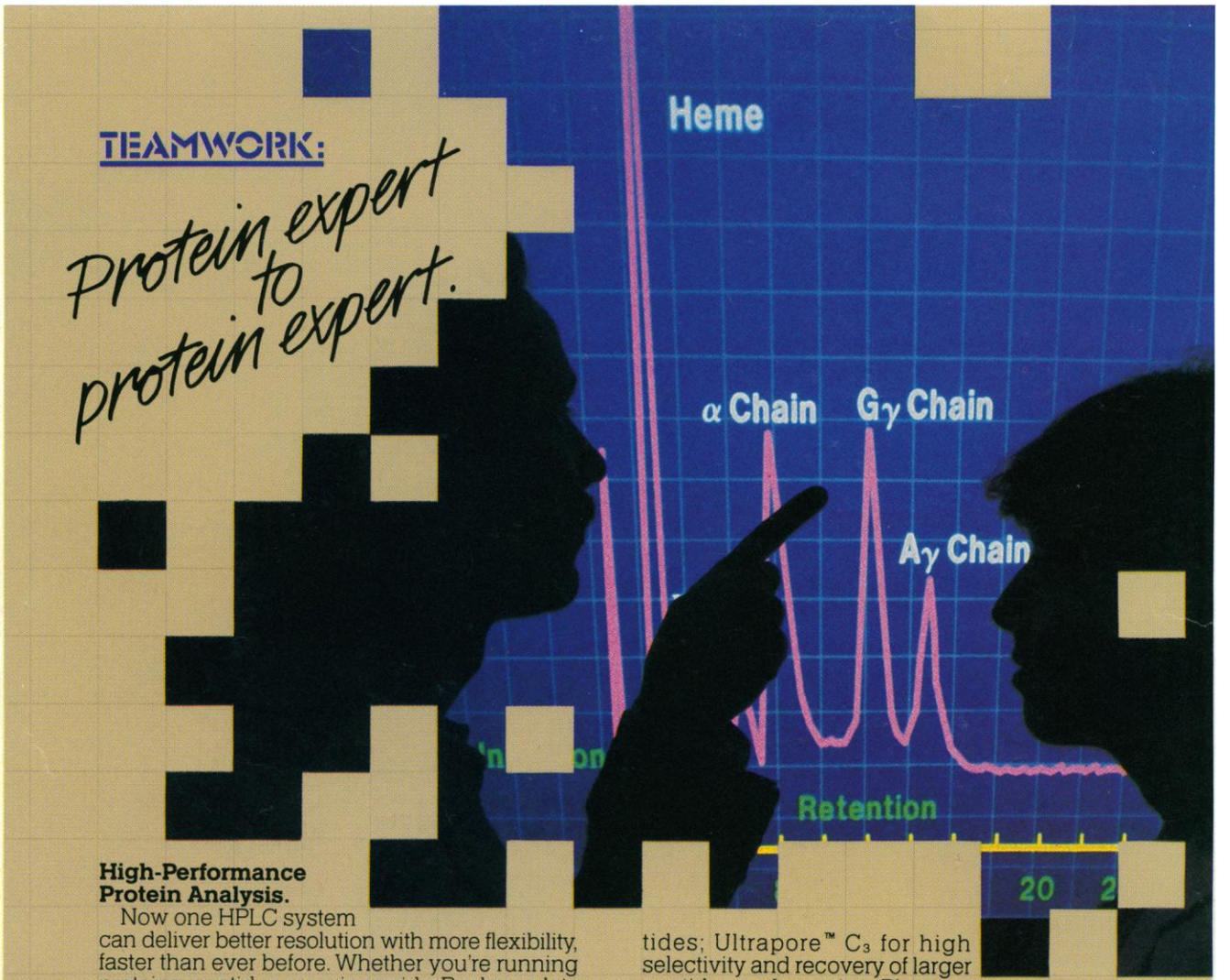
American Association for the Advancement of Science

SCIENCE

14 March 1986
Vol. 231 ■ Pages 1225–1340
$2.50

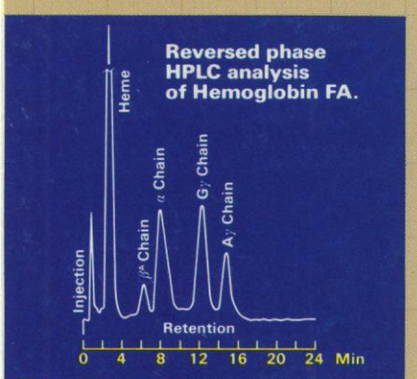


High-Performance Protein Analysis.

Now one HPLC system can deliver better resolution with more flexibility, faster than ever before. Whether you're running proteins, peptides or amino acids, Beckman lets you optimize for the precise results you want. Here's how...

Proteins: 4 methods on one flexible system.

Flexibility means being able to switch easily between reversed phase, hydrophobic interaction, ion exchange, or size exclusion chromatography. That's why our Series 340 chromatographs feature an easy-to-use programmable controller. Gradient changes are a snap! For isocratic SEC methods, our Model 114 pump assures outstanding flow control. And total flow range from 1μl - 30mL/minute for micro to semi-prep.



Peptides: Fast analysis and high recovery.

Exclusive Beckman/Altex columns for fast protein-peptide LC: Ultrasphere® C_{18} for high efficiency and resolution of small peptides; Ultrapore™ C_3 for high selectivity and recovery of larger peptides and proteins. Plus you can scale up to semi-prep with the same chemistries. 18 other chemistries. Over 100 columns in all!

Amino Acids: Versatile and economical HPLC.

Modular design means you can optimize for amino acids, too. Choose chemistries for pre- or post-column derivitization. Ion exchange or reversed phase methods. UV or fluorescence detection.

Let's Talk: One expert to another.

With 50 years of experience in the life sciences, Beckman gives you unparalleled support and expertise with our worldwide network of applications specialists, sales and service representatives. For help with bioresearch HPLC, expert-to-expert, call your local Beckman office.

In the U.S. call toll free 800/742-2345. Or write, Beckman Instruments, Inc., Altex Scientific Division, 2350 Camino Ramon, San Ramon, California 94583. Offices in major cities worldwide.

