American Association for the Advancement of Science

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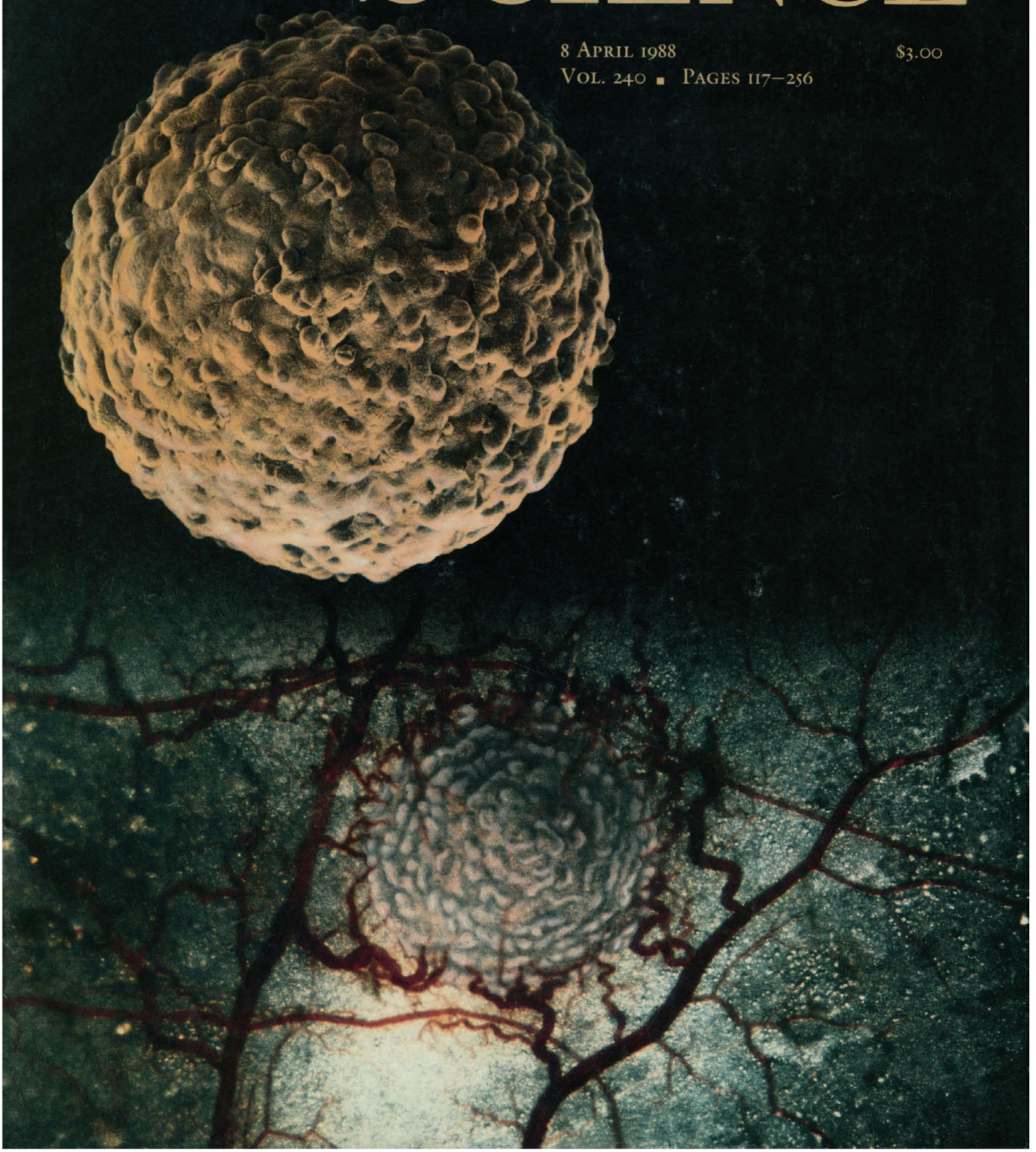
Vol. 240 ■ Pages 117–256



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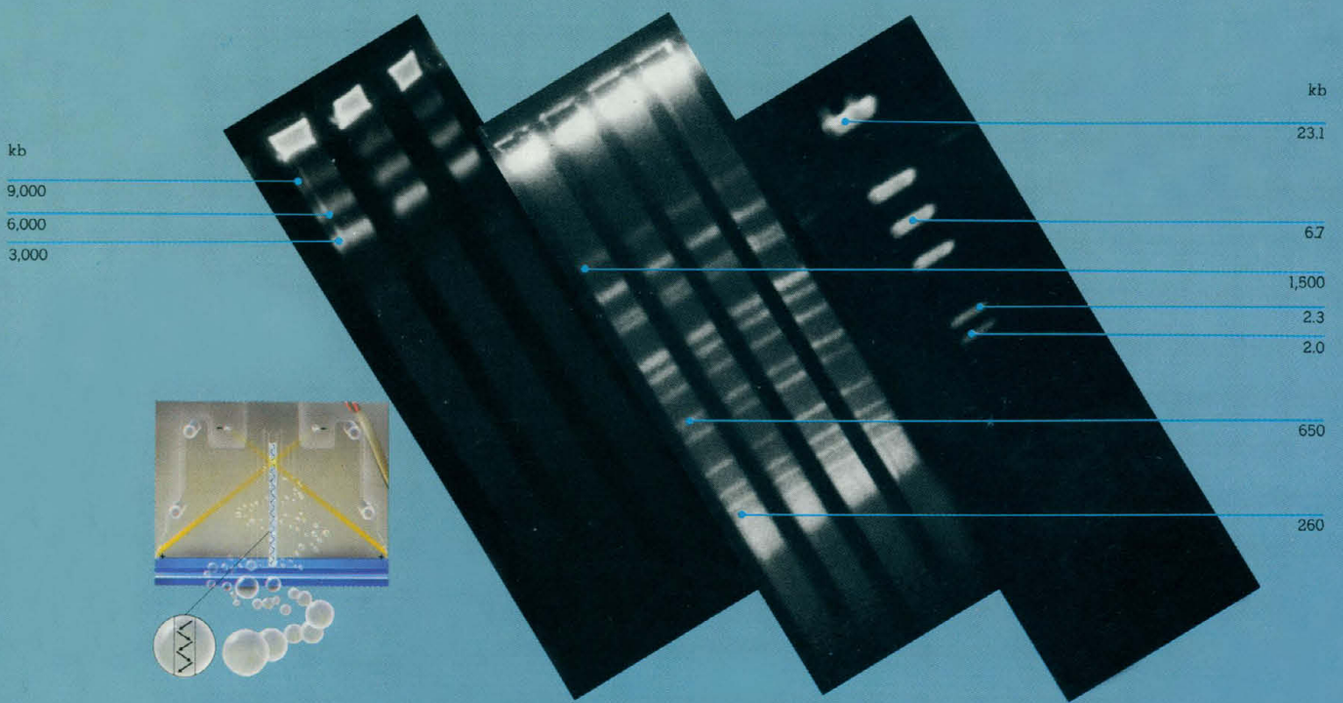

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Fig. 1. 9000 kb separation achieved using GeneLine with whole chromosomes of Schizosaccharomyces pombe.

Fig. 2. High-resolution lanes produced using GeneLine with whole chromosomes of the yeast Saccharomyces cerevisiae.

