltimore, Maryland 21218
ABRAHAM M. LILIENFELD
School of Hygiene and Public Health, Johns Hopkins University, Baltimore, Maryland 21205

Concerning Y. Orlov and A. Sharansky

The following letter to A. P. Alexandrov, president of the Soviet Academy of Sciences, was signed by us and 145 of our colleagues. It concerns physicist Yuri Orlov and mathematician Anatoly Sharansky. Both are being held in Lefortovo Prison in Moscow. Orlov is charged with making anti-Soviet statements regarding the implementation of the Helsinki agreement. Sharansky has been held incommunicado without charge for more than 7 months following his application to emigrate. It is thought that he is to be charged with treason.

The undersigned, writing as individual scientists and engineers, wish to express our concern about the situations of physicist Yuri Orlov and mathematician Anatoly Sharansky. We assign great importance to the benefits of scientific and technological cooperation between the citizens of our two countries. We share with our colleagues in the Soviet Union the hope that our growing international fraternity will serve as a powerful force for peace and friendship in the world. However, the present situation of Orlov and Sharansky suggests a regression to the conditions of twenty-five years ago, which will inevitably create major new barriers to the cooperation which we have achieved since those times. The implementation of the Helsinki agreement will be hindered severely by the legal accusations being made against two Soviet scientists who question the effectiveness of that implementation. In particular, the charge of treason against Sharansky will have a chilling effect on future international cooperation between scientists and engineers. We respectfully request that you use your good offices with the judicial authorities to obtain the dismissal of charges against Orlov and Sharansky.

For identification, the undersigned are scientists and engineers at Argonne National Laboratory, Argonne, Illinois.

LLOYD G. HYMAN
JOSEPH J. KATZ, TIMOTHY O'CONNOR
MURRAY PESHKIN, G. ROY RINGO
Argonne National Laboratory, Argonne, Illinois 60439

Cancer Congress in Argentina

A group of scientists and physicians, deeply concerned about reports of political repression, torture, and executions in Argentina and about the implications of participating in the 12th International Cancer Congress in Buenos Aires, have drafted the following statement:

The undersigned physicians and scientists engaged in cancer research and patient care are deeply concerned by the flagrant abrogation of human rights in Argentina, the country in which the 12th International Cancer Congress is scheduled to be held on October 5–12, 1978 at Buenos Aires. Recent reports [Nicholas Wade, *Science* **194**, 1397 (1976): "Repression in Argentina: Scientists caught up in tide of terror"] leave little doubt that scientists, physicians, professors, journalists, intellectuals, and other citizens have been arrested, imprisoned without benefit of habeas corpus, often tortured, and sometimes executed without trial. We cannot in good conscience condone such actions, nor can we participate in an International Cancer Congress however worthy its cause, if it is held in Argentina. To prevent the adverse impact which such a boycott might well have on the international effort against cancer, we call upon the officers of the International Union Against Cancer (UICC) to convene in emergency session for the purpose of considering an alternate venue for the 12th International Cancer Congress in 1978.

We invite U.S. scientists and physicians who share these views to join us in signing this petition. Copies will be made available on request to Dr. Henry Rappaport, City of Hope National Medical Center, 1500 East Duarte Road, Duarte, California 91010.

We understand that similar actions are now under way in Canada and France. We hope that colleagues in all the countries which are signatories of the Helsinki declaration of human rights will join in this protest.

DAVID BALTIMORE
Center for Cancer Research, Massachusetts Institute of Technology, Cambridge 02139
EMIL FREI III
Sidney Farber Cancer Institute, 44 Binney Street, Boston, Massachusetts 02115
HENRY S. KAPLAN
Department of Radiology, Cancer Biology Research Laboratory, Stanford University Medical Center, Stanford, California 94305
HENRY RAPPAPORT
City of Hope National Medical Center, Duarte, California 91010
HOWARD M. TEMIN
McArdle Memorial Laboratory for Cancer Research, University of Wisconsin Medical Center, Madison 53106

This Stay-Clean™ laminar flow system

reduced the animals' airborne contamination

from 1,000,000 particles per cubic foot to 0 particles in minutes.*

(Isn't your research worth that protection?)

If airborne microbial contamination can jeopardize your work in any way, consider our Stay-Clean™ system. It can protect your animals, your experiment, your investment, and your nervous system.

What is the Stay-Clean system?
Basically, a system which provides a flow of highly-filtered laminar flow air directed horizontally across an enclosed animal cage chamber.

Does it work?
Yes, the efficient filtering system greatly reduces airborne contaminants, be they microbial or non-viable particulate matter. All particulate matter 0.3 microns or larger is removed. And because the animals are "downstream" from the laminar flow source, the re-entry of ambient contaminants into the cage is prevented.

How is the Stay-Clean being used?
Generally speaking, whenever airborne contamination can jeopardize a colony or a research effort, ultra-clean laminar flow air can materially reduce such contamination. The Stay-Clean system is particularly useful in reducing colony-threatening cross-contamination.

