American Association for the Advancement of Science

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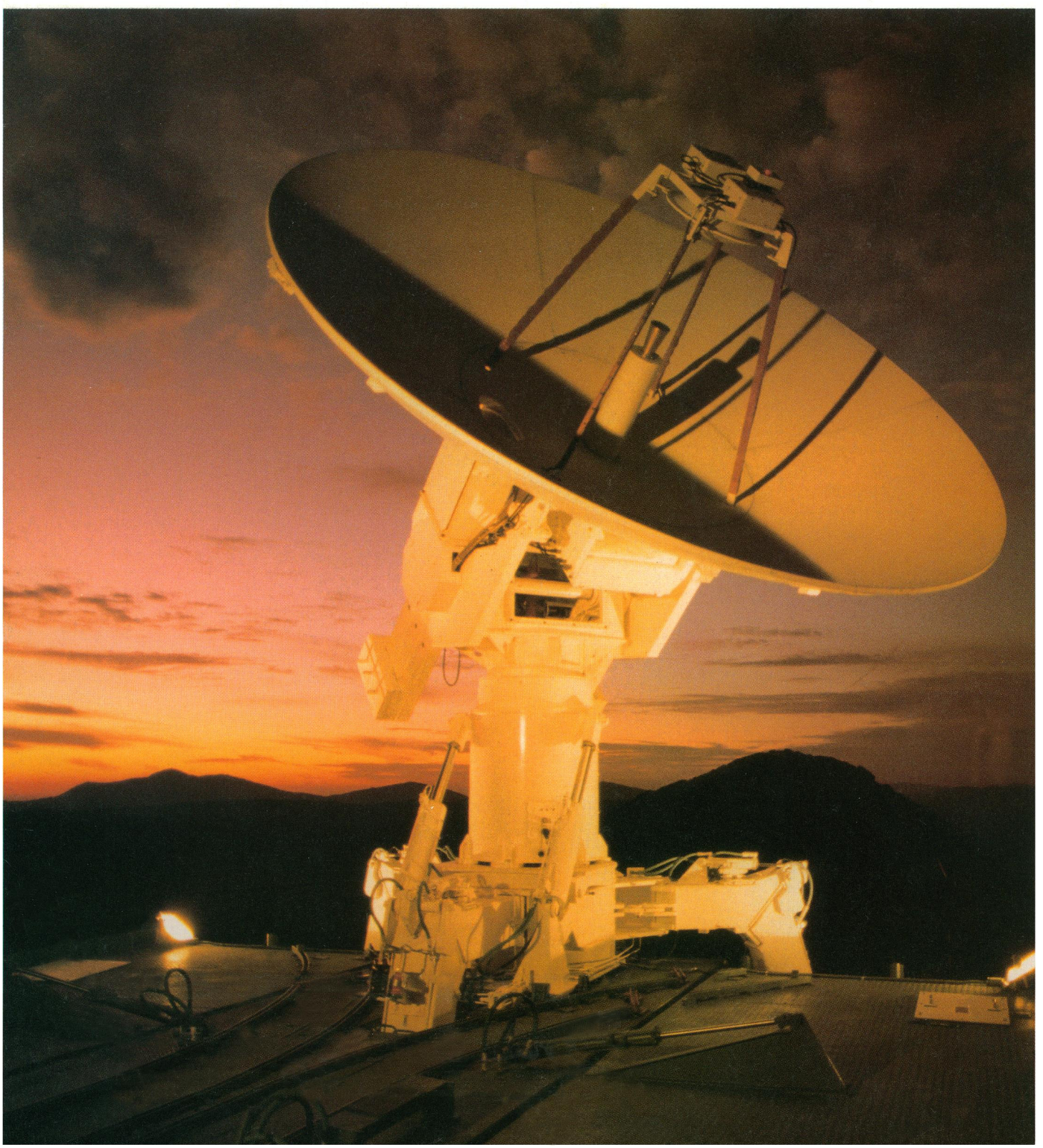

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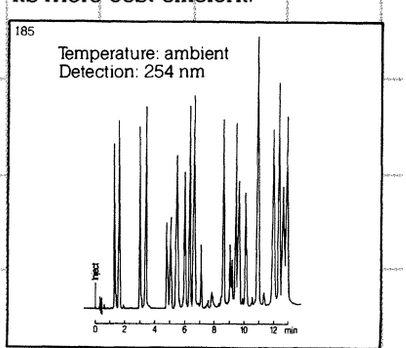

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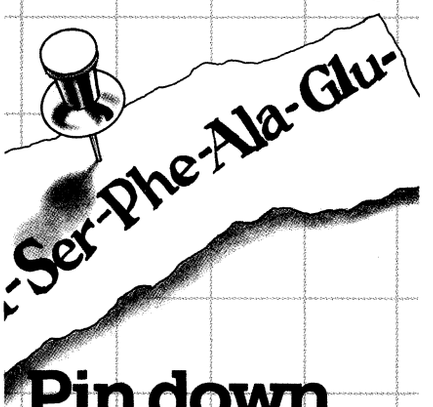

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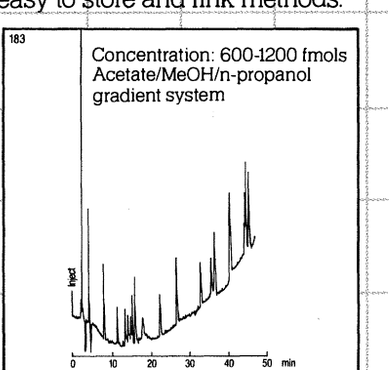

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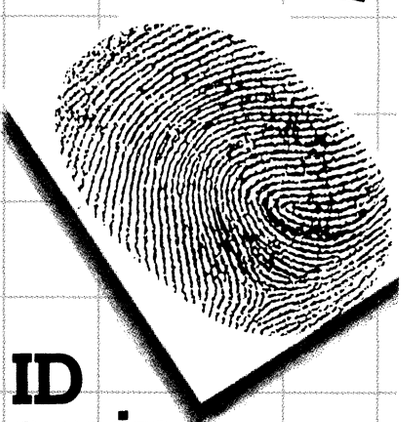