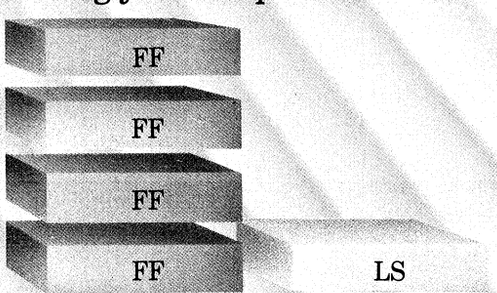
BECKMAN

See us at FASEB, Booth F41-49

Circle No. 90 on Readers' Service Card

FAST FLOWS GET FASTER

Cutting your reequilibration time



High flow rates give you faster throughputs. But a fast throughput just isn't enough to optimize your process. That's because your overall separation speed is getting dragged down by columns that take too long to re-equilibrate. And that's costing you more than you think. In time and money.

Now there's an answer. LS DEAE-Trisacryl. It lets you re-equilibrate four times faster than the leading fast flow gel. LS-Trisacryl gives you more runs and more protein per day—regardless of scale. From lab, through pilot to fullscale industrial production—four times faster. Cost-effective. Super-productive.

Proteins x 2

LS-Trisacryl doubles your bioprocessing throughput. Boosting flow rates ahead of every other fast flow gel. And with the same high binding capacity, it's the big reason why leading drug and biotech producers are already switching to LS. LS is Large Scale. Matrix engineered for the chemistry and strength you need. Hard. Inert. Synthetic. Meeting the daily demands of industrial use for the shortest separation time ever. With DEAE, CM and SP groups for ion exchange and GF 05 for industrial desalting.

Buy a liter and see for yourself

LS-Trisacryl delivers fast results. We can prove them. So can you. Just get your first liter and test this new gel under your own conditions. But you may be surprised. You're likely to get much better results than those we've claimed. Just put us to the test and place your first order today. You'll gain more than you think.

BIOTIC FUTURES THROUGH BIOTECHNOLOGY

LKB
BROMMA

LKB-Produkter AB, Box 305, S-161 26 Bromma, Sweden.
Tel. +46(8)98 00 40, telex 10492

Antwerp (03) 218 93 35 · **Athens-Middle East** +30 (1) 894 73 96 · **Copenhagen** (01) 29 50 44
Hongkong (852) 5-555555 · **London** (01) 657 88 22 · **Lucerne** (041) 57 44 57 · **Madras** (044) 45 28 74
Moscow (095) 255-6984 · **Munich** (089) 85 830 · **Paris** (01) 64.46.36.36 · **Rome** (06) 39 90 33
Stockholm (08) 98 00 40 · **Tokyo** (03) 293-5141 · **Turku** (021) 678 111 · **Vienna** +43 (222) 92 16 07
Washington (301) 963 3200 · **Zoetermeer** (079) 31 92 01
Over 60 qualified representatives throughout the world.

LS-Trisacryl is developed and manufactured by IBF Pointet-Girard (Rhône Poulenc Group) IBF

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

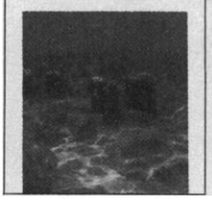
SCIENCE

ISSN 0036-8075
14 MARCH 1986
VOLUME 231
NUMBER 4743

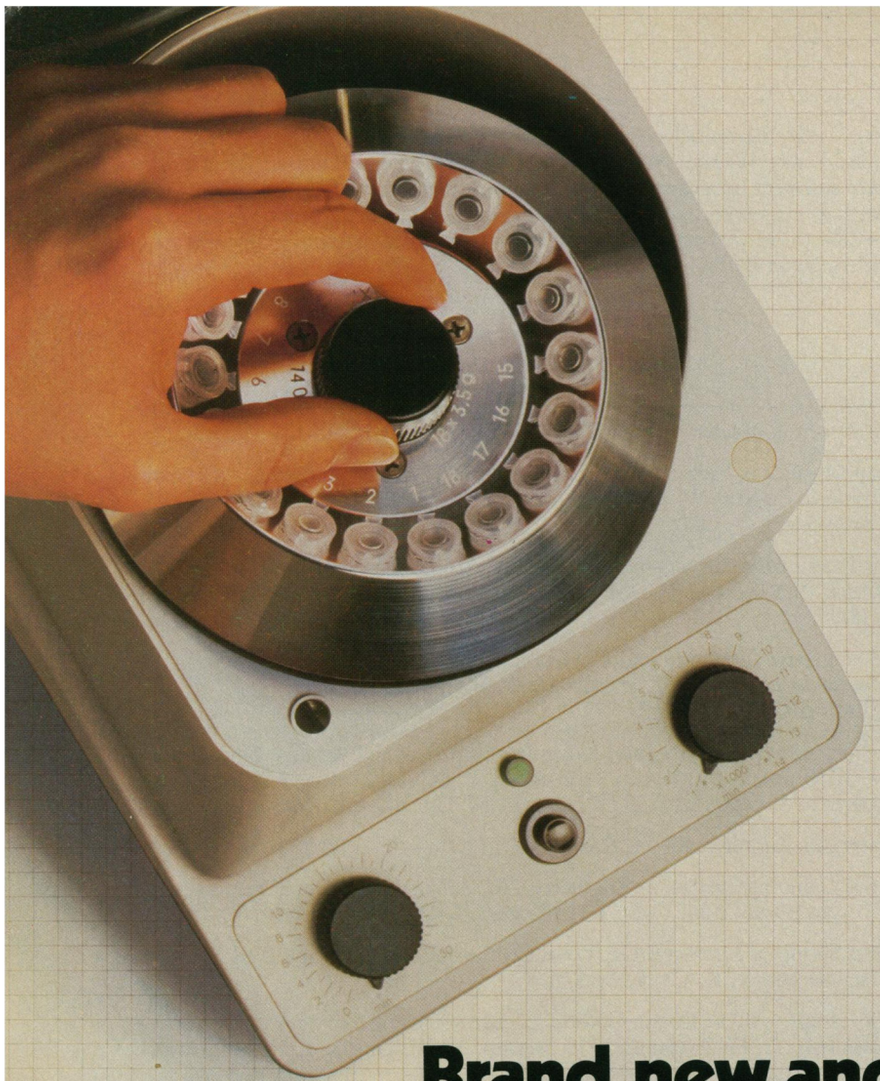
■ **SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005.** Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Now combined with **The Scientific Monthly®** Copyright © 1986 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): $60. Domestic institutional subscription (51 issues): $98. Foreign postage extra: Canada $24, other (surface mail) $27, air-surface via Amsterdam $65. First class, airmail, school-year, and student rates on request. Single copies $2.50 ($3 by mail); back issues $4 ($4.50 by mail); Biotechnology issue, $5.50 ($6 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of $1 per copy plus $0.10 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 $1 + .10. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

■ 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.

