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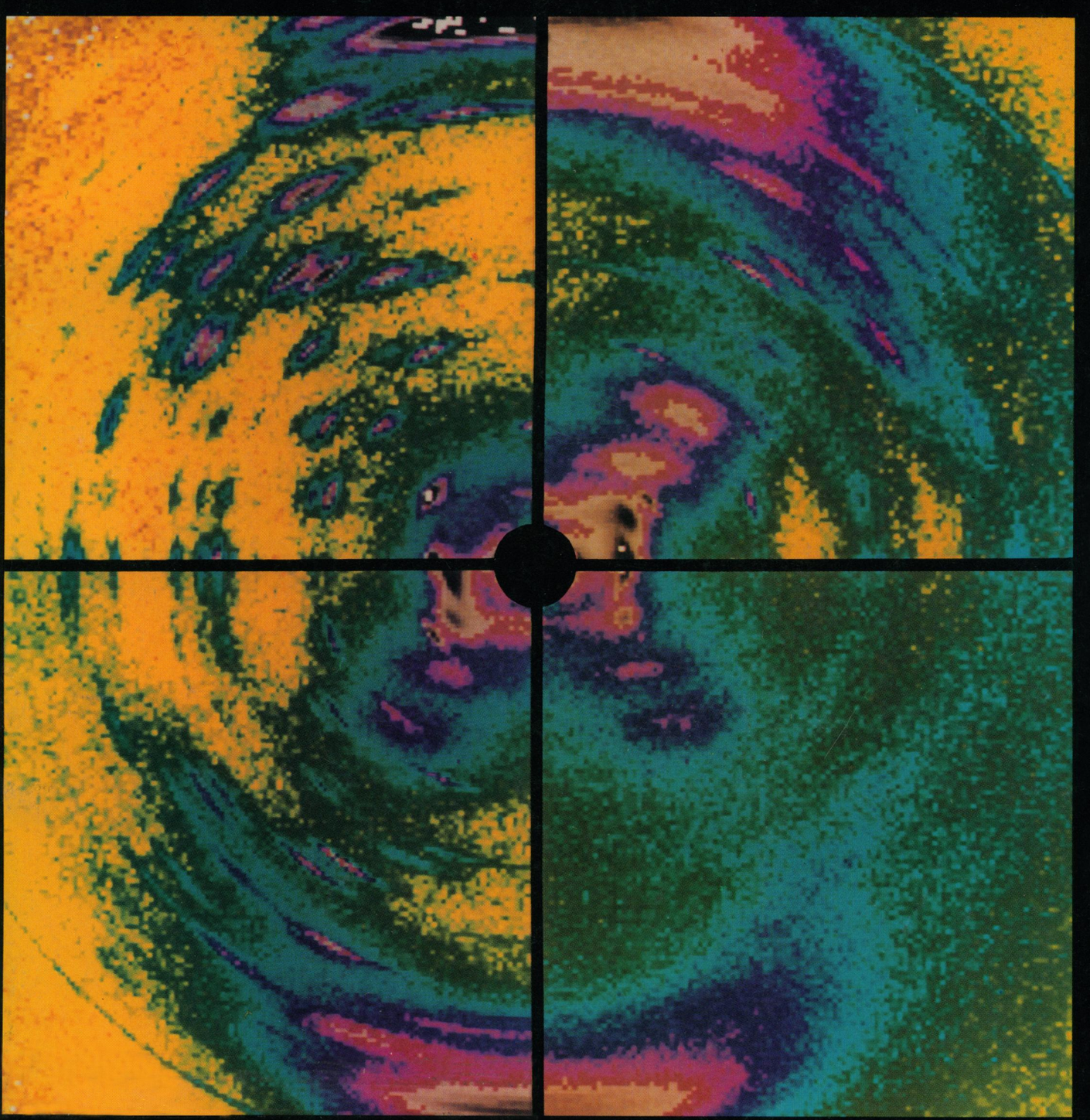