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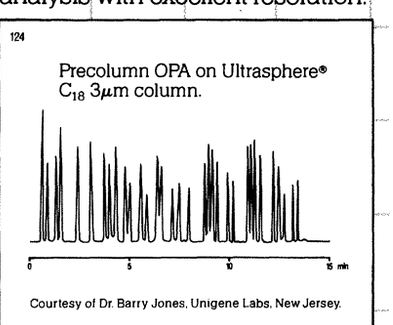

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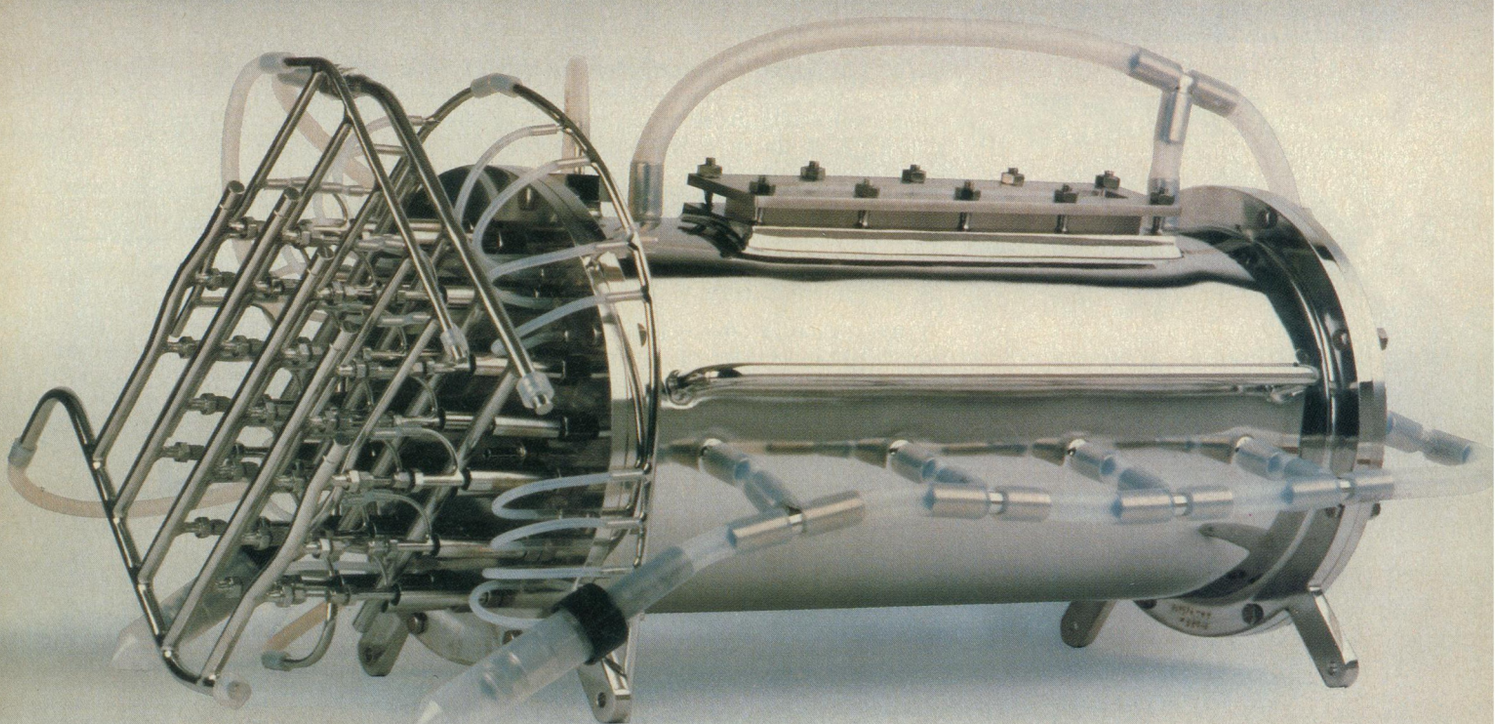