Who's using the Stay-Clean now?
Small sample of users:

University of Notre Dame
Sloan-Kettering Institute
Wayne State University
University of Cincinnati
University of Rochester
Albert Einstein College of Medicine
Union Carbide Corporation
National Naval Medical Center
University of Pittsburgh
National Institutes of Health
U.S. Department of Agriculture
Johns Hopkins School of Medicine
University of Missouri
Environmental Protection Agency
M.I.T.
University of Southern California
Pennsylvania State University
University of Michigan
New York University Medical Center
University of Wisconsin
University of Alabama
Cornell University Medical Center
Litton Bionetics
Hoffman-La Roche

Why not let us know if you'd like to see one in operation in your area.

Special note to Stay-Clean owners:
We now offer a special continuing service/re-certification program that protects you after the initial 12 month warranty. Ask us about it.

Why is Lab Products "the leader in environmental protection for lab animals"?
Because we offer the widest selection of such products. Isosystem™, a simple, inexpensive housing system that can provide a protected micro-environment within any macro-environment. Enviro-Gard™ filter system: permanent filter bonnets (washable and auto-clavable) to fit virtually all plastic cages. See-Through™ suspended cage systems: with special formed plenum filtering system. And, of course, the Stay-Clean laminar flow system herein described. *Please note:* The particle counter shown above is most useful for monitoring air purity and it, too, is available from us.

More information?
Write for our Stay-Clean brochure 2D2. And if you don't have our extensive catalog showing our *other* products and describing our custom fabrication, please request that also.

Lab Products Inc.,
365 W. Passaic St.,
Rochelle Park, N.J. 07662
(phone: 201/843-4600)

lab products inc a BioMedic company

Lab Products...not just plastic cages, metal cages, custom fabrication, laminar flow systems, bedding, automatic watering systems, accessories...

* Depending upon room size, etc., this unit can reduce particle count of 100,000 to 1,000,000 particles per cubic foot to 0 particles per cubic foot 0.3 micron or larger in minutes.

21 October 1977, Volume 198, Number 4314 **SCIENCE**

Soil and Coal: A Cost-Benefit Inquiry

The Secretary of Interior has proposed a moratorium on strip mining of "prime" agricultural land. Even though the recently passed strip-mining bill does not incorporate this specific proposal, its discussion raises some fundamental questions which should be of concern to conservationists, economists, and scientists generally, as well as to lawyers and politicians.

- Is society really faced with a choice between food and energy, or is this a false issue? More likely, the choice is between more coal and a loss of topsoil (permanent or temporary, depending on the degree of restoration).
- To make a rational rather than emotional choice, can one establish the short-term and long-term values to society of both soil and coal?
- Are these values properly expressed by the price of coal and farmland?
- If the market price does not fully express the long-term value of farmland to society, how should this value be determined?
- How much farmland would have to be diverted before its value rises?
- How is prime land defined, and why should a moratorium be limited to it?
- How can we identify and minimize any damaging side effects of mining?

Another set of questions is concerned with fair treatment of mining as one of the important uses of land.

- Does the proposal constitute a "taking" of property rights (in a constitutional sense) by depriving the landowner of mineral royalties?
- Why is there no comparable moratorium on other land uses that would divert farmland permanently, such as housing developments and highway construction?
- By the same token, should one not prohibit agricultural overexploitation of land, which causes substantial soil loss by erosion and thereby represents mining of the soil?*

A third set of questions recognizes that the agricultural value of strip-mined land can be at least partially recovered with proper restoration measures.

- What is the right amount to spend on land restoration?
- Should the amount be related to the total value of the minerals extracted, or to the value (and price) of the land itself?

For example, prime wheat land in North Dakota sells for up to $300 an acre. The value of the mined lignite may be as high as $300,000 an acre. Depending on the degree of restoration, the cost may range from a few hundred to several thousand dollars per acre. A major mining company in New Mexico has been spending $4000 to $5000 per acre, on land selling for $55 per acre, merely to speed up natural seeding and restoration. Some additional questions are raised by this discussion.