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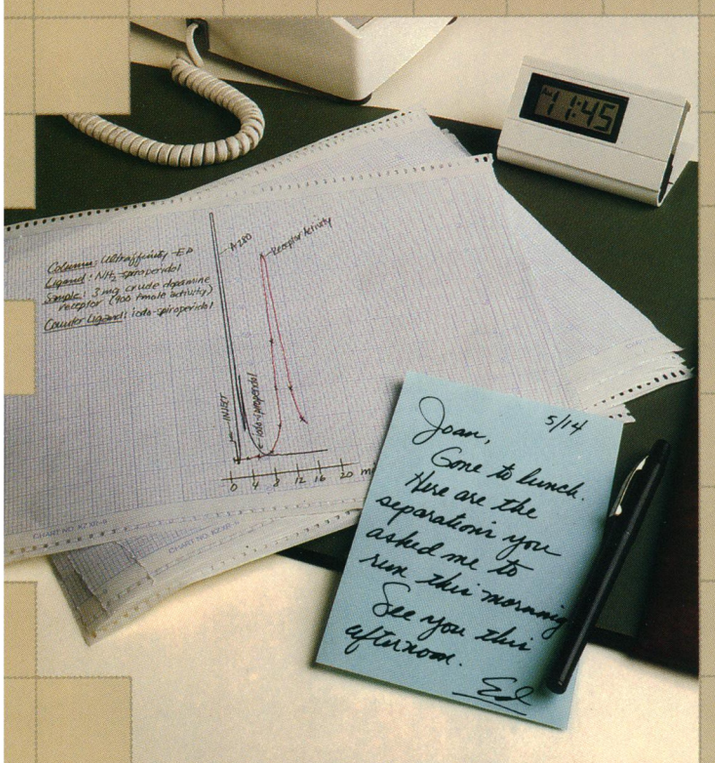

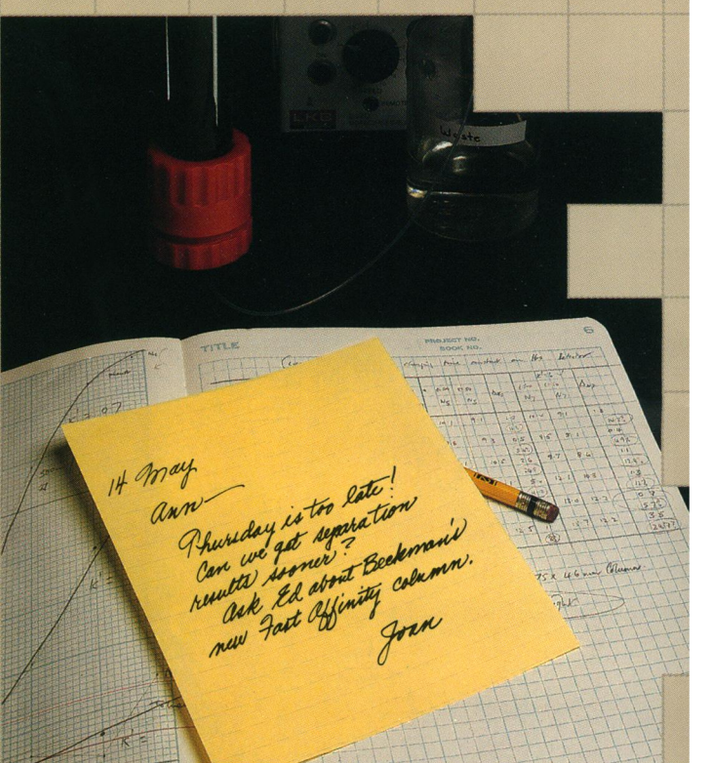

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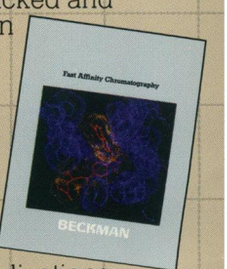

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COVER Quadrants from x-ray diffraction patterns recorded from fibers of the two-stranded polynucleotide poly[d(A-T)] · poly[d(A-T)] at various stages during the D to B conformational transition in the DNA double helix. The diffraction patterns were recorded using the Science and Engineering Research Council's Daresbury Laboratory Synchrotron Radiation Source. See page 195. [W. Fuller, Department of Physics, University of Keele, Staffordshire ST5 5BG, United Kingdom]

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Meteorite scenario pieced together