SCIENCE



COVER Heliotropically oriented subtidal columnar stromatolites in Hamelin Pool, Shark Bay, Western Australia. These stromatolites, forming in about 2 meters of water and built by a diatom-dominated microbial community, are inclined toward the north as evidenced by the inclined sunlight rays in the slightly turbid water. See page 1279. [S. M. Awramik, Department of Geological Sciences, University of California, Santa Barbara 93106]



The new Eppendorf Micro Centrifuge.

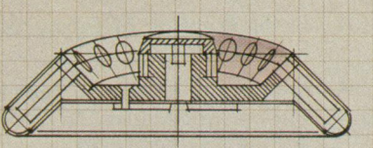
With 50% higher capacity, variable speed, quieter operation, and quick-release rotor.

Brand new and turning 18.

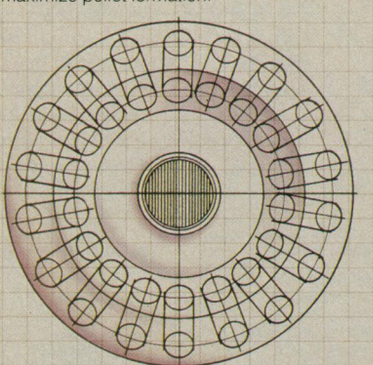
Higher capacity...plus.
The new *18-place* Model 5415 Micro Centrifuge gives you important operating advantages—with unique Eppendorf quality.

Versatile in use.
Model 5415 has a variable-speed motor that reaches a maximum of 14,000 rpm with an RCF of 16,000 x g; a 30-minute timer; and a momentary button for short spins. It accepts 1.5 mL, 500 µL, 400 µL, and 250 µL Eppendorf Microcentrifuge Tubes and blood collection microtubes, such as B-D Microtainer*Tubes.

New rotor design.
The enclosed rotor design reduces air turbulence for quieter operation. And the new quick-release feature lets you transport the rotor *with* tubes—especially convenient when the centrifuge is run in a cold room.



Enclosed rotor design reduces air turbulence and noise. Tubes are angled precisely at 45° to maximize pellet formation.



Quick-release feature allows the 18-position rotor to be easily transported even when loaded.

*Microtainer® Tubes is a registered trademark of Becton Dickinson and Company.

Safe and rugged.
The Eppendorf 5415 Micro Centrifuge is UL listed for safety. It's so rugged that an accidentally unbalanced load won't cause excessive vibration or motor damage. For more information or a demonstration, call or write: Brinkmann Instruments Co., Division of Sybron Corporation, Cantiague Road, Westbury, NY 11590, Tel: 800-645-3050; in New York, 516-334-7500. In Canada: 50 Galaxy Blvd., Rexdale, Ontario M9W 4Y5, Tel: 416-675-7911.

Specifications

Maximum speed	14,000 rpm
Maximum RCF	16,000 x g
Test-tube capacity	18
Time required for maximum speed	10 sec
Time required to stop	12 sec
Dimensions (L x W x H)	28 x 21 x 28.5 cm

eppendorf

Shaping the future. **Brinkmann** INSTRUMENTS CO.

BRK-5280

For literature circle reader service number 50
For a demonstration circle reader service number 51

Pest management

THE production and widespread use of insecticides is not sufficient to control insect pests, because insects develop resistance to these compounds more readily than scientists can synthesize new ones (page 1255). In the last 40 years, only four major classes of pesticides have been developed—chlorinated hydrocarbons, organophosphates, carbamates, and photostable pyrethroids—and these have generally been used heavy-handedly without regard for ensuring their continued effectiveness over the long term. Hundreds of insecticide-resistant strains of agricultural pests have emerged from natural populations treated with pesticides. Brattsten *et al.* advocate an integrated pest management strategy in which insecticide use will be balanced with basic studies of how biological and environmental factors contribute to the development of resistance so that means may be discovered for avoiding or overcoming the problems of resistance.

Topography of Venus

PLANET Venus' highest mountain, Maxwell Montes, and the surrounding region have been mapped in fine detail by radar imagers and altimeters carried on two Russian spacecraft, Venera 15 and Venera 16 (page 1271). The Venera spacecraft orbited 1,000 to 65,000 kilometers above the surface of the planet for 8 months in 1983 and 1984; radar sensors recorded surface features through the dense carbon dioxide atmosphere. Signals sent back to Earth were processed into topographic maps and charts and are described by Alexandrov *et al.* Maxwell Montes, discovered in 1978, is situated on the continent Ishtar in Venus' northern hemisphere. At its peak, the mountain rises more than 11 kilometers above the surface east of the continent's central plain, Lakshmi. A large circular crater, Cleopatra Patera, on the western slope contains a second, smaller, circular crater. Folds fringing the Cleopatra Patera region appear to be covered by volcanic or meteoritic materials, and numerous cone-shaped structures to the south appear to be volcanic in origin. Venus orbits closer to Earth than other planets and is about the same size as Earth. Venus may have experienced an early evolution similar to that of Earth, since geologic analyses show comparable structures on these two terrestrial planets.

Scant ant chromosomes

THE law of parsimony, a basic tenet of biology, has been met by the genetic system of a group of *Myrmecia pilosula* worker ants (page 1278). Nicknamed "bulldog" ants because of their stings and vicious attacks on adversaries (usually termites), these ants carry all the genetic material they need on a single pair of chromosomes. Despite their warlike, carnivorous behavior, they are "social" ants, living communally. The discovery of a colony of social insects with such a low chromosome number is unexpected, because social organisms typically have higher chromosome numbers than do their phylogenetic "sibling" relatives living solitary lives. Crosland and Crozier collected the unusual ants in a nature reserve near Canberra, Australia, and found that individual cells contained either a single chromosome (cells from males) or a single chromosome pair (cells from worker females). The economy of the ants' genetic system will be of obvious interest and value in genetic studies.