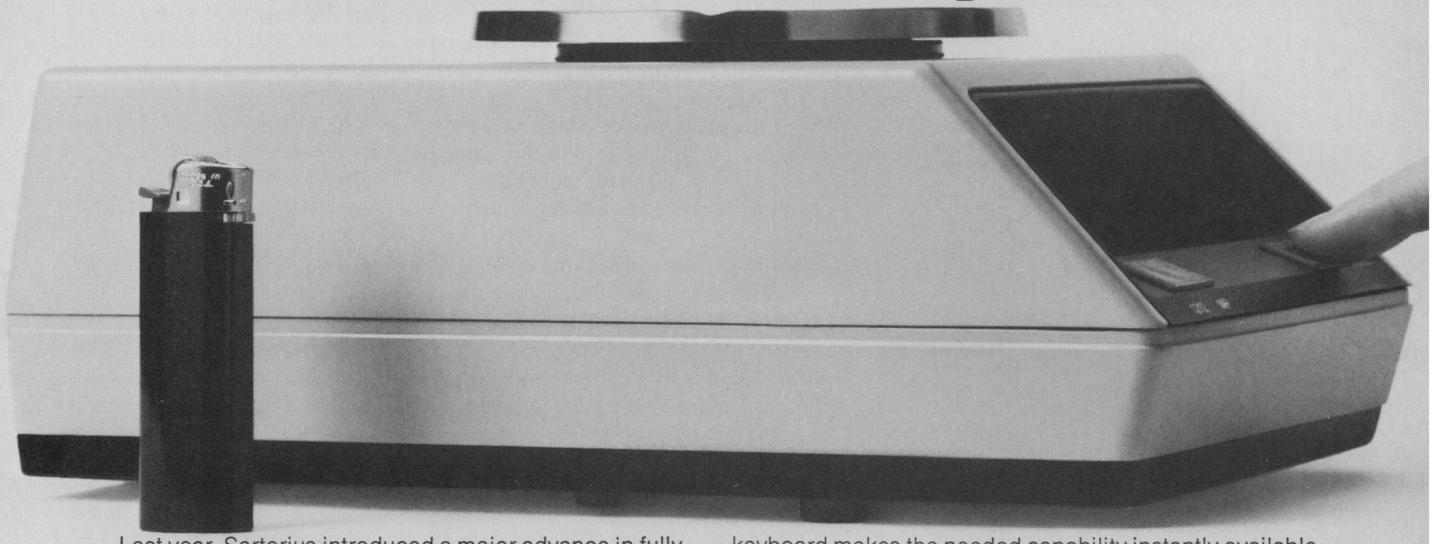
- Since costs rise very rapidly with the degree of restoration, how does one determine the optimum degree?
- Can the benefits from restoration exceed the original value of the land so as to justify these very high restoration costs?
- What would be the best social use of the funds earmarked for restoration: restoration of strip-mined land in other areas; restoration of eroded farmland; or restoration of city slums?

This discussion has broader implications—for example, to the mining of minerals on public lands and even in national parks and wilderness areas. It is well to keep in mind that while coal mining disturbs more land than other mining activities, the areas involved can be quite small. As an example, if the total U.S. coal production, 600 million tons per year, were concentrated in the deep beds of Wyoming's Powder River Basin, the amount of land disturbed would be only 10 to 20 square miles a year. This example points to the need for guidelines that can be used to decide the circumstances under which a mineral deposit is more unique and valuable than a piece of farmland or of wilderness area.—S. FRED SINGER, *Department of Environmental Sciences, University of Virginia, Charlottesville 22903*

*C. H. M. van Bavel, *Science* **197**, 213 (1977).

SARTORIUS DOES IT AGAIN!

Introducing new microprocessor-equipped electronic balances with new capabilities, new add-on data keyboards, and new low (from $1,295) prices.



Last year, Sartorius introduced a major advance in fully electronic weighing with the revolutionary Series 3700 Balances.

This year, Sartorius does it again with its new MP models. These extremely versatile electronic top-loading balances utilize Texas Instruments microprocessors to vastly expand data handling and processing capabilities.

With optional plug-in keyboards that can be added anytime, MP models can be used to convert weight data, select programs, recall information and even calculate results.

Some typical applications for these balances include: instantaneous conversion from metric to non-metric calibration (weighings in pounds, ounces, carats, grains, pennyweights, etc.), parts counting, mean weight determination, percentage weighing, and variable integration time for more precise animal weighings.

MP models also provide complete weighings in 1-2 seconds, instant electronic taring, automatic overload protection, a built-in vibration filter, data storage memory, and are available with BCD and analog outputs.

Can you afford to buy a new balance without these capabilities?

When you choose a Sartorious MP model, you have selected a balance that will be quite as advanced tomorrow as it is today. Even if you do not need all its capabilities now, the purchase of the appropriate plug-in keyboard makes the needed capability instantly available any time in the future. Only Sartorius offers this flexibility.

For all their advanced technology, Sartorius MP models, priced as low as $1,295 are significantly less expensive than many other electronic balances without such features. For literature, write: Sartorius Balances Division, Brinkmann Instruments, Inc., Cantiague Road, Westbury, N.Y. 11590.

sartorius

MODEL (Partial Listing)	1205MP	1202MP	1212MP (Dual Range)	3704	3716 (Dual Range)	3713MP (Dual Range)	3802MP
Weighing Range	0-160g	0-300g	0-30g 0-300g	0-1200g	0-120g 0-1200g	0-300g 0-3000g	0-6000g
Readability	0.001g	0.01g	0.001g 0.01g	0.01g	0.01g 0.1g	0.01g 0.1g	0.1g
Price	$2295.	$1295.	$1650.	$2195.	$1995.	$2495.	$3225.

Circle No. 183 on Readers' Service Card