EVIDENCE of a large meteorite or comet smashing into the earth more than 1 billion years ago comes from both the hole left behind and the ejected pieces that have been found hundreds of kilometers away. Gostin *et al.* describe an unusual and widespread layer of shattered igneous rock fragments in the 600-million-year-old Bunyeroo Gorge Formation in southern Australia (page 198). This formation consists largely of shale deposited in a quiet marine environment. The rock fragments have distinct shock-induced deformations that could only have resulted from a hypervelocity (more than 1000 meters per second) impact—one that a meteorite would be capable of producing. Both the fragmentation patterns and the ages of the fragments (between 1500 and 1600 million years old) are like those characteristic of the outcrop at Lake Acraman, 250 to 300 km away. Williams describes this hexagonal crater that is at the center of a multi-ringed structure; it is the largest probable impact structure in Australia and one of the largest such craters in the world (page 200). The best explanation for the finding of matching rocks at Lake Acraman and in the Bunyeroo Formation is impact and ejection by a meteorite; the fortuitous deposition of the ejected material into an environment so different from the one in which it originated has made this association apparent.

T-cell cycling

CELLS advance through their life cycles in response to various external and internal signals (page 203). Two stimuli that affect the cycling of thymus-derived T cells of the immune system are activation of the antigen receptor and activation of the interleukin-2 (IL-2) receptor. Stern and Smith studied how these forms of activation affect the cycling of experimentally synchronized T-cell populations. When the antigen receptor was activated, resting T cells were aroused but did not move forward through the cycle; they did, however, become "competent" to respond later to other stimuli. When the IL-2 receptor was subsequently activated, the competent T cells increased gradually in size, accumulated cytoplasmic RNA, synthesized DNA, and eventually proliferated; early in this process, the product of the proto-oncogene c-*myb* was produced. The functional relation of c-*myb* production to cell cycle progression remains to be determined along with other features of the cycling process.

Beetle toxin

NOTORIOUS potato pests, the Colorado beetles, may fend off predators by releasing a toxin from their defense glands (page 221). Daloze *et al.* milked beetles (by gentle squeezing) and collected and characterized the toxin, a dipeptide in which glutamic acid is coupled to an unusual amino acid not found in proteins. The substance was toxic to ants. Related substances are known in fungi, where they are potent enzyme inhibitors and antibiotics, but have not previously been reported in insects. Other members of this newly identified group of compounds may eventually be found performing similar toxic or defensive functions elsewhere in nature.

Web or wed

WHEN female Sierra dome spiders in high-density populations in the wild reach sexual maturity, they mate immediately with a male waiting at the web for this advantageous mating opportunity (one yielding many fertilizations) (page 219). In low-density populations in the wild or in the laboratory, females who have been sexually deprived for 7 to 10 days embark on a contingency plan: they incorporate a sex attractant (pheromone) into their dome-shaped webs to attract nomadic males. Watson describes how the first male spider to arrive at the web of an unmated virgin female rapidly dismantles a large portion of the web, compressing the silk threads into a ball or dense rope; the two spiders then mate. The balling up of the web apparently inhibits further evaporation of the pheromone so that other males are not attracted to the female. Although "advertising" succeeds, the cost to the female is high: she loses much of her semipermanent dome-shaped home (used not only for sexual encounters but also for catching prey), and she loses the chance to mate with the best male available, a chance that would have come had there been male rivalry on the web.

Monitoring cataracts

IN the search for drugs that can prevent or inhibit cataract development, in monitoring the clinical effectiveness of such drugs, and in detecting early signs of cataract formation, a noninvasive technique—carbon-13 nuclear magnetic resonance (NMR) spectroscopy—may be of use (page 223). Cataracts impair vision by clouding the lens of the eye. They are thought to develop when, in response to high glucose concentrations, the enzyme aldose reductase converts glucose to the sugar-alcohol sorbitol; sorbitol remains trapped in the lens, water enters the lens to compensate for the osmotic imbalance, swelling occurs, fibers rupture, and a cloudy lens results. Other metabolic pathways in the lens may also contribute to the process. Using NMR spectroscopy, Williams and Odom monitored sugar metabolism in rabbit lenses maintained in organ culture in the presence of pharmacologic agents that are known to inhibit aldose reductase activity. Tolrestat, sorbinil, sulindac, ibuprofen, acetaminophen, and aspirin were all effective in inhibiting enzyme activity, diminishing sorbitol accumulation, decreasing swelling, and delaying changes in lens transparency. Their clinical usefulness will ultimately depend on the balance between their inhibitory effects, their side effects, and their toxic properties.