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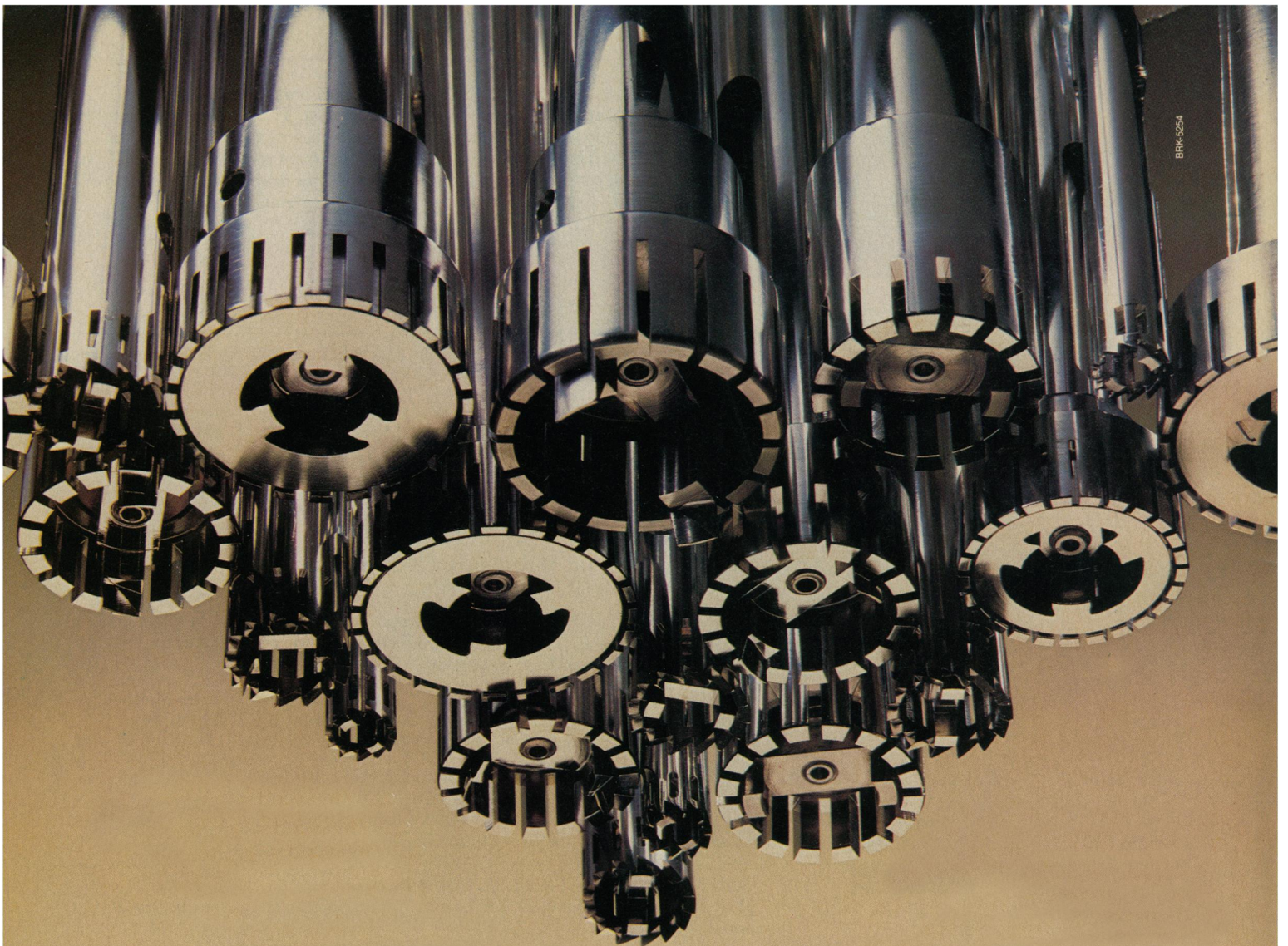

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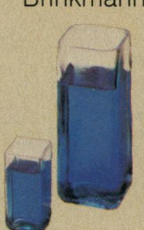

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El Niño and marine denitrification

A cold anomaly along the coast of Peru, thought to be related to the 1982–1983 El Niño, may have caused increased denitrification in the Pacific Ocean that, in turn, affected the global nitrogen balance (page 1200). Marine denitrification is mediated by bacteria; it involves conversion of combined nitrogen (nitrates, nitrites, nitrous oxide) to free nitrogen gas. It proceeds best in regions of the ocean deficient in oxygen and amply supplied with nitrates and organic matter. Codispoti *et al.* estimate that a 2 to 25% increase in total marine denitrification occurred in 1985 and speculate on its cause. Changes in ocean dynamics that were associated with El Niño and the following cold anomaly could have transported excess nutrients and fixed nitrogen to shallower regions: in the upper waters, plants grew and abundant organic matter was generated; this material sank to regions where bacterial metabolism (including denitrification) then flourished.

Fossil birds, climate, and primate evolution

ANCESTORS of humans and apes that were developing in the Fayum depression of Egypt during the Oligocene Epoch (25 to 37 million years ago) probably lived in a warm, wet, tropical swamp rich in floating vegetation, having little seasonal variability, and bounded by forests, open woodlands, and grasslands (page 1202). Bird fossils found in deposits in a region that also contains remains of the earliest known hominoid primates have provided clues to the past climate because many of the avifaunal fossils belong to families that are alive today (whereas most of the mammalian fossils are from taxa that are now extinct). Through identification of the habitat requirements (some of which are quite restricted) of contemporary birds from these families, the early climate and biologic conditions that affected the evolution of species in the past have been deduced. Olson and Rasmussen found fossils of jacanas, shoebilled storks, herons, cranes, cormorants, ospreys, eagles, and other, mostly aquatic, birds; their habitats today overlap only in Uganda north and west of Lake Victoria where the climate is warm and tropical. Today, as in the Oligocene, a number of primate species coexist with the birds in the vicinity of the swamp.

Gene transfer in β-thalassemia

SATISFACTORY treatments are not currently available for hereditary β-thalassemias, and some forms of the disease are fatal early in life (page 1192). Costantini *et al.*, using a mouse model of β-thalassemia, show that the genetic deficiency can be corrected by gene transfer into the germ line. Cloned β-globin genes (human or mouse) were injected into fertilized mouse eggs and the eggs transferred into foster mothers. Transgenic progeny could make normal β-globin chains from the foreign gene; so could their progeny. In some mice that had received the human gene, anemic signs and symptoms were completely alleviated; in others that had received the mouse gene, partial (perhaps because of the lower level of gene expression) repair of the defect and reduction of anemia were noted. While transfer of a gene into the germ line would not be appropriate for correcting thalassemias in humans (transfer into somatic cells—specifically those stem cells from which red blood cells arise—is required), these experiments demonstrate that a cloned gene can substitute for a defective gene in thalassemic red blood cells.

Mate selection in butterflies

THE mating system that has evolved among *Colias* butterflies helps perpetuate fitness within the population with regard to flight, mating, and other traits (page 1187). Males visually locate females to court by virtue of the females' colorful wing patterns. They perform flight and "wing-flicking" maneuvers, and their successful courting performance depends on the fueling of flight muscles; fueling, in turn, depends on biochemical processes involving the enzyme phosphoglucose isomerase (PGI). Females select males for mating and become more choosy as they age. They can mate several times, but the eggs they lay all have the genes of the most recent mate. Watt *et al.* found that older, more discriminating females chose males with "superior" PGI genes (for the form of the enzyme that has been associated with increased flight capacity, survivorship, and overall mating success) roughly 92% of the time; younger females on a first mating chose such males only about 71% of the time. Females exercising greater discrimination therefore get mates and produce progeny having the optimal genotype for PGI-related traits.