Fig. 3. Separation down to 2 kb using GeneLine with a Hind*III digest of lambda phage DNA.*

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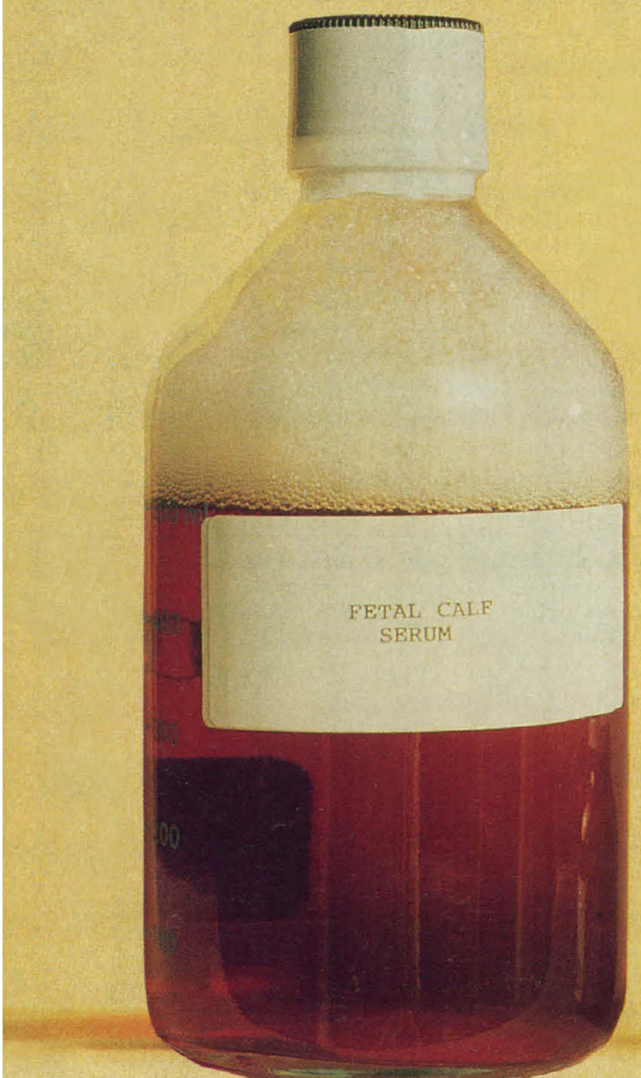

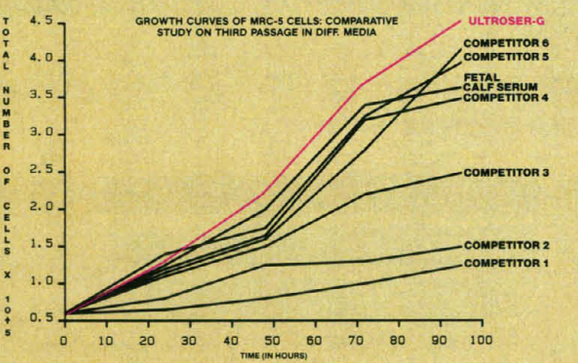

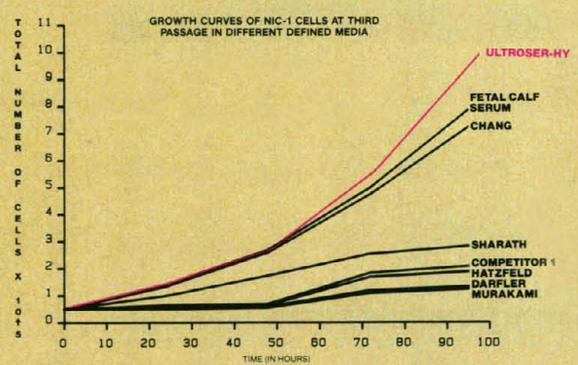

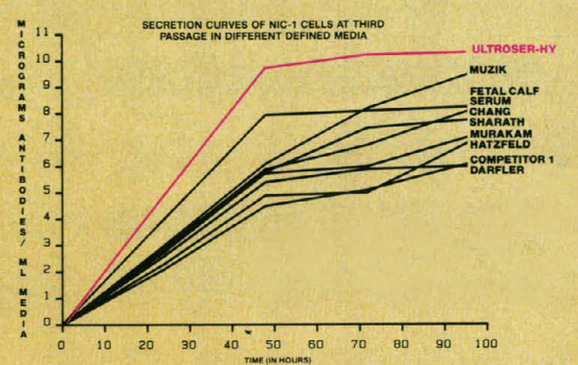

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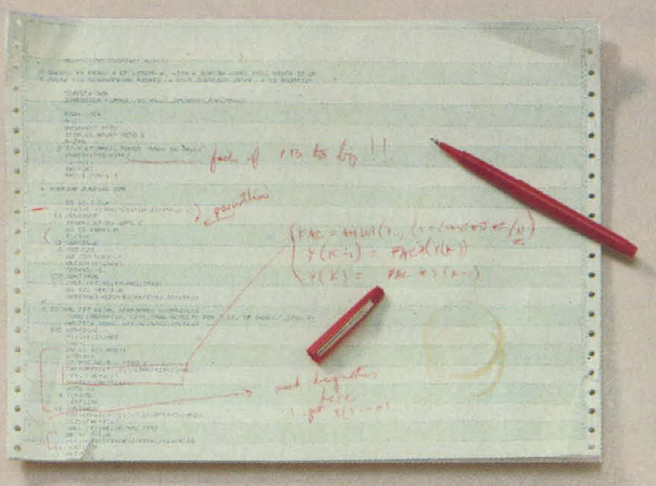
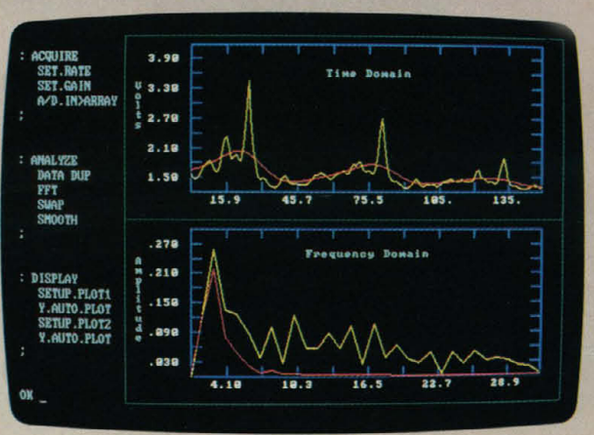
COVER A multicell spheroid human squamous cell carcinoma (top) which is used as an in vitro research model for intervascular microregions of larger, solid malignant tumors or for small tumors where vascularization may be just beginning (as shown at the bottom). Spheroid diameter is approximately 300 micrometers. See page 177. [University of Rochester Cancer Center: Harvey Carapella, art director; Shari E. Harwell, layout; Chris Santarose, airbrush artist; scanning electron microscopy in collaboration with David P. Penney and Nadia Kutyreff; vascular study in collaboration with H. A. Eddy]

Write. Right.





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Film features

How do thin liquid films flow when they are only a few molecules thick, and how do their properties compare with those of bulk liquids (page 189)? Israelachvili *et al.* report that narrowly confined liquids form discrete molecular layers and that, in a compressible lateral-sliding device, smooth surfaces shearing past each other exert a frictional force or shear stress that depends critically on the number of layers involved. Once a critical shear stress is attained, sliding begins. The viscosity of the thin film is seven orders of magnitude higher than the viscosity of the bulk fluid. With increasing thickness, the physical properties of the film resemble those of the bulk and their behavior no longer depends on "quantization" or the number of layers that had formed; for the samples studied, bulk behavior was expected to be seen when from seven to ten molecular layers separated the two surfaces. The possibility of making distinctions between properties of submicroscopic materials and those of the bulk is of both theoretical and practical interest.