Stromatolites and sunlight

MICROORGANISMS requiring sunlight for growth and metabolism can construct stromatolites (cover)—domes, columns, cones, pillars, and tufts of organic and sedimentary material matted into layers—that orient toward the sun (page 1279). Living at fluid-sediment boundaries, the blue-green algae, diatoms, and flexibacteria that build stromatolites can trap and bind and precipitate sediments that are flowing by. Awramik and Vanyo found that if winds or currents are not strongly influencing the growth of a stromatolite, orientation toward the sun can be quite marked. A number of modern stromatolites growing in hot springs in Yellowstone National Park and in the intertidal and subtidal waters of Hamelin Pool in Western Australia oriented toward the sun, with those in the Northern Hemisphere (Yellowstone) inclining southward and those in the Southern Hemisphere (Australia) inclining northward. A number of fossil stromatolites, formed by the activities of ancient microorganisms, also have shown heliotropism. Records retained in the laminae of fossil stromatolites provide paleontologic data that constrain geophysical models describing the past relations of Earth with the sun and the moon.

Anaplasmosis vaccine

EACH year, 50,000 to 100,000 cattle in the United States die of anaplasmosis, a rickettsial disease characterized by severe anemia, weight loss, abortion, and death (page 1299). A vaccine against the infectious agent that causes anaplasmosis is now under development by Palmer *et al.*, who isolated an immunogenic protein from the surface of the disease pathogen, *Anaplasma marginale*. Immunization with a subunit of the protein protected cows from doses of *A. marginale* that caused disease in unprotected animals. The subunit is a component common to numerous isolates of the pathogen from distant regions of the United States and abroad and thus has the potential to provide cross-protection against infection by related strains. These experiments open the way for production of large amounts of the immunogenic subunit by cloning techniques and constitute a step toward curbing a major infectious disease of cattle. Prevalent in tropical and subtropical regions, anaplasmosis has a significant economic impact in Western and Third World countries.

THE LIGHT OF DISCOVERY

MICROPHOT

Now the most advanced, integrated and versatile instrument for research light microscopy...The Nikon Microphot. So advanced it will enhance the very process of discovery itself.

Available in two models, the Microphot FX has a built-in camera, while the Microphot may be equipped with any camera from Nikon's FX system.

The Microphot FX microscope uses a microprocessor and software program to provide flawless, automatic photography. Features include binocular focusing for photography with *moveable* 1% spot metering or 30% averaging. FX direct-projection provides fast shutter speeds, maximum metering sensitivity, and reduced glare and flare.

Both the Microphot FX and Microphot allow you to perform *all* viewing and analytical techniques in transmitted and reflected light...with a single instrument. You have the option of multiple functions simultaneously—photomicrography, image analysis, CCTV, microspectrophotometry.

Discover the Microphot FX and Microphot for yourself. Contact Nikon Inc., Instrument Group, 623 Stewart Avenue, Garden City, New York 11530. (516) 222-0200.

Nikon
Extending Man's Vision

For information circle reader service number 52
For a demonstration circle reader service number 53

SCIENCE

14 MARCH 1986
VOLUME 231
NUMBER 4743

Greenhouse Role of Trace Gases

Atmospheric scientists are emphasizing the role of trace gases as important factors in a future substantial global increase in temperature.* They estimate that, in 1980, trace gases contributed more than half as much to a greenhouse effect as did increased carbon dioxide.

From 1880 to 1980, CO_2 increased from about 275 parts per million (ppm) to 339 ppm. The principal relevant trace gases in 1980 were CH_4, 1.6 ppm; N_2O, 0.3 ppm; CCl_2F_2, 0.00028 ppm; CCl_3F, 0.00018 ppm; and O_3, which increased in the troposphere substantially over earlier values.

The key to effectiveness of the trace gases lies in their infrared absorption characteristics. They are transparent to most of the incoming solar radiation, but effective in absorbing outgoing earth radiation in the wavelength range 8 to 12 micrometers. That is the window through which a substantial fraction of the earth's heat ordinarily escapes. The earth's blackbody radiation is at a maximum in that wavelength region, and water is less effective as an absorber in that part of the spectrum.

Methane (CH_4) is at present the most effective greenhouse trace gas. Its concentration has been increasing about 1 percent per year since 1950. The total content in the atmosphere is about 5000 million tons. Methane is destroyed slowly, mainly in the troposphere, by the reactive OH. Residence time for CH_4 is 5 to 10 years. This implies an annual addition of at least 500 million tons to hold the level constant. Growth of 1 percent per year requires an extra addition on the order of 50 million tons. Principal sources of CH_4 appear to be ruminant animals, organic-rich sediments, and rice paddies. A complicating factor in estimating trends in CH_4 distribution is the competition of CO for OH. Emissions of CO have been increasing, and they destroy OH that otherwise might react with CH_4.

For a long time, nitrous oxide (N_2O) has been present in the atmosphere in substantially its current concentration. It has a residence time greater than 100 years. It is increasing at about 0.2 percent per year, with microbial interactions with fertilizers in soils and combustion of nitrogen-rich fuel likely sources. Destruction by stratospheric photolysis is the only known removal process. The contribution of N_2O to the greenhouse effect is about one-sixth that of CH_4.

The chlorofluorocarbons CCl_2F_2 and CCl_3F (freons) came into major use in the 1960's. Global emissions of them actually declined from the mid-1970's through 1982, but their long residence time, 120 years and 70 years, respectively, leads to a continuing buildup. In 1980, their contributions to a greenhouse effect were, respectively, one-third and one-fifth that of CH_4. Another halocarbon that could become important is $C_2H_3Cl_3$, which is used as a solvent. It has a residence time of about 10 years, and its concentration has been increasing at the rate of 8 percent per year. Much of the CCl_4 that has been produced is now in the atmosphere—mixing ratio 0.00013 ppm (about 3.6 million tons). Residence time of the chemical is 25 to 50 years. However, it does not absorb in the important region of the spectrum. Two other commercially significant halocarbons, C_2HCl_3 and C_2Cl_4, have short residence times and have thus no consequential greenhouse effects.