Beads assist in liver cell transplantation

LIVER transplantation is the only option available at present for treating patients with acute liver failure, but a strategy for transplantation of normal liver cells attached to beads, described by Demetriou *et al.*, may change the clinical prospects (page 1190). Liver cells were attached to collagen-coated dextran beads and injected into the peritoneal cavities of mutant rats that had protein deficiencies related to liver disfunctions. The transplants "took" (in contrast to transplants of liver cells without beads). Bead-delivered cells became embedded in a network of fibroblasts and connective tissue within the peritoneal cavity. Blood vessels began connecting the aggregates to the circulation, and albumin and conjugated bilirubin in bile were measurable in the previously deficient animals. The first results are extremely promising both because functions were restored and because no toxicity or inflammatory reactions were noted.

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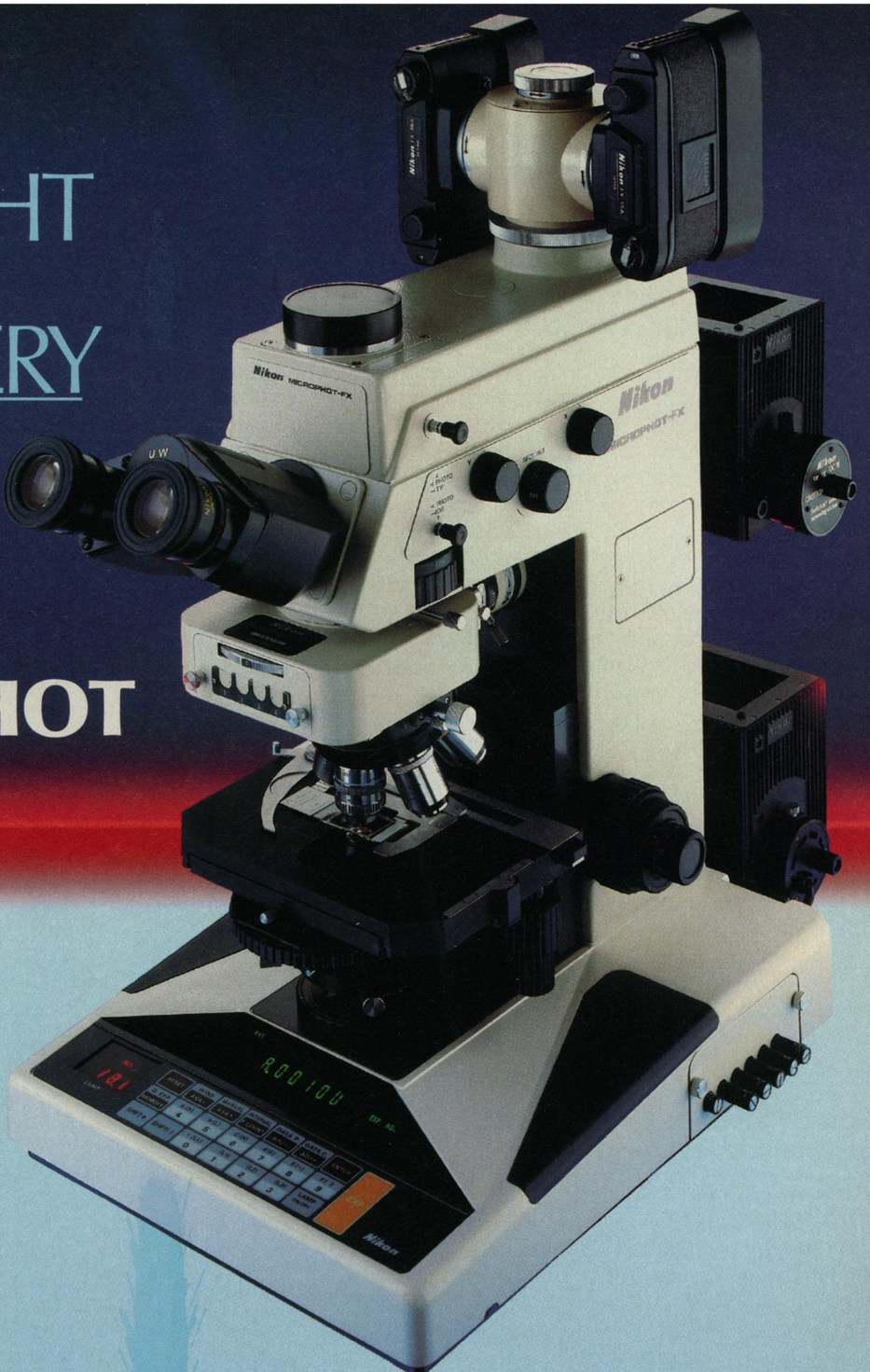

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SCIENCE

12 SEPTEMBER 1986
VOLUME 233
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A Mission in Transition

The task of enhancing public literacy where science and technology are concerned is at once compelling and uphill. Undeniably, this task needs to be approached primarily through early and intermediate education so as to build a foundation of principles and perceptions that one will carry through life in an era of growing complexity and troubling choices. But this is a large order as things now stand, and the limits to public understanding of science are large and troubling.

For 40 years AAAS has had the stated goal of increasing the public understanding of science. Among a variety of AAAS initiatives directed to that goal, two stand out. The first was the AAAS role in aiding the launching of "Nova," the prized public television program that has earned a large audience. The second was the creation in 1979 of a new magazine dedicated expressly to bridging the distance between science and the citizen, an initiative emanating from the concept of Allen Hammond, at that time editor of Research News at *Science*.

When AAAS ceased publishing *Science 86* this summer and sold its assets to Time Inc., we could reflect on both good and bad news. The good news was that *Science 86* and its predecessor editions had been a roaring editorial success beyond all expectations, with a high circulation and a fascinated cohort of readers. The bad news was a severe advertising famine, resulting in a heavy burden on AAAS's financial resources and an unacceptable exposure to indefinite adversity.