Electric field x-ray scattering

THE structures of viruses, synthetic polymers, inorganic colloids, and other materials can be probed with a new scattering method described by Koch *et al.* (page 194). In the prototype experiment, tobacco mosaic virus (TMV) was used because this type of virus has been intensively studied with other methods and thus structural comparisons are possible. A strong electric field was applied to the virus solution, and the axes of the virus particles became oriented parallel to the field, forming end to end dimers. X-rays were directed at the solution and scattering patterns recorded; the relaxation curves were similar to those obtained with light sources. This adaptation of electric field scattering technology for use with x-rays should circumvent some of the problems that have been encountered with light sources: x-rays pass through and therefore are not absorbed (like light rays) by samples, and the shorter wavelength of x-rays improves the ratio of particle size to wavelength, an important relation for ensuring that scattering patterns will be representative of internal structures.

Retinoblastomas and growth factor

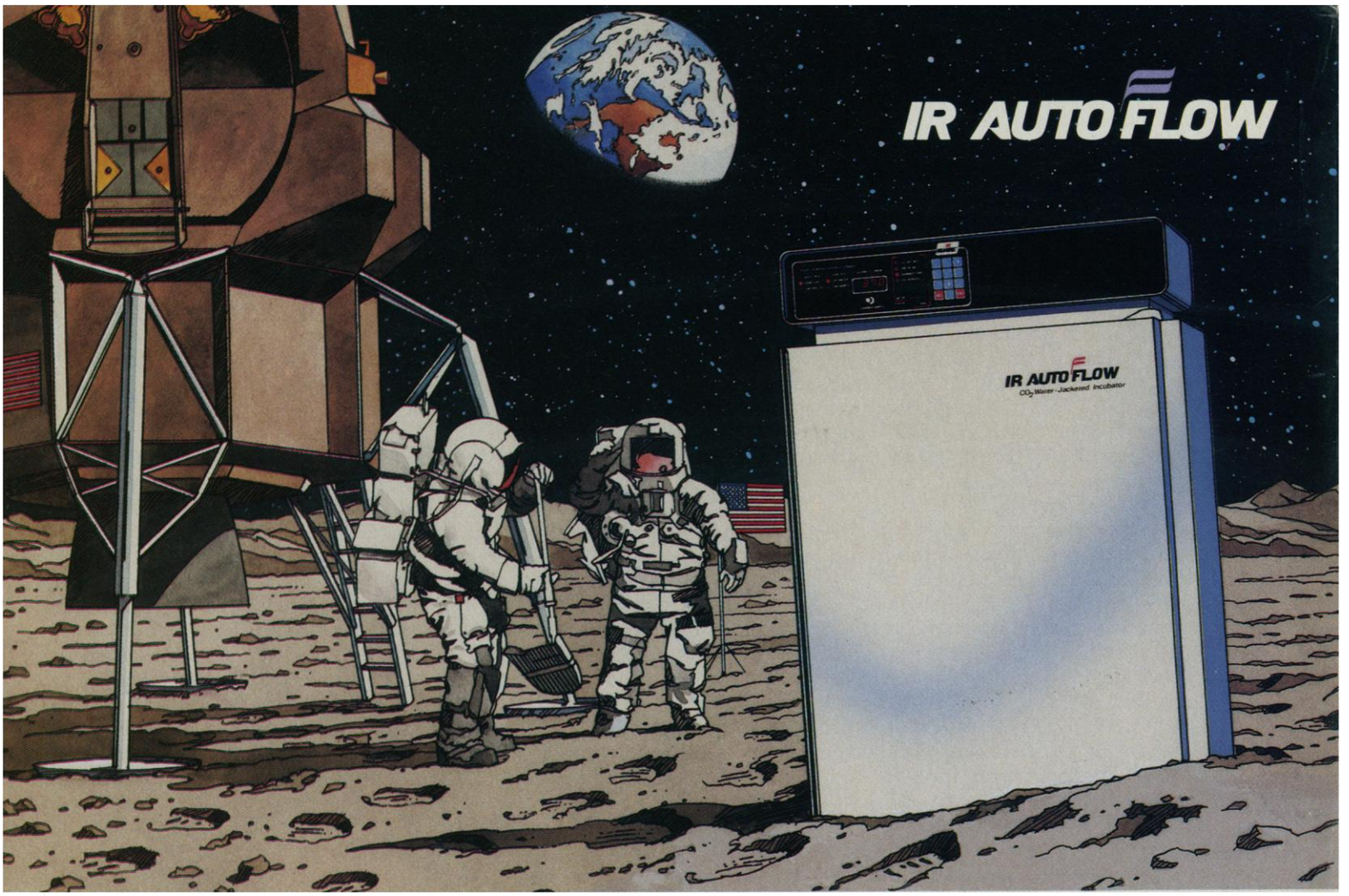
RETINOBLASTOMA cells lack detectable receptors for transforming growth factor beta (TGF-β), one of several secreted substances that restrain normal cell proliferation (page 196). Receptors for TGF-β are regularly found on normal cells and on tumor cells including those, like the retinoblastomas, that are of neuroectodermal origin. In control cells, in this case retinal cells from fetuses, treatment with TGF-β inhibited cell division. In contrast, treatment of retinoblastoma cells with TGF-β had no effect on DNA synthesis, cell division, or cell morphology. The possibility that retinoblastoma cells lacked receptors for TGF-β was confirmed with binding studies. Kimchi *et al.* propose that a TGF-β receptor deficit on retinoblastoma cells might foster tumor growth: lacking growth factor receptors, the cells are able to escape from the negative control that TGF-β would otherwise exert over their unchecked proliferation.

Beans and weevils

A naturally occurring insecticide, arcelin-1, is found in wild beans; it protects the bean seeds from the insect pests Mexican bean weevils (page 207). The gene for arcelin-1 was transferred from wild beans to cultivated bean plants, and these plants then produced seeds resistant to the weevils; artificial seeds to which purified arcelin-1 was added also were protected. Osborn *et al.* discuss how properties, activities, structures, and occurrences of arcelin-1 compare with those of phytohemagglutinin (PHA), a common plant substance that also has some antipest activities. Arcelin-1 has so far been found in no bean cultivars and in only 10% of wild bean lines; PHA is found in about 90% of wild and cultivated bean lines. DNA sequences, derived protein structures, and some biologic activities of the two are similar; in addition, the two compounds have tightly linked genes, are encoded by homologous genes, and probably are derived from a common progenitor. In mammals, PHA binds to carbohydrates in the gut and disrupts epithelial cells; it may do the same in the guts of susceptible pests. (Larvae of susceptible insects that feed on the seeds typically die at the first instar.) Arcelin, which also has carbohydrate-binding activity, might act similarly. Commercially, arcelin might be of use for transfer into plant seeds that otherwise are damaged by weevils and other arcelin-susceptible insect pests during storage.