Climate modelers have great computational power at their disposal, but the atmospheric system is complex. Thus, estimates of a warming corresponding to the equivalent of a doubling of CO_2 have a range of 1.5° to 4.5°C. In addition, there is uncertainty about the timing of a warming. No one can be sure of the natural lag time in the response of the earth's physical and biological systems. Heat transfer from the oceanic surface waters to deeper waters could determine the rate at which the earth's climate equilibrates to a new energy budget. The other unpredictable is the behavior of humans. Experience tells us that extrapolation from the present is not a good guide to the long-term future. However, humans are increasing the concentrations of greenhouse gases, and ultimately major effects are likely to be manifest.—PHILIP H. ABELSON

*This editorial is based on testimony by Ralph J. Cicerone, director of the Atmospheric Chemistry Division, National Center for Atmospheric Research, Boulder, CO, before the Senate subcommittee on toxic substances and environmental oversight on 10 December 1985.

OLYMPUS®

The Image of Quality

BH2-MDO: the most advanced multi-viewing system.

The quality of any microscope relies on the interrelationship of its optical performance, its mechanical capability and the component system...accessories and attachments...that increases its capabilities to grow with your needs. That is the Olympus advantage!

A major achievement of the BH-2 Series is the BH2-MDO Multiple Viewing System. Now, as many as 10 observers can simultaneously view and study a single specimen, with precisely the same orientation, magnification, field of view and illumination brightness.

Superior Olympus optics and special coatings make possible this much needed tool for medical, scientific, educational and industrial applications. In fact, a moveable illuminated pointer visible by all viewers and controlled at the central BH-2 microscope, appears in green or orange for maximum contrast with any specimen stain. This permits easier and clearer discussion and study.

To see a demonstration of BH-2 multiple viewing, for two to ten flexibly-positioned stations, phone toll-free 1(800) 446-5967. Or write for literature: Olympus Corporation, Precision Instrument Division, 4 Nevada Drive, Lake Success, NY 11042-1179.
In Canada: W. Carsen Co., Ltd., Ontario.

OLYMPUS

For literature circle reader service number 1
For a demonstration circle reader service number 2

was divided into four occupational zones. The one next to the new Polish territory was assigned to Russia and is still occupied by Russian troops. It was named East Germany. Geographically speaking, it represents the central part of the old German Reich with the capital of Berlin as its center. The Russian czars had little, if any, influence on the German population next to the Russian border. They certainly had none on the population of what is now East Germany.

After having been under Turkish domination, Hungary was liberated by the Habsburg dynasty, and from the beginning of the 18th century it remained under Habsburg control. There surfaced, however, some Magyar opposition. It flared up in the Revolution of 1848 which led to the short-lived Hungarian Republic. Russian and Austrian troops subdued it. In 1867 Hungary became a constitutional kingdom in union with Austria. The Austro-Hungarian dual monarchy was an acknowledgment of Hungarian parity with Austria. Under those circumstances there were few opportunities for the czars to exert their influence and to prepare Hungary for Russian domination.

Finally, the concept of Russia's growing influence, first under the czars, and then under Soviet domination until, finally, effective control was reached, does not coincide with the historical record. It is important to realize that there was a lapse of a generation between the end of the czars (1917) and the beginning of Soviet rule in Eastern Europe in 1945. Furthermore, effective control was obtained only by military occupation.

ERNEST W. VOLKMANN
Rural Delivery 5,
Post Office Box 226S,
Ligonier, PA 15658

Response: In reply to Rochester, the original Rand monograph on which my article was based included estimates of the U.S. costs corresponding to the costs of the Soviet empire. In brief, the corresponding costs for the U.S. "empire" as a share of the U.S. gross national product were one-third those of the Soviet Union when its empire costs were calculated in dollars—and one-eighth when the Soviet empire costs were calculated in rubles—for the 1971–1980 period. For the single year 1980, the corresponding U.S. costs were approximately $11 billion compared with $41 billion and 42 billion rubles for the Soviet Union. Rochester's suggestion about including a cost-benefit coefficient for each type of U.S. and Soviet empire expenditure is an interesting idea, although it would be difficult to translate into practice.

In reply to Dudley, by defining the terms "empire" and "imperialism" as I did, I sought to give them as precise and nonpejorative meanings as possible, to the extent that these quite ambiguous terms and concepts permitted. If one reads historical literature on, for example, the Roman, Ottoman, and British empires of the past, one finds that the terminology is usually much less precise than what I used in the *Science* article.

I would not take issue with Volkmann's review of the history of Soviet relations with Eastern Europe. Moreover, nothing in my article conflicts with his assertion that Soviet control in Eastern Europe was obtained by military occupation.

CHARLES WOLF, JR.
Rand Graduate Institute,
Rand Corporation,
Post Office Box 2138,
Santa Monica, CA 90406-2138

AIDS and Female Circumcision

Uli Linke's letter (17 Jan., p. 203) about AIDS in Africa suggests that contact with blood during intercourse may be an indirect consequence of the African practice of female circumcision. It then describes an extreme and rare form of female circumcision—infibulation. Infibulation is found only in a part of northeastern Africa (*1*), outside the region where AIDS has been reported, and is very different in its social and biological effects from the kind of female circumcision that is practiced more widely in Africa.

A secondary problem with the logic of hypothesizing that AIDS is transmitted by a traditional custom is that in Africa it appears to be primarily an urban disease, as it is in the United States. Traditional customs, such as female circumcision, have their origins in the rural sector. I think it would be more productive to look at data pertaining to life in African cities and to examine such phenomena as male labor migration, often described as being disruptive to marriage and family life.