The decision to cut losses, at the expense of a magazine that was a demonstrable achievement for the public understanding of science, was acutely painful. What has been learned from our 7-year venture? On the business side of the matter, a built-in economic risk was present from the beginning because of the unpredictability of advertisers' perceptions of a science magazine as a medium for selling consumer goods. Additionally, it is plain that a nonprofit organization should have had greater discretionary resources than we did if it hoped to take on stiff competition from the profit sector of the publishing industry and to hang tough over a prolonged cycle of deficit financing.

Turning to the mission itself, the lessons are quite different. With a talented staff, AAAS demonstrated that science can be made both understandable and absorbing through the print medium. The loss of *Science 86* has been accompanied by a flood of letters from readers whose evident deprivation is keen and inconsolable. Indeed, a number of readers have offered to pay more for their subscriptions if this would resuscitate the magazine. There is a clear message here. The demand for responsible science journalism is strong, very strong. That is a highly positive sign that the well-documented problem of scientific literacy is by no means insoluble.

Now AAAS must decide how best to continue addressing its responsibility to communicate science to an avidly interested nonscientist audience. We have had good success with radio programming over the years, beginning with a public radio program called "Focus" and continuing with "Report on Science" on CBS, with an estimated listening audience of about 5 million, and perhaps our radio efforts can be scaled up. A different option would be to greatly enlarge our Mass Media Science and Engineering Fellows program that places young scientists and engineers at print and broadcast sites, a project designed to familiarize scientists with the needs of the media in reporting and commenting on scientific and technical news developments. We have, at intervals, looked longingly at the attractions of television as a medium for explaining science, but although the economics of communicating on commercial channels are discouraging, the potential of cable could be another story. And from a strategic point of view, enhancing the capabilities of the professional science reporters and writers could turn out to be an option with much promise.

The troubling outcome of our venture with a general interest science magazine has in no way deflected AAAS from its objective. The Board of Directors has begun to explore a broad range of initiatives in the arena of communication about science and its place in an informed society, and it welcomes the counsel of our members at this transition point in the association's work.—WILLIAM D. CAREY

Letters

Supercollider Funding

M. Mitchell Waldrop did a fine job of reporting issues related to the Supercollider (SSC) (Research News, 25 July, p. 420). However, he did not note the important comments on the SSC that were made in the Department of Energy (DOE) Energy Research Advisory Board (ERAB) study "Guidelines for DOE long-term civilian research and development," which was issued in December 1985 and which I chaired. ERAB looked at all DOE civilian R&D and made the following summary statements regarding the SSC:

- Increased funding of the SSC must not preempt other DOE civilian R&D priorities, as there are important, less expensive projects to fund in the near term.
- The SSC site selection contest under way may be premature.
- Because of its size, the SSC will require a national commitment, which must be based on (i) adequate research and engineering studies to support capital costs and project schedules; and (ii) international participation to defray a part of the costs. Initiation of the SSC is a basic science issue, not an energy issue.

ERAB member opinions on the SSC varied dramatically. Some felt that money for construction should be found, no matter what. At the other extreme, some members felt that the high energy physics "emperor has no clothes" and even $550 million per year for such abstract research is a national waste.

To believe that the SSC can be funded in these days of severe federal budget deficits without having an impact on other research is totally unrealistic. Available funds for research are and will continue to contract. Nevertheless, it may be in the national interest to sacrifice other research in order to move ahead with this exciting new venture.

ROBERT L. HIRSCH
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Plano, TX 75075

Biotechnology Regulation

By analogy to molecular biology's "one gene–one enzyme" hypothesis, Daniel E. Koshland, Jr., proposed recently (Editorial, 2 May, p. 561) a "one-license–one hearing" policy toward federal agencies' evaluation of new biotechnological products. Koshland correctly decried some of the regulatory and litigation-related delays and described the frustrations of industrialists and academics, but his solution is oversimplistic.

It is obvious that biotechnology is neither well circumscribed nor homogeneous, but encompasses many disciplines from molecular biology and entomology to crystallography and bioprocessing engineering. New biotechnology ranges from fish farming enhanced by recombinant DNA-derived hormones and food plants with improved protein quality to microbes programmed to produce interferon or to degrade toxic wastes. Thus, governmental oversight for ensuring that products do not compromise public health or safety cuts across the jurisdiction of many regulatory agencies. These agencies, in turn, have various statutory mandates, different agency missions, and disparate degrees of scientific expertise.

Recognizing these complexities, the Administration in 1984 formed an interagency working group under the former White House Council on Natural Resources and the Environment (now the Domestic Policy Council). The working group has sought to achieve a balance between regulation adequate to ensure health and environmental safety and flexibility sufficient to avoid impeding the implementation of the new technologies. It concluded that existing laws—perhaps with some clarification—were adequate for oversight of the new products, but that some mechanism for coordinating scientific information and regulatory philosophy would be useful. Consequently, in November 1985 the Biotechnology Science Coordinating Committee (BSCC) was formed. Its function is *not* to perform redundant reviews of individual product applications or to second-guess agency decisions but rather to ensure that there is coordination among the various agencies overseeing biotechnology product regulation and that comparable principles and rigor are employed in agency evaluations.

The agencies recently published major statements of policy on oversight of biotechnology (*1*), in which the BSCC attempted in two important ways to avoid the regulatory redundancy and delays of concern to Koshland. First, for the situations where more than one agency could share jurisdiction, a *lead* agency was identified; second, the principle was established that where there is shared jurisdiction, one agency can defer to the scientific review of another. While "one license–one hearing" could be the goal to which we aspire, there are examples where it cannot suffice; for example, the nature and extent of the review (by the Environmental Protection Agency) of an enzyme intended as a drain cleaner would of necessity be quite

different from the review [by the Food and Drug Administration (FDA)] if the same enzyme were intended for use as a thrombolytic agent administered intravenously to patients.

We are convinced that protection of human health and the environment, stimulation of industries using new biotechnology, and assurance of safety of products are mutually compatible. The FDA's record of having approved more than 150 products (including in recent weeks the first interferons and a monoclonal antibody that treats acute renal transplant rejection) that use recombinant DNA or hybridoma techniques in their manufacture is evidence of this conviction.