Variations on a theme

THERE are more than 500 species of *Drosophila* on the Hawaiian islands (page 217). The extreme isolation of the Hawaiian archipelago, combined with the occasional upthrust of a new habitable island, are credited with this remarkably broad radiation from probably only one or two founder females. Hawaiian *Drosophila* have startling morphologies. In addition, their wide variability is expressed in courtship behaviors. Songs sung by male flies in the presence of females of their species were recorded for 20 of the 106 species of picture-winged *Drosophila*. Some "sang" with their wings; others vibrated abdominally. The acoustic features of the songs fit into four distinct groups: click-trains, complex pulse-trains, "purrs" (simple pulse-trains), and "hums" (simple tone songs). Hoy *et al.* suggest that novel sounds and novel mechanisms for producing Hawaiian love songs may have evolved in this isolated tropical setting; some of the tones and tunes had never before been recorded and appear to be distinctive for Hawaiian flies.



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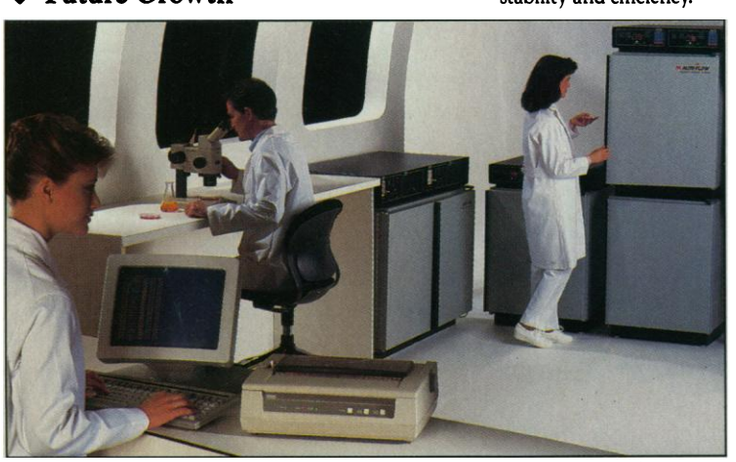

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SCIENCE

8 APRIL 1988
VOLUME 240
NUMBER 4849

The Perfect Money Management System

By now, any reader of a daily newspaper should have come to the conclusion that people are stupid, hesitant, and emotional about spending their own money, but wise, bold, and objective when spending other people's money. The second-guessers of school boards, cities, the National Institutes of Health, Congress, and even presidential candidates are supremely confident that they can handle matters far better than those to whom the funds are entrusted. A sound fiscal policy would prevent people from spending their own money and make them responsible for someone else's.

Let us start, for example, with the rich. The rich are extremely unhappy, as evidenced by their divorces, drug use, and interminable cocktail parties. There should be no trouble in convincing the rich that giving money to the homeless is far better than escaping to the Riviera or constructing new tax shelters for old loopholes. This approach would reinforce their own self-images, as well as make them widely beloved in the community.

Once the rich have been reduced to penury, it would of course be necessary to compensate them in some way, and a possible source is the philanthropic foundations. Foundations are notorious for spending their money badly, as anyone who was turned down for a grant will tell you. Foundations generally set criteria to find something new and innovative; they admonish each grantee that funds are given only for a limited period, after which the grantee must continue the project "from other sources." Of course, everyone knows that the only "other sources" are other foundations, thus requiring a massive game of musical chairs. The idea of giving money to the rich, however, is so innovative that it is bound to be popular with foundations, who will make lemmings look like individualists as they rush to be first in this program.

This will, of course, require us to rescue the foundations, but fortunately there is a ready and massive source of cash in one of the most inept organizations on the globe, the U.S. military. The military, as everyone knows, spends its money ridiculously, buying garden variety hammers for $2000 each, and sending troops off to godforsaken places that do not even have three-star restaurants and may be as dangerous as downtown Manhattan. It should take only 5 minutes of appropriate briefings to convince the joint chiefs of staff that giving trillions to foundations will qualify as humanitarian aid and will actually be a lot more fun than cruising around the Strait of Hormuz.

Recompensing the U.S. military will not be easy, but if there is one organization that is running even more poorly than the U.S. military, it is the Soviet army. The decision to put large numbers of troops in Afghanistan has got to be one of the monumental blunders of all time, since that nation lacks oil, minerals, and even a Riviera. It should be no problem, therefore, to get the military leaders to put their money elsewhere, but their willingness to subsidize the U.S. army might take a little persuading. Still, Gorbachev, who is one of the great public relations men of history, will think it is a terrific idea, and should be able to say, "Who fights the guy who's paying the rent?"

Ultimately, of course, this will require repaying the Soviet army. But that should be no problem, because U.S. taxpayers are well conditioned to receiving infinite advice on how their money should be spent. Nevertheless, there may be some complaint when they discover that supporting the Soviet army is even more expensive than supporting their own army. The increase in taxes will probably draw some fire, since the taxpayers will argue that they were promised by Senator X or presidential candidate Y that the entire U.S. budget could be balanced by "soaking the rich." They will be reassured, however, when it is explained that the politicians had told the truth, but had just left out the trifling detail that it is the Internal Revenue Service that determines who is rich. When average taxpayers, who earn $25,000 a year, have two children in college, and big mortgages, discover that they are rich, they will, of course, rejoice at their new status and willingly assume any burden. A minor problem may arise when these taxpayers discover that the increased taxes will prevent them from paying the mortgage on the house, thus forcing them into the ranks of the homeless. That simply completes the circle and is what we mathematicians call an internally consistent system.

This fiscal philosophy will be greeted with enthusiasm, since most people find it so painful to spend their own money and so much fun to spend other people's.

—DANIEL E. KOSHLAND, JR.

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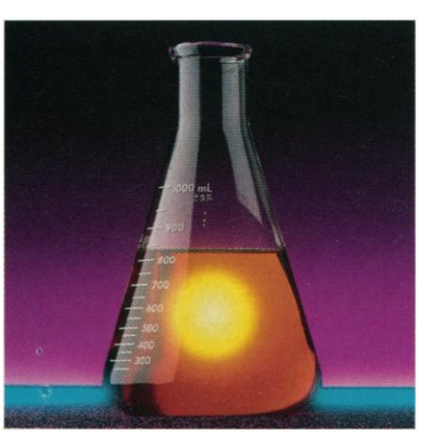

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equipped to be appropriately selective—and even kind—in making post-retirement appointments, usually on a part-time basis (and at an appropriately lower stipend). They are ill equipped and incompetent to discharge elderly colleagues for cause when the seniors become liabilities rather than assets to the academic enterprise. To expect them to use performance criteria to discharge superannuated tenured faculty, their friends and colleagues, is wishful and unwise. The arbitrary age limit is an essential protection.

The most valuable among the aging faculty often welcome retirement as giving their options greater flexibility. Some of the less valuable follow Koshland's blue-collar pattern and opt for early retirement. There are, however, a number of other less valuable faculty who will hang on until the bitter end. Without reasonable and arbitrary age limits, most faculties and administrators are morally incapable of coping with the problems that these tenacious colleagues present.

Reconsideration of national policy with respect to retirement age is seriously needed.

M. BREWSTER SMITH
Board of Studies in Psychology and Adlai E. Stevenson College, Univerisity of California, Santa Cruz, CA 95064

Stunned Sex Interviewers?

William Booth's account of the lost sex survey (News & Comment, 4 Mar., p. 1084) says that sex interviewers should not be "phased" by details of sexual aberrations. Have no fear. They may be "fazed" by such items, but they can only be "phased" by weapons in the hands of crewmen from the starship Enterprise.