MIKE BURTON
Department of Anthropology,
University of California,
Irvine 92717

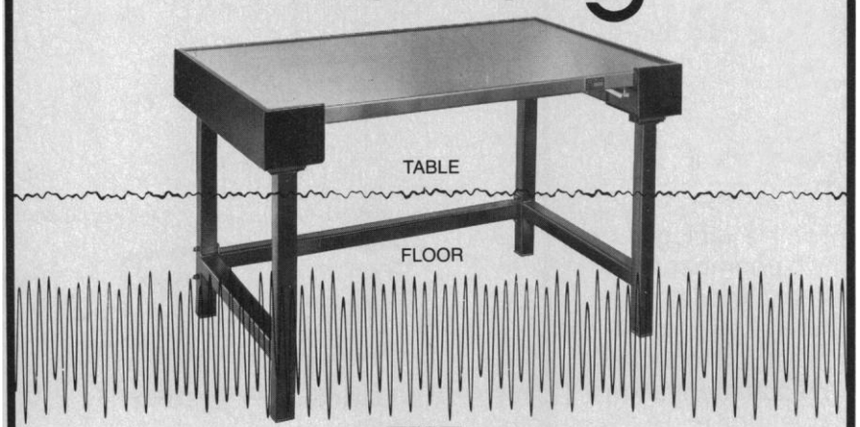
REFERENCES

1. R. O. Hayes, *Am. Ethnol.* **2**, 617 (1975).

An air operated, self-leveling Micro-g table provides maximum isolation throughout its long, trouble-free life. Performance is virtually unaffected by time; Micro-g construction practically eliminates problems due to aging and wear. Patented TMC Gimbal Piston provides approximately equal attenuation of both vertical and horizontal vibration. Series 61 Lab Tables and Series 63 Dual-Post Tables are standard in sizes from 30″ x 30″ to 36″ x 48″. Special accessories such as padded arm rests, sliding shelves, high-performance honeycomb top, etc. are available. SEND FOR FREE CATALOG.

vibration isolation systems.

MICRO-g®



TMC

Technical Manufacturing Corporation

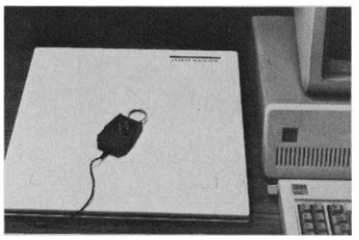
15 Centennial Drive, Peabody, Massachusetts 01960 • Telephone: 617-532-6330 • Telex: 951408

TMC-12R

Circle No. 64 on Readers' Service Card

AUTOMATE MEASUREMENT ON YOUR IBM PC

NEW



New digitizing tablet with Sigma-Scan™ measurement software. $1195

Cat #3011 — 12″ x 12″ system

Resolution of .025 mm, accuracy of at least .25 mm. Comes with state-of-the-art software for area, linear, perimeter, length of curvy line, and angular measurements. X, Y point or stream digitizing. Descriptive statistics. Transfer data to other programs in standard ASCII or DIF format.

This and other new Microcomputer Tools for the Scientist. Call or write today for FREE catalog.

JANDEL SCIENTIFIC

2656 Bridgeway, Sausalito, CA 94965
800-874-1888
(In Calif. call 415-331-3022)

Circle No. 12 on Readers' Service Card

FROM 1.5 ML TO . . .

The Maxi-Mix II offers variable speed mixing efficiency plus the flexibility to accommodate mixing 1.5 ml tubes up to volumetric flasks.

- Interchangeable mixing surfaces: 3 1/2″ rubber pad and conventional single tube cup
- Speed control from 100 RPM to 3000 RPM
- Two mode operation: pressure touch or continuous operation

Available through your local lab distributor or contact:

Thermolyne

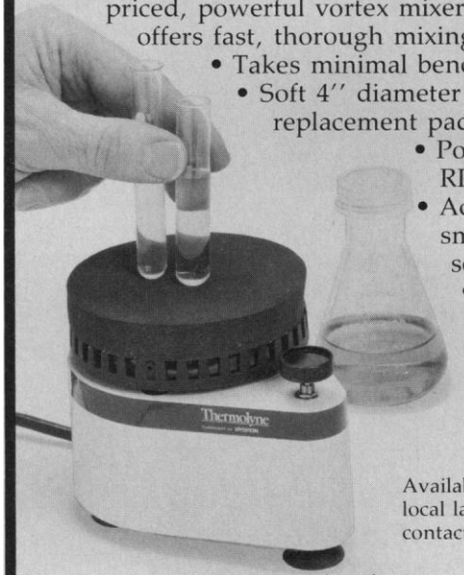
SUBSIDIARY OF
SYBRON

2555 Kerper Blvd. • Dubuque, IA 52001 • (319) 556-2241 • (800) 553-0039

Circle No. 77 on Readers' Service Card

MAXI-MIX I NOW JUST $133.00

Thermolyne's Maxi-Mix I is an economically priced, powerful vortex mixer that offers fast, thorough mixing action.



- Takes minimal bench space
- Soft 4″ diameter top and replacement pad
- Powerful 3000 RPM motor
- Accommodates small flasks or several tubes
- Top mounted on/off switch

Available through your local lab distributor or contact:

Thermolyne

SUBSIDIARY OF
SYBRON

2555 Kerper Blvd. • Dubuque, IA 52001 • (319) 556-2241 • (800) 553-0039

Circle No. 78 on Readers' Service Card

AAAS Annual Meeting

Philadelphia, 25–30 May 1986

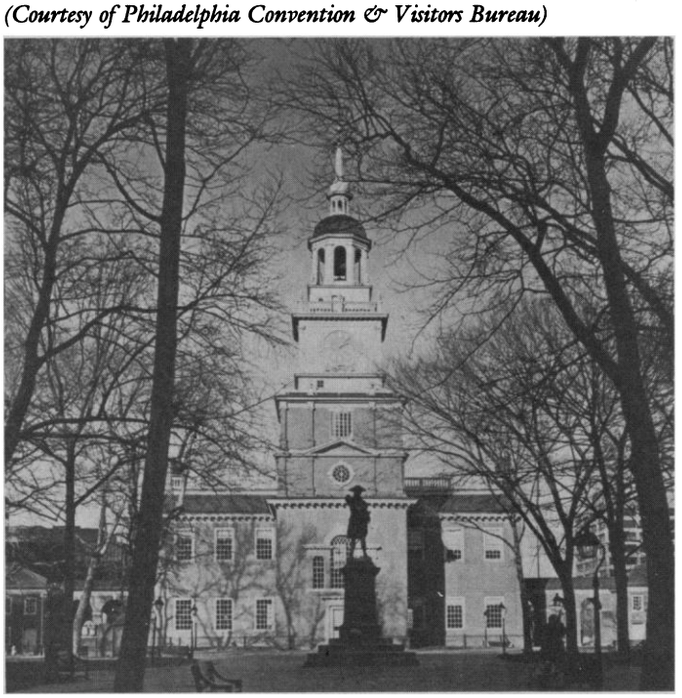
Tours

THE PHILADELPHIA ADVISORY COMMITTEE TO THE AAAS Annual Meeting is pleased to offer 15 tours organized especially for registrants. These tours are only a sampling of the many scientific and cultural institutions located in and around the City of Brotherly Love. We at AAAS are delighted to join our Philadelphia hosts in inviting you to visit as many of these exciting sights and places as possible.