However, government cannot perform regulatory oversight of scientific and commercial endeavors in a vacuum. We require the advice and criticism of academics and of the public. And while we welcome such commentary as Koshland's in *Science*, there are alternatives to effecting better regulation. The most direct is to analyze and comment on the scientific assumptions in statements of policy, and we urge individual scientists and professional organizations to make the required investment in time and energy to do so. The FDA's last statement of policy on biotechnology elicited a dismal response: a mere 34 official comments. Can that really be all the interest there is in the scientific and regulatory approaches of a major regulatory agency—with responsibility for products accounting for 25 cents of every consumer dollar—to important new technologies?

In addition, public education via lectures and articles directed at nonspecialists, while less direct, is a worthy investment.

Perhaps there was appropriate but unintended irony in Koshland's metaphor of "one gene–one enzyme," which is not an invariant principle. It is now known that certain messenger RNA precursors can be spliced in alternative ways, such that a single primary messenger RNA transcript may ultimately yield two or more very different polypeptides. Likewise, "one license–one hearing" can be a useful, although not universally applicable, model.

HENRY I. MILLER
FRANK E. YOUNG
Food and Drug Administration, Rockville, MD 20857

REFERENCES

1. *Fed. Regist.* **51**, 23301 (26 June 1986).

Response: The Biotechnology Science Coordinating Committee appears to be an excellent approximation of the simplicity and responsibility that were advocated in my editorial. I do not think the lack of letters indicates lack of interest but perhaps a past experience of scientists having suggestions fall on deaf ears. Miller and Young deserve great credit for their good solution to a difficult problem and for a receptiveness that will encourage responses.

I hope that Washington bureaucracy does not get as complex as gene expression. If it does, we may have to extend the adage "Ontogeny recapitulates phylogeny" to "Sociology recapitulates enzymology."

—DANIEL E. KOSHLAND, JR.

Erratum: In the article "Mathematicians recognize major discoveries" by Gina Kolata (Research News, 15 Aug., p. 722), Fields Medal winner Michael Freedman was incorrectly described as being a member of the University of Southern California faculty. Freedman is Charles Lee Powell Professor of Mathematics at the University of California, San Diego. In addition, several names in the article were spelled incorrectly. Field's should have been Fields, Nevalinna and Navanlinna should have been Nevanlinna, Kirky should have been Kirby, Atyiyah should have been Atiyah, and Strasen should have been Strassen.

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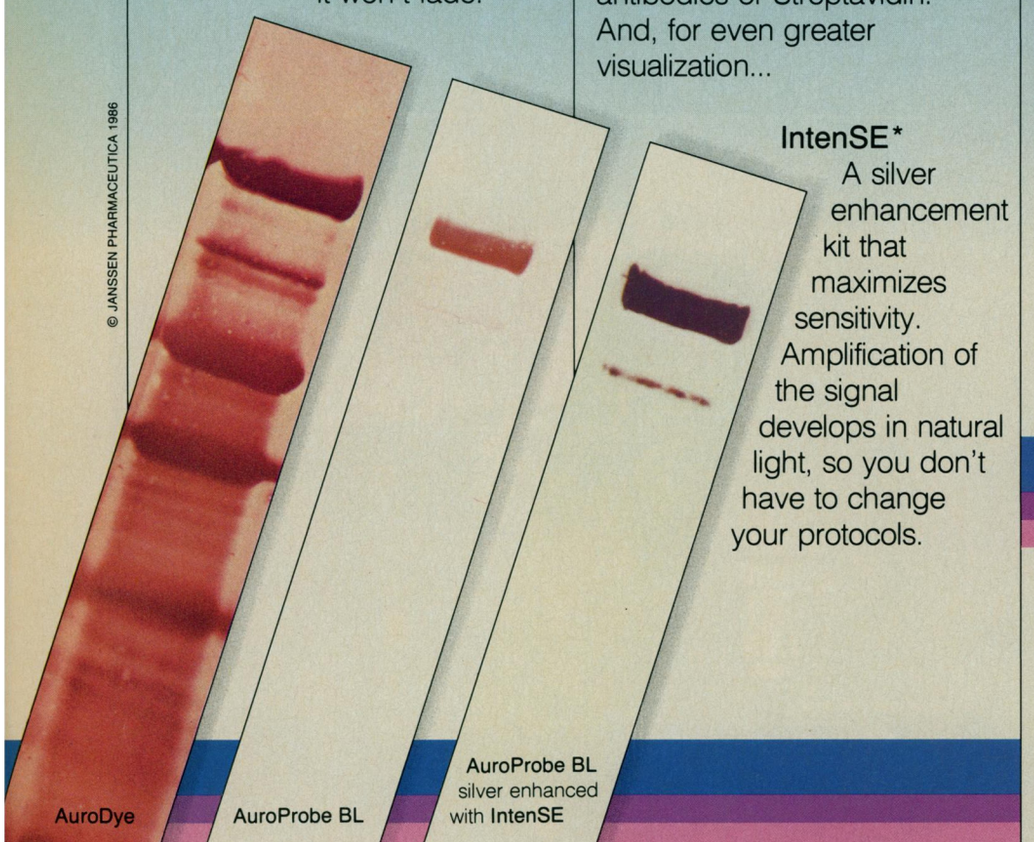