WILLIAM R. GAFFEY
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La Différence?

In her well-informed article "Why do women live longer than men?" (Research News, 9 Oct., p. 158), Constance Holden mentions Verbrugge's suggestion that the difference in longevity "appears to be to some extent biological." This may be so, although no attempt was made to specify the biological roots of this difference by relating it to the difference in metabolic rate between men and women.

A plot of age-specific death rates of the general population against the rate of oxygen consumption—the oxygen quotient per hour in calories per square meter of body surface—separately for men and for women at all adult age levels displays parallel curves revealing that women, in contrast with men, burn their fire of life at a rate that is 8 to 10% lower than that of men (*1*). Evidently, a constant proportion of the difference in longevity is based on the body mass–energy expenditure relation. Truly, and literally: "Vive la différence!"

ROLAND FISCHER
07190 Esporles, Mallorca, Spain

REFERENCES

1. R. Fischer, *Experientia* **22**, 178 (1966).

Erratum: In the letter "Behavioral research and AIDS prevention" by William W. Darrow (25 Mar., p. 1477), (*1*) in line 7 of the second paragraph should have been (*2*).

Erratum: In the report "DNA amplification for direction detection of HIV-1 in DNA of peripheral blood mononuclear cells" by Chin-Yih Ou *et al.* (15 Jan., p. 295), the fourth sentence of reference 21 (p. 297) should have read, "The PCR reaction mixture contained 1 μg of PBMC DNA, 100 pmol each of primers (Table 2), 200 μ*M* each of four deoxyribonucleoside triphosphates, 10 μ*M* tris-HCl, *p*H 8.3, 50 m*M* KCl, 2.5 m*M* $MgCl_2$, 0.01% gelatin, and 0.6 unit of thermoresistant DNA polymerase of *Thermus aquaticus*."

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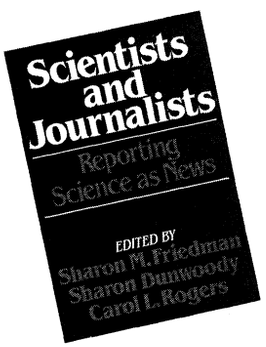

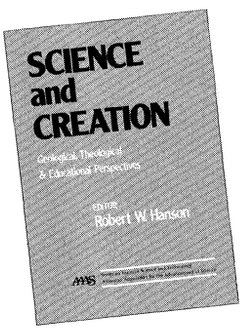

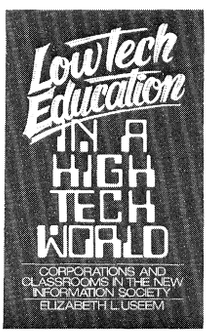

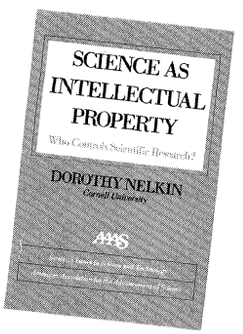

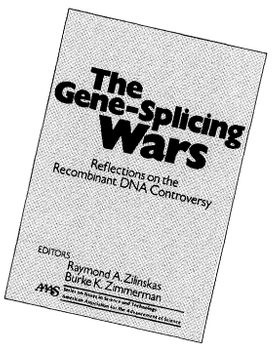

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Dorothy Nelkin

Who controls research? A growing number of legal and administrative disputes raise critical issues of professional sovereignty, scientific secrecy, and proprietary rights. Nelkin offers cases illustrating the dilemmas that arise as the interests of scientists, the rights of citizens, and the security needs of government and industry come into increasing conflict.

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Edited by Raymond A. Zilinskas and Burke K. Zimmerman

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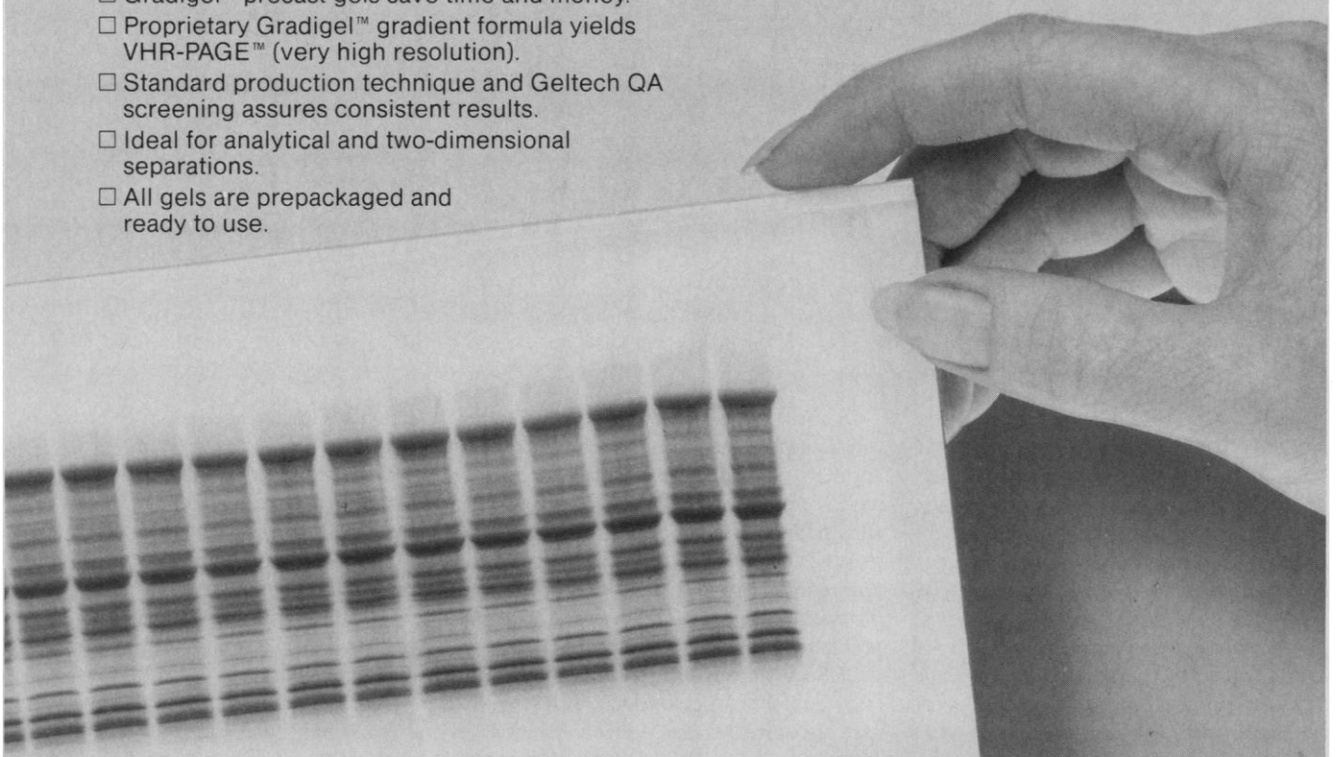