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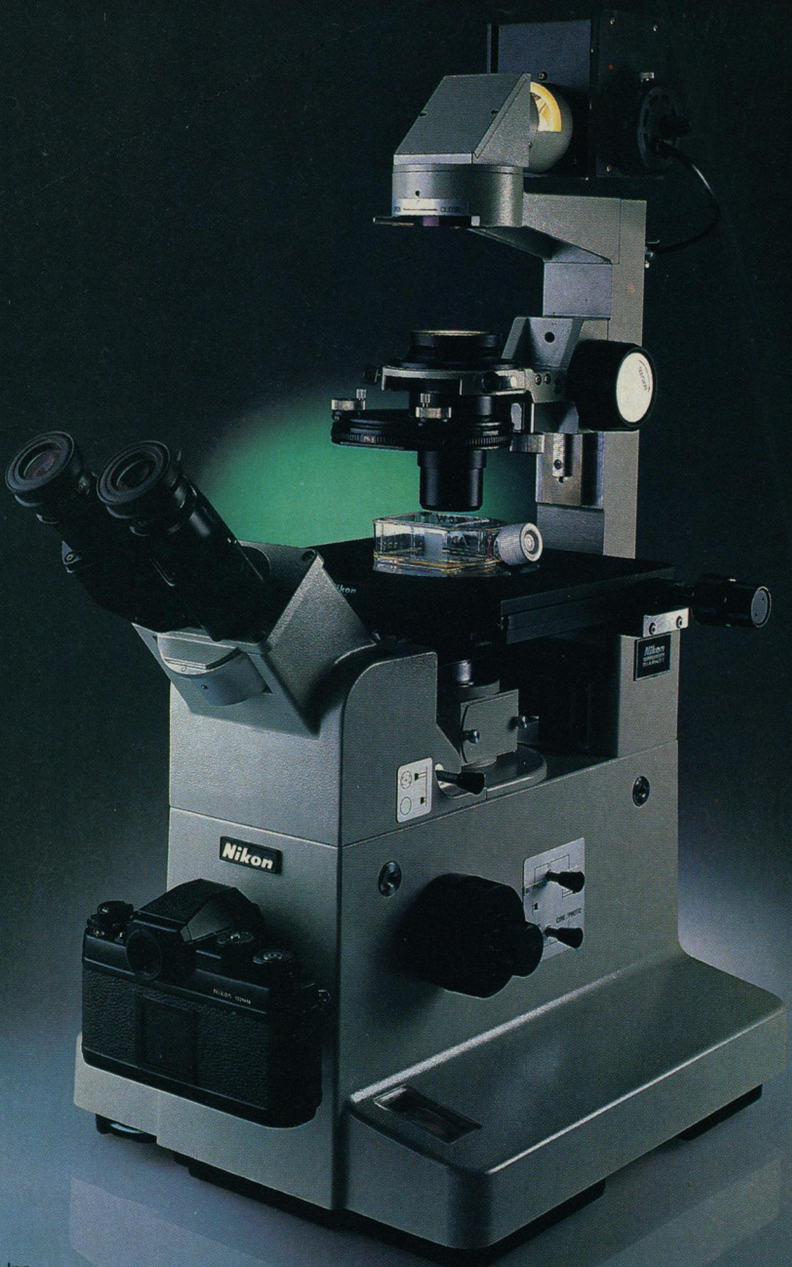

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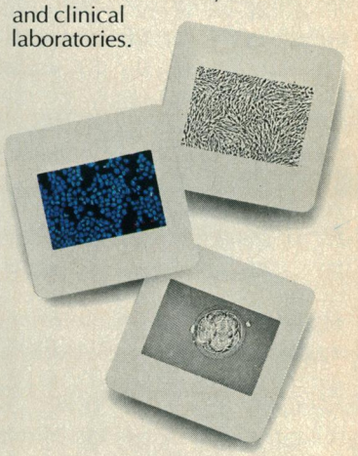

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Gold

Economic geologists are experiencing a severe depression in demand for their services. The bright spot in an otherwise gloomy picture is gold. The selling price of this metal (about $11 per gram) is sufficient to justify an eager and expanding global search for it.