1. **Philadelphia Museum of Art**. Sunday, 25 May, 11:45 am–2:15 pm (Limit: 48 persons)

The Philadelphia Museum of Art, America's third largest museum, with 10 acres of gallery space, is itself the finest example of Greco-Roman architecture in the country. The tour will concentrate on "Science and the Arts." The mutual concern of artists and scientists for understanding man and nature has often led them in similar directions in efforts to unravel the mysteries of life. This tour of the museum's collections will draw upon images created by artists over several centuries, ranging from Peter Paul Rubens to Thomas Eakins and Constantin Brancusi. After the guided tour, you will have one hour to explore the rest of the museum before returning to the hotel.

(Courtesy of Philadelphia Convention & Visitors Bureau)



2. **Fairmount Park Mansions**. Sunday, 25 May, 1:00 pm–4:00 pm (Limit: 48 persons)

Bus tour down the Benjamin Franklin Parkway—the Champs Elysees of Philadelphia—passing Logan Circle, the Franklin Institute, and the Academy of Natural Sciences. Then on to Fairmount Park, the world's largest municipal park, which contains many sculptures including Remington's "The Cowboy." You will then take a private tour of two of the restored Fairmount Park Mansions, returning via Kelly Drive, home of historic Boathouse Row.

3. **Morris Arboretum of the University of Pennsylvania**. Monday, 26 May, 1:00 pm–4:00 pm (Limit: 40 persons)

Located on the northwestern edge of Philadelphia, the Morris Arboretum comprises 175 acres of landscaped grounds, botanical laboratories, and a one-of-a-kind Victorian fernery. The visit, hosted by Arboretum director Dr. William M. Klein, will include highlights of a collection noted for its many mature specimens of Asian trees in a Victorian garden setting. Rhododendron bloom should be at its peak, together with native magnolias, American yellowwood, white fringe tree, and Chinese dogwood. Research programs, including ongoing work on the flora of Pennsylvania, will be described by staff members of the Willaman Botanical Laboratories.

4. **Walking Tour of Historic Philadelphia**. Monday, 26 May, 1:00 pm–4:00 pm (Limit: 96 persons)

Step back 200 years with knowledgeable guides for a delightful look at our past: Touch the Liberty Bell, see Independence Hall, Congress Hall, and State House Yard. Go past the Second Bank along cobblestoned Library Walk to Dolley Todd's House, an 18th-century garden, Carpenters' Hall, a "barrow" street, Franklin's Court, and picturesque Society Hill with its restored homes, "busybodies," 18th-century carriage steps, gardens, hidden walkways, and more.

5. **University of Delaware** (Newark). Tuesday, 27 May, 8:00 am–4:30 pm (Limit: 40 persons)

After a coffee reception, the tour starts with the Center of Catalytic Science and Technology, a research center specializing in single crystal surfaces, well-defined supported metals, supported metal and metal-oxide clusters, catalytic hydroprocessing, and spectroscopic methods for catalyst characterization. Next is the Center for Composite Materials, a national engineering research center for composite manufacturing science and engineering. After a complimentary lunch, the tour continues at the Institute of Energy Conversion, one of the world's largest thin-film solar-cell R&D laboratories.

6. **The Franklin Institute Science Museum**. Tuesday, 27 May, 1:00 pm–5:00 pm (Limit: 100 persons)

The Franklin Institute Science Museum explores a variety of topics including mechanics, aviation, shipbuilding, astronomy, earth sciences, optics, and mathematics. It includes the Fels Planetarium, a computerized state-of-the-art facility. This tour, conducted by Daniel L. Goldwater, Director of Exhibits and Chief Scientist, will focus on the museum's newest permanent exhibit: "Electricity and Electronics," which integrates historic artifacts and reconstructions with new technologies, such as a music synthesizer and a robot-controlled videocamera. Meet your tour guides at the 17th Street entrance of the Franklin Plaza Hotel for the walk around Logan Circle to the Franklin Institute.

7. **University of Pennsylvania**. Tuesday, 27 May, 2:00 pm–5:00 pm (Limit: 20 persons)

The University of Pennsylvania's data network and information services provide residence halls and campus, Philadelphia homes, and local area networks with services ranging from library catalog and literature search through departmental microcomputer labs to national networks and scientific computing facilities. The presentation will cover the architecture costs, progress, and the considerations that went into decisions in these areas.

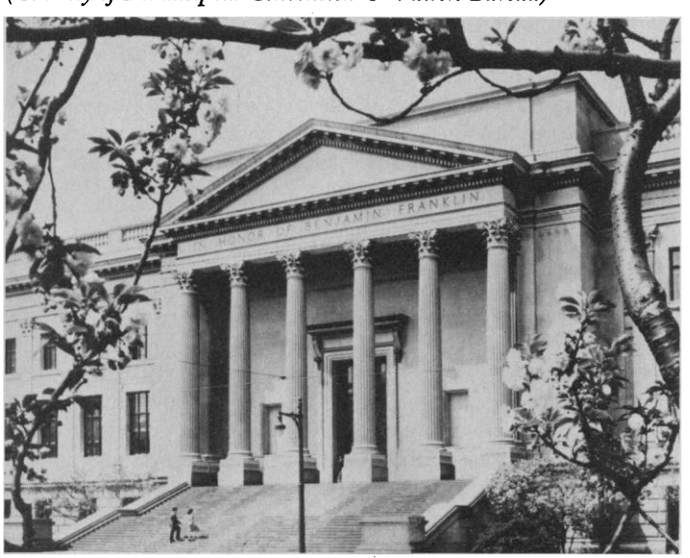
8. **E. I. du Pont de Nemours & Co.** (Wilmington, Delaware). Wednesday, 28 May, 9:00 am–2:30 pm (Limit: 48 persons)

The tour of the du Pont Company's Experimental Station will include demonstrations and exhibits selected from current work in polymers, molecular biology, medical diagnostics, chemical synthesis, electronic materials, computer science, and engineering. This site is the company's main research location; cameras are not permitted. Complimentary lunch provided by du Pont.