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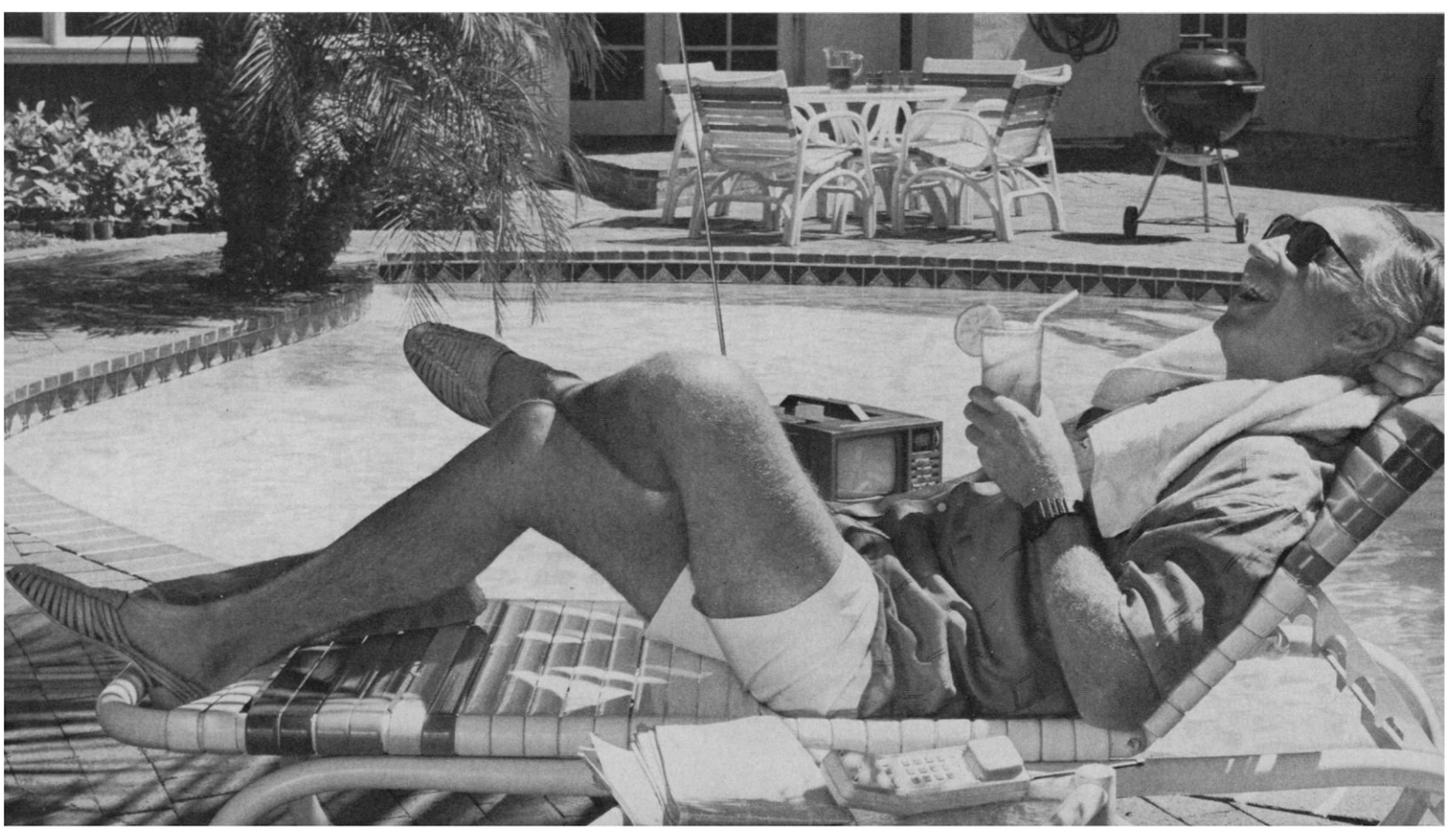

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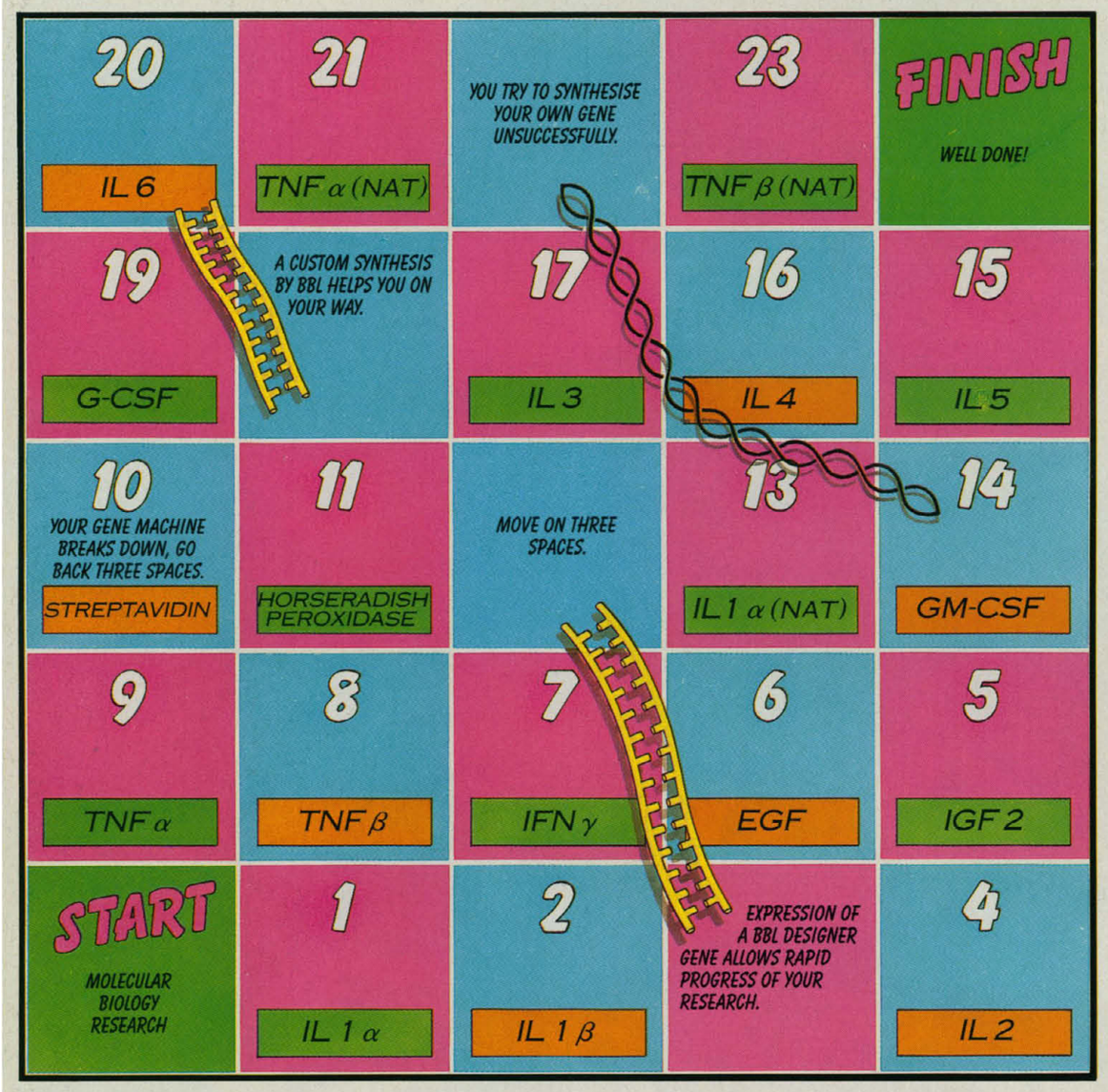