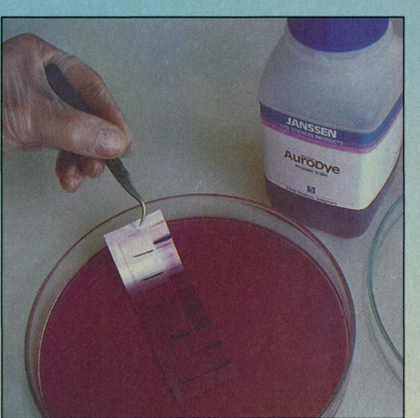

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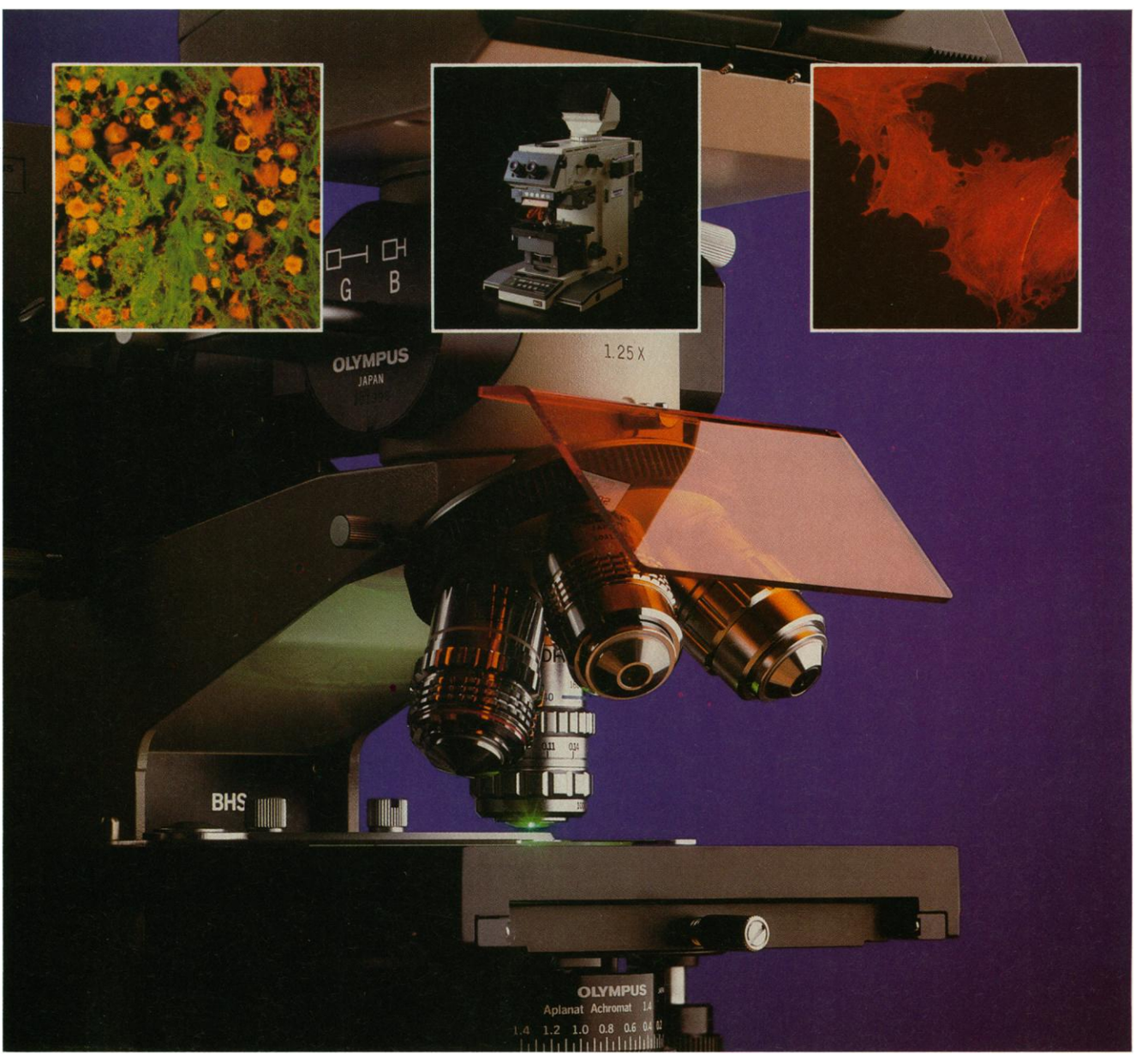

For information circle reader service number 24
For a demonstration circle reader service number 25

SCIENCE/SCOPE®

You are reading perhaps the most successful corporate advertising campaign ever, Science/Scope, which marked its 20th anniversary in September 1986. The campaign—distinguished by its editorial style of writing, newsletter format, and yellow background color—was created in September 1966 to inform readers of advances in technologies and programs at Hughes Aircraft Company. It has won scores of awards for creative excellence and for leading readership surveys in a variety of publications. The first ad reported on such technological advances as a technique for keeping a satellite stable in orbit, an infrared-guided missile, and a spacecraft instrument that could categorize the surfaces of planets. Today Science/Scope appears in approximately 80 publications worldwide and 10 languages. We thank our readers for their continued support.

Four sophisticated antennas will let Intelsat VI communications satellites concentrate signals on four major population areas on Earth. The four squareax antennas used in combination represent a multitude of technology breakthroughs made possible through advanced computer-aided design/computer-aided manufacturing (CAD/CAM) techniques. The antennas receive microwave signals from Earth and retransmit them with pinpoint precision. Without the squareax antennas, those signals would be uselessly dispersed over populated and unpopulated areas alike. Hughes designed and built the antennas and is heading a team of international aerospace companies that is building the Intelsat VI satellites.

A new process called vacuum brazing will soon help manufacture advanced radar components for U.S. fighter aircraft. Vacuum brazing forms extremely strong joints between lightweight metals, allowing engineers to design parts that previously could not be manufactured. The process involves treating parts with a special brazing alloy and a small amount of magnesium. The parts are placed inside the vacuum furnace, which normally operates at a pressure of one millionth of an atmosphere, and heated to temperatures of 1100°F. Because vacuum brazing requires no flux, it is far more economical than conventional flux dip brazing, in which components are dipped into molten salts. The process also eliminates corrosion caused by trapped or residual flux. Hughes engineers are investigating how vacuum brazing might be used to fabricate heat dissipators and other radar parts.

Helping to trim energy consumption is one major use of a hand-held infrared viewer. The device is a Hughes Probeye® viewer, which senses heat and displays images through an eyepiece. Mining officials use the device to inspect electrical systems and mechanical equipment because it detects potentially dangerous short circuits and overheating hardware. Real estate owners, developers, and appraisers use the viewer to determine the structural and thermal integrity of buildings. The unit reveals moisture spots in roofing and spots where buildings might be gaining or losing heat.

Hughes is seeking experienced engineers and scientists to further develop advanced spacecraft systems and components for communications satellites. Openings are in the fields of: software, computers, and data processing systems; electrical components; microwave/RF communication systems development; on-board spacecraft electronics and control systems; satellite design, integration, propulsion, and electrical power system development; spacecraft manufacturing, systems test and evaluation; GaAs applications R&D. Send your resume to Dan Frownfelter, Hughes Space & Communications Group, Dept. S2, S4/A300, P.O. Box 92919, Los Angeles, CA 90009. Equal opportunity employer. U.S. citizenship required.

For more information write to: P.O. Box 45068, Los Angeles, CA 90045-0068

HUGHES
AIRCRAFT COMPANY

Subsidiary of GM Hughes Electronics

Call for Contributed Papers

1987 AAAS Annual Meeting ✦ Chicago ✦ 14 – 19 February

Deadline: 10 October 1986

Plan to attend the next Annual Meeting of the AAAS in Chicago, IL, 14–19 February 1987 at the Hyatt Regency Hotel. Although it is too late to propose symposia for the 1987 Annual Meeting, contributed paper abstracts can be submitted up to 10 October 1986.

The privilege of submitting a contributed paper for a presentation at the Annual Meeting is open **only** to AAAS members and fellows. Although the member/fellow need not be one of the authors, their endorsement (indicated by his or her signature on the original abstract) is required.

There are two types of presentation formats—poster and slide:

POSTER PRESENTATION: Each contributor will be assigned to a poster session and will have a bulletin board on which to display large, easy to read text and graphics for approximately 1½ hours so that the work can be discussed with interested parties.

SLIDE PRESENTATION: Unlike papers submitted for a poster session, those sent as slide presentations will go through a second selection process. Abstracts whose subject matter closely relates to that of an accepted symposium will be chosen for a coordinated slide session. Each contributor will have approximately 10 minutes to present their work and show 2"x2" (35mm) slides or overhead transparencies. If a paper is not selected for a slide session, the contributor will be notified and given the option of presenting at a poster session or withdrawing the submission.

Instructions for Contributors

Your abstract will be reproduced directly from your copy at about two-thirds the original size. Therefore, it is very important that you follow our guidelines precisely.

- ✦ Submit a clean, easily readable original copy of your abstract on ordinary white bond paper.
- ✦ The typed abstract must fit within a 5-inch square.
- ✦ Indent, space, underline, and capitalize specifically as in the example at right.
- ✦ Use only reproducible black ink for symbols and signs which must be hand lettered.
- ✦ Use only a letter quality printer if you use a word processor.
- ✦ Do not draw a box around the abstract.
- ✦ Do not cut and paste your abstract onto another piece of paper.

At the top of the page, indicate which broad scientific discipline encompasses your subject matter. Also, provide up to 3 index words which specifically describe the area or specialty within this scientific discipline. You must specify the type of presentation you wish to give (slide or poster). As stated above, not all submissions for a slide presentation will be accepted.

At the bottom left of the page, type the full name, mailing address, and telephone number of the person to be notified regarding scheduling and other information. At the bottom right, type the name and affiliation of the AAAS member or fellow submitting the abstract leaving adequate space for their signature.

Send the original plus one copy of your abstract no later than 10 October 1986 to:

Contributed Papers
AAAS Meetings Office
1333 H Street, N.W.
Washington, DC 20005

AAAS ANNUAL MEETING IN CHICAGO (14-19 FEBRUARY 1987)
Abstract submitted for a contributed paper presentation

Scientific discipline of subject matter: _____

Specialty of this discipline (provide up to 3 index words):

_____ _____ _____

Type of presentation (indicate one): ___ POSTER ___ SLIDE

_____ *5 inches (12.7 cm)* _____

5 inches (12.7 cm)

Indent Five Spaces and Type Title in Upper and Lower Case Letters and Underline. AUTHOR'S NAME IN UPPER CASE (Institution Name in Upper and Lower Case), SECOND AUTHOR (Institution).*

Double-space and type abstract. The full width of the column of typed material should be 5 inches (12.7 cm) and must not extend beyond that. The total length of the material, from top of title to bottom of footnotes must not exceed 5 inches (12.7 cm). Abstracts which exceed these parameters will be returned. All special symbols and signs which must be hand lettered (e.g., π) should be rendered in reproducible black ink as clearly and carefully as possible. The entire submission should be of camera-ready quality so that it can be photographed, turned into a plate, and printed. The printed abstract will be about 2/3 the size of the typed version. Avoid paragraphing as this wastes space. However, you may use your allotted space to neatly letter in equations and diagrams as you deem necessary,

$$\Gamma^{\mu}_{\lambda\nu} = \frac{1}{2} g^{\mu\sigma}\left(\frac{\partial g_{\sigma\lambda}}{\partial x^{\nu}} + \frac{\partial g_{\sigma\nu}}{\partial x^{\lambda}} - \frac{\partial g_{\lambda\nu}}{\partial x^{\sigma}}\right)$$

$$R_{\mu\tau} = \frac{\partial \Gamma^{\lambda}_{\mu\lambda}}{\partial x^{\nu}} - \frac{\partial \Gamma^{\lambda}_{\mu\nu}}{\partial x^{\lambda}} + \Gamma^{\sigma}_{\mu\lambda}\Gamma^{\lambda}_{\nu\sigma} - \Gamma^{\sigma}_{\mu\nu}\Gamma^{\lambda}_{\lambda\sigma}$$

as indicated in this example.

*Double-space and type footnotes.

Person to be contacted about abstract:

Full Name
Mailing Address

Submitted by AAAS member:

Type name of member
Type affiliation of member

_____
(signature of member)