Many people have the impression that gold occurs as nuggets in streambeds and being a noble metal is only dissolved by aqua regia, a mixture of concentrated hydrochloric and nitric acids. But gold occurs in other environments and is quite mobile under some natural conditions. The concentration of gold in the earth's crust is about 5 parts per billion. Yet a combination of natural chemical and physical processes has led to chunks of gold weighing as much as 30 kilograms. Economic geologists are still arguing about the mechanisms leading to ore formation, but their fund of knowledge and new tools are leading to successes in finding ore. Much of the new gold being found is not in placers but in stratiform deposits. In many of the latter, the gold is disseminated in host rocks in such a way that it is invisible to the naked eye.

The outlines of how gold is extracted from sedimentary or volcanic rocks in which it is present at levels of 5 parts per billion are generally agreed on. Some kind of complexing agent is involved that renders the gold soluble in a hot (175° to 450°C) aqueous fluid. The fluid under great pressure finds its way to a plumbing system, for example, a fault, leading toward the surface. On the way to the surface the complexing agent reacts with wall rock or in some other way loses its solubilizing capability. Gold is not the only element mobilized by this process. Other elements include antimony, arsenic, copper, lead, mercury, molybdenum, silver, and zinc. A number of different complexing agents have been proposed, but the likeliest candidates are those involving sulfur. For example, T. M. Seward conducted experiments with 0.5 molar NaSH at 1000 bars pressure. One kilogram of a solution having a *p*H of 7.47 at 20°C dissolved 150 milligrams of gold at 300°C. At 175°C about 11 milligrams dissolved. The complex formed was probably $Au(HS)_2^-$.

Much of the gold being mined today around the world was mobilized and processed to form placer deposits about 2800 million years ago. The largest occurrences are located at an unconformity between Archean and Proterozoic strata. In the United States the new gold being found was emplaced much later.

The Canadians have been using tools that could be applicable elsewhere.* They have been taking advantage of the fact that vegetation takes in gold. The presence of the element in leaves and woody material can be detected by neutron activation analysis. As little as 1 part per billion can be found in 10 grams of wood ash. This procedure is particularly applicable in Canada because most of the solid rock is covered by glacial till. However, roots of the trees reach deep into the soil. Apparently the roots contain or exude complexing agents that dissolve gold. At any rate, when the sap rises in the spring it carries with it the element. Subsequently during the growing season the concentration of gold diminishes somewhat and varies in different parts of the tree. Some remains at the end of the season. Extensive measurements have been made of trees over gold deposits. The gold concentrations found in the ash of samples from trees growing in glacial till above mineralization often exceed 100 parts per billion when the specimens are collected in early spring. The ash of trees not above mineralization has concentrations about a third as much. One informant was especially enthusiastic about this method. He pointed out that sampling the ground during the winter was difficult and that in summer "the flies eat you." But the vegetation could be harvested at any time. Another informant told of sampling trees from a helicopter.

Although most of the gold known in the United States is in the west, a recent find at Cobalt, Connecticut, indicates that the resources of the east may be substantial. A student field party from the University of Connecticut, led by Professor A. R. Philpott, has found a gold-containing specimen assaying at the level of 190 grams per ton. The find is located at a fault a short distance from an ancient cobalt mine.—PHILIP H. ABELSON

*See D. Carlisle, W. L. Berry, I. R. Kaplan, J. R. Watterson, Eds., *Mineral Exploration: Biological Systems and Organic Matter* (Prentice-Hall, Englewood Cliffs, NJ, 1986).

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Brompheniramine	1.50	Disopyramide	2.70	Methylatropine	1.27	Promethazine	1.25
Bupivacaine	1.41	Doxylamine	1.37	Methylhom-atropine	4.2	Pronethalol	1.26
Butorphanol	1.99	Ephedrine	1.83	Methylphenidate	1.70	Propoxyphene	2.3
Carbinoxamine	1.33	Ephedrine, pseudo-	1.34	Metoprolol	1.64	Propranolol	1.13
Chlorpheniramine	2.26	Homatropine	1.63	Nadolol A	3.98	Terbutaline	1.22
Clidinium	1.21	Labetalol A	2.10	Nadolol B	3.03	Tocainide	1.44
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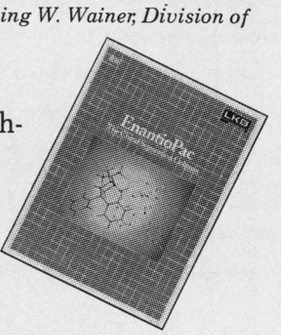

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