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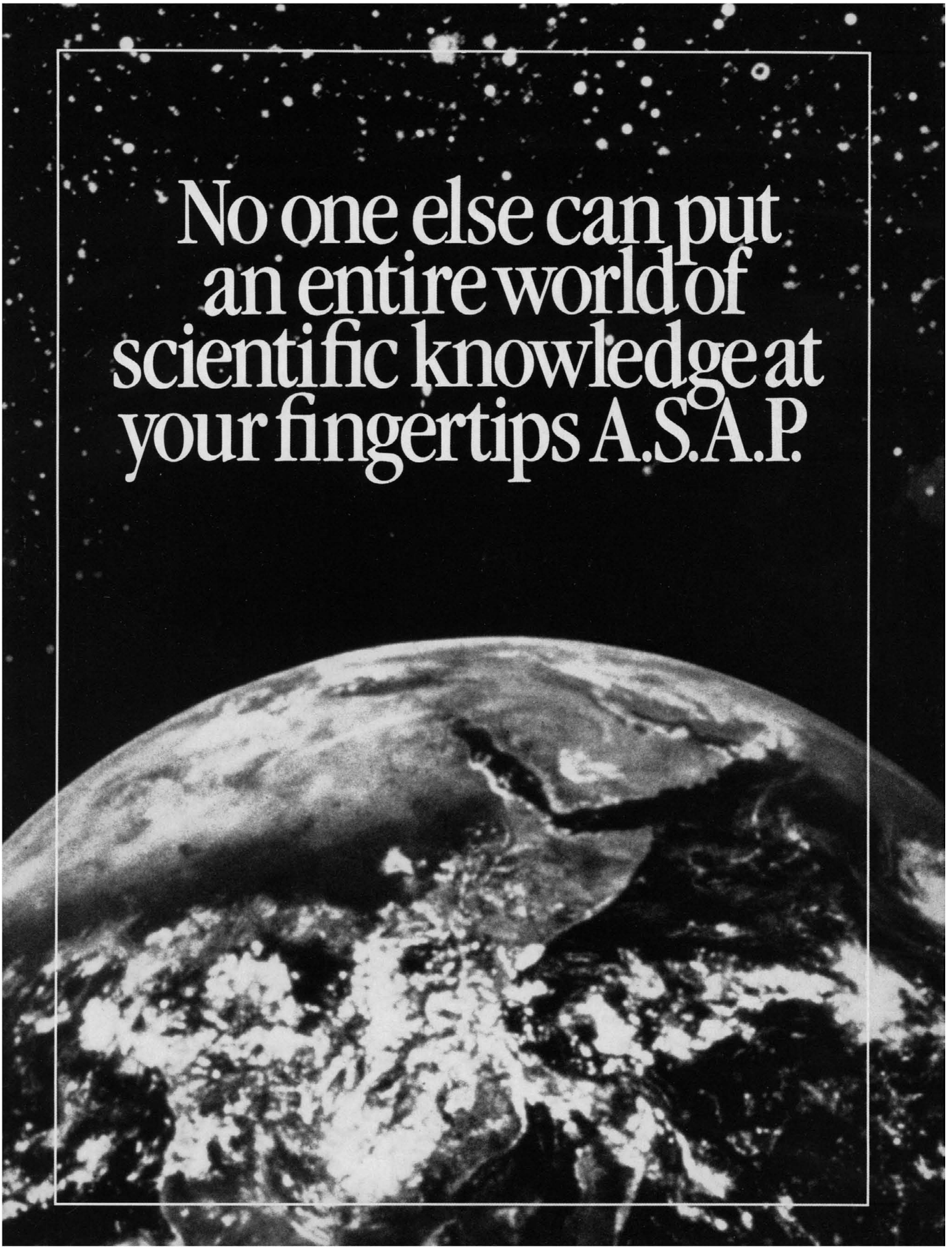
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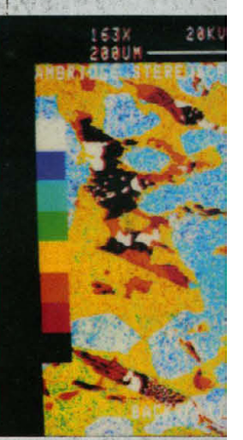

S.E.M. Image of a Heart Valve –
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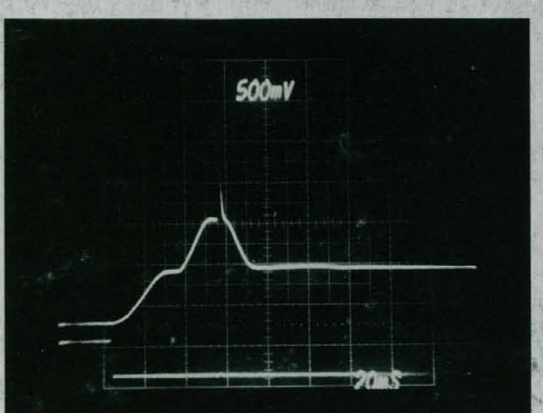

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	Type 339	Integral Pack 4.5x4.2 in.	ISO 640/29°	Self-timing	General purpose, high speed, medium contrast.
	Polacolor ER Type 669	Pack 3¼x4¼ in.	ISO 80/20°	60 seconds	Medium contrast; extended dynamic range. Balanced for daylight and electronic flash.
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	Polacolor ER Type 59	Sheet 4x5 in.	ISO 80/20°	60 seconds	Medium contrast; extended dynamic range. Balanced for daylight and electronic flash.
	Polacolor ER Type 809	Sheet 8x10 in.	ISO 80/20°	60 seconds	Medium contrast; extended dynamic range. Balanced for daylight and electronic flash.
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	Type 803	Sheet 8x10 in.	ISO 800/30°	30 seconds	Fine grain medium contrast film. No coating required.
Print & Negative	Type 55	Sheet 4x5 in.	ISO 50/18°	20 seconds	Negative requires brief clearing in sodium sulfite solution, washing and drying before use.
	Type 665	Pack 3¼x4¼ in.	ISO 80/20°	30 seconds	Negative requires brief clearing in sodium sulfite solution, washing and drying before use.
Instant Color Overhead Transparency	Colorgraph Type 691	Pack 3¼x4¼ in.	ISO 80/20°	4 minutes	Small format overhead projection use.
	Colorgraph Type 891	Sheet 8x10 in.	ISO 80/20°	4 minutes	For overhead projection use.
Instant B&W Radiographic Transparency	Type TPX	Sheet 8x10 in.	N/A	60 seconds	Medium to high contrast. High speed Orthochromatic sensitivity. No darkroom needed.
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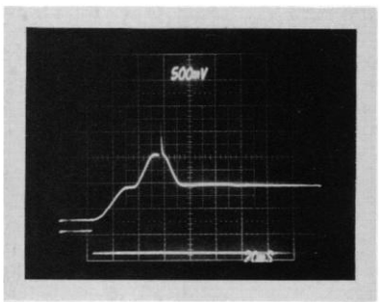
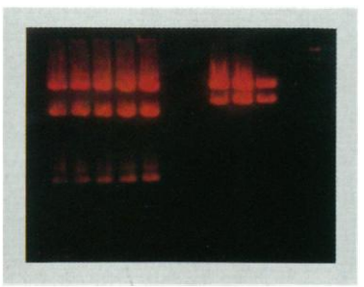
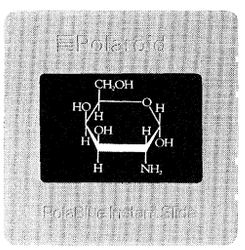


Test and Measurement. Polaroid Type 667 black and white high speed print film and Polaroid DS-34 Direct Screen Camera were used to document this oscillograph.