9. **Rohm & Haas Company** (Spring House, Pennsylvania). Wednesday, 28 May, 9:30 am–2:30 pm (Limit: 36 persons)

The Rohm & Haas complex encompasses 10 modern buildings on a 140-acre site 20 miles north of Philadelphia. Demonstrations include the modern engine test facility, sophisticated capabilities for detecting and analyzing trace quantities of chemicals in terms of parts per trillion, and research in agricultural and coatings resins. Complimentary lunch provided by Rohm & Haas. **Note**: For this tour, registrants must submit in advance the name, address, and citizenship of each person for whom a ticket is purchased. Proof of identity is required on entering the facility; foreign nationals must show passports. Cameras are not permitted.

(Courtesy of Philadelphia Convention & Visitors Bureau)



10. **Fox Chase Cancer Center**. Wednesday, 28 May, 1:00 pm–4:45 pm (Limit: 20 persons)

The Fox Chase Cancer Center, located on a 47-acre campus in Northeast Philadelphia, was formed in 1974 from the union of the American Oncologic Hospital and The Institute for Cancer Research. You will visit the research, administrative, and patient care facilities, including the Center's new nuclear magnetic resonance facility which houses the most powerful magnet commercially available.

11. **Smith Kline & French Laboratories** (Upper Merion, Pennsylvania). Thursday, 29 May, 8:30 am–12:30 pm (Limit: 96 persons)

Smith Kline & French Laboratories, the pharmaceutical division of SmithKline Beckman Corporation, will conduct tours of its new R&D facilities. Come meet outstanding men and women in science and learn about SK&F's programs, which are targeted at major therapeutic areas in gastroenterology, immunology, and cardiovascular, respiratory, anti-infectives, and anticancer research. A complimentary lunch will be provided. Cameras are not permitted.

12. **The Wistar Institute**. Thursday, 29 May, 2:00 pm–4:00 pm (Limit: 48 persons)

The oldest independent biomedical research organization in the nation, the Institute is famous for its contributions in aging, cancer, rabies, multiple sclerosis, and the relationship between diet and degenerative diseases. The theme of the program is "Fundamental Research in Cell and Molecular Biology." After welcoming remarks, the visitors will tour laboratories staffed by Institute scientists. Complimentary refreshments will be served.

13. **Candlelight Stroll**. Thursday, 29 May, 7:30 pm–9:00 pm (Limit: 48 persons)

Relive Colonial days in picturesque Society Hill in the historic area of Philadelphia. Costumed guides recreate the customs and lifestyles of this old neighborhood of restored townhouses, 18th-century carriage steps, hidden walkways and courtyards, private gardens, historic churches, and more. You may return to the hotel in your bus at 9:00 pm or stay to enjoy the Headhouse Square activities and return on your own.

14. **DNA Plant Technology Corporation** (Cinnaminson, New Jersey). Friday, 30 May, 8:30 am–11:30 am (Limit: 30 persons)

A slide presentation describing biotechnology research will be followed by a tour of the research facility. The tour, featuring numerous laboratories and an extensive greenhouse complex including a state-of-the-art tropical greenhouse, will be of special significance to those interested in plant genetics and tissue culture. Cameras are not permitted.

15. Philadelphia Electric Company. Friday, 30 May, 1:45 pm–4:15 pm (Limit: 48 persons)

The Philadelphia Electric System Control Center is the operating center for PECO's high-voltage transmission and generation network. A computer system known as SAMAC (system automatic monitor and control) provides information display and analysis needed by the system operators. Two large Burroughs computers scan 42 remote terminals located throughout the P.E. system to obtain real-time system data. Live data is displayed on 37 color CRT monitors and is available to system analysis programs, the results of which are used to make the minute-to-minute operating decisions required for a large metropolitan utility. The SAMAC system is one of the outstanding engineering achievements of its time.

Tour Tickets Order Form

AAAS Annual Meeting ◆ Philadelphia ◆ 25–30 May 1986

Mail to: AAAS Meetings Office, Dept. R, 1333 H Street, NW, Washington, DC 20005

Name _____ Tel. No.: ( ) _____

Institution or Company _____
(If part of mailing address)

Street Address _____

City _____ State _____ Zip Code _____

For Tour 9 indicate citizenship: _____

Indicate any special requirements due to a handicap: _____

Tour No.		Ticket Price	No. of Tickets
1.	Philadelphia Museum of Art (5/25)	$ 6.00	____
*2.	Fairmount Park Mansions (5/25)	15.00	____
*3.	Morris Arboretum (5/26)	7.00	____
*4.	Walking Tour (5/26)	12.00	____
5.	Univ. of Delaware (5/27)	9.00	____
6.	Franklin Inst. Museum (5/27)	Free	____
7.	Univ. of Pennsylvania (5/27)	7.00	____
8.	E. I. du Pont de Nemours & Co. (5/28)	7.00	____
9.	Rohm & Haas Co. (5/28)	7.00	____
10.	Fox Chase Cancer Center (5/28)	7.00	____
11.	Smith Kline & French Labs. (5/29)	6.00	____
12.	The Wistar Institute (5/29)	6.00	____
*13.	Candlelight Stroll (5/29)	10.00	____
14.	DNA Plant Technol. Corp. (5/30)	9.00	____
15.	Philadelphia Electric Co. (5/30)	6.00	____

Total amount enclosed or charged $ _____

Total number of tickets ordered _____

Tours are limited to Annual Meeting registrants only. All tours depart from and return to the 17th Street entrance of the Franklin Plaza Hotel at the times indicated. Comfortable walking attire is recommended.

Tour prices include transportation costs and any admission fees. Tickets will be mailed to you in early May. Orders received **after 9 May** will be held at the AAAS Ticket Desk at the Franklin Plaza Hotel. *Please order tickets for Sunday tours early enough so that they can be mailed to you.* Refund requests must be made by letter or telegram to the AAAS Meetings Office **before 16 May** and will be honored after the Meeting. No refunds will be made on cancellations received after this date.

Handicapped registrants who need advance tour information or assistance should so indicate on the order form, or contact *Virginia Stern, AAAS Project on the Handicapped in Science, 1333 H Street, NW, Washington, DC 20005 (telephone: 202-326-6667).*

*Please note that Tours 2, 3, 4, and 13 are not fully accessible to mobility-impaired persons.

My check is enclosed. ☐

Charge to my ☐ VISA or ☐ MASTERCARD. Account No. _____ Expiration Date _____

Cardholder's Name _____ Signature _____