Biotechnology. Polaroid Polacolor ER Type 669 film and the Polaroid MP-4 Multipurpose Camera were used to produce this image of an electrophoresis pattern from an enzyme digestion of Plasmid DNA. Type 667 and Type 53 black and white films are also used for electrophoresis documentation.



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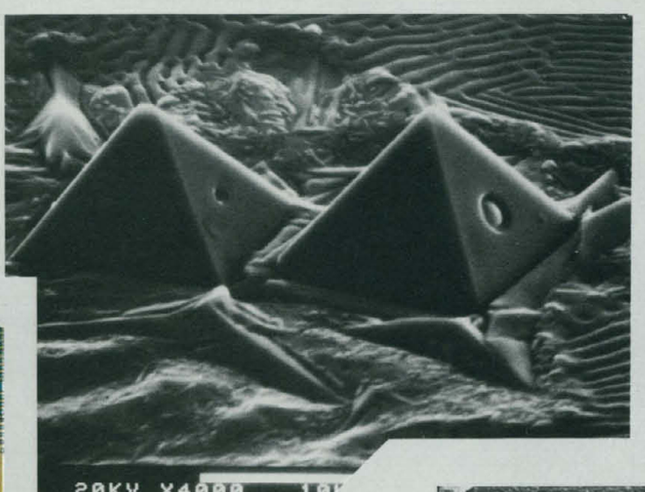

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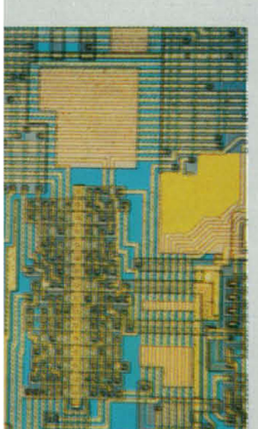
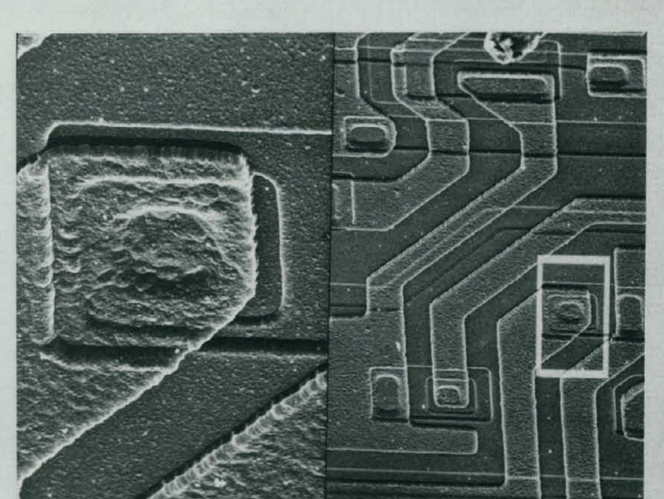
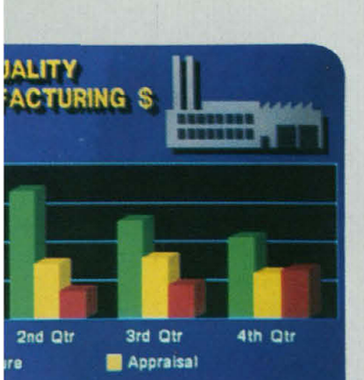
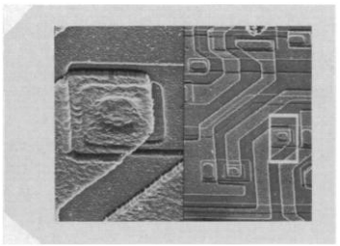
PolaPan Type 52





Cost Analysis Graph –
Colorgraph Type 691

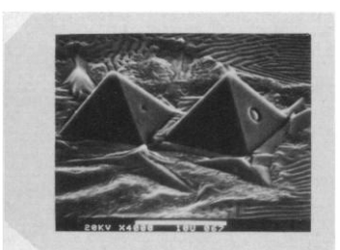




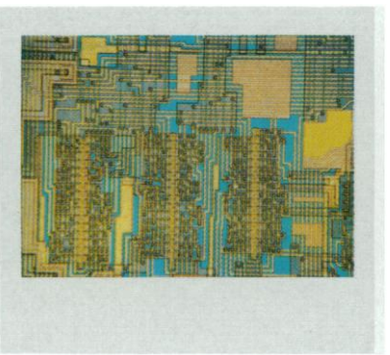
Electronics. PolaPan Type 52 sheet film was used to capture this split-field S.E.M. of an integrated circuit. This black and white, fine grain print film offers a wide tonal range and provides superb detail.

Quality Assurance. This particle analysis of a metal alloy, shown on Polaroid High Speed AutoFilm Type 339, displays consistent saturated color and requires no pulling, timing, or peeling. It was made with the Polaroid FreezeFrame Video Image Recorder.

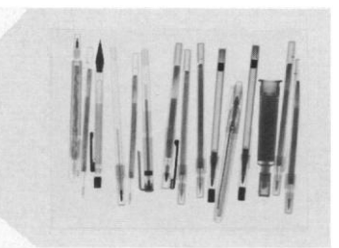
Failure Analysis. This S.E.M. image of a heart valve, magnified 18x, is on Type 55 instant film. This black and white sheet film provides you with a positive and negative to make high quality, professional images.



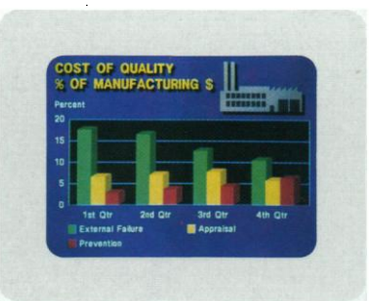
Metallurgy. This S.E.M. image magnified 4000x is of the inner surface shrinkage cavity formed on solidification of a nickel-tin eutectic alloy sphere levitated in microgravity aboard the space shuttle. To capture the fine detail, Polaroid Type 55 black and white instant film was used.



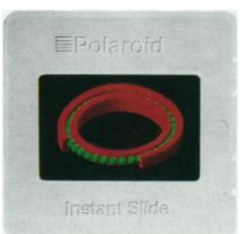
Clean Room Microscopy. Polaroid AutoFilm Type 339 was used to produce this photomicrograph of an integrated circuit viewed through an optical microscope.



Non-Destructive Testing. This X-ray of a representative group of pens was made on Type 53 to view the alignment of the parts. This general purpose high speed film requires no print coating.



Presentations. An instant color overhead transparency, such as this cost analysis graph, can be made using Polaroid Colorgraph Type 691 film. This full color film creates small format overhead transparencies so the latest findings can be presented instantly. The actual graph was generated on a personal computer using the PalettePlus Computer Image Recorder.



Graphic Design. To capture the subtle color differentiations in this CAD/CAM image of a ball bearing, new Polaroid High Contrast PolaChrome Instant 35MM Slide Film was used. New High Contrast PolaChrome provides bright, high quality, color slides in minutes for presentation or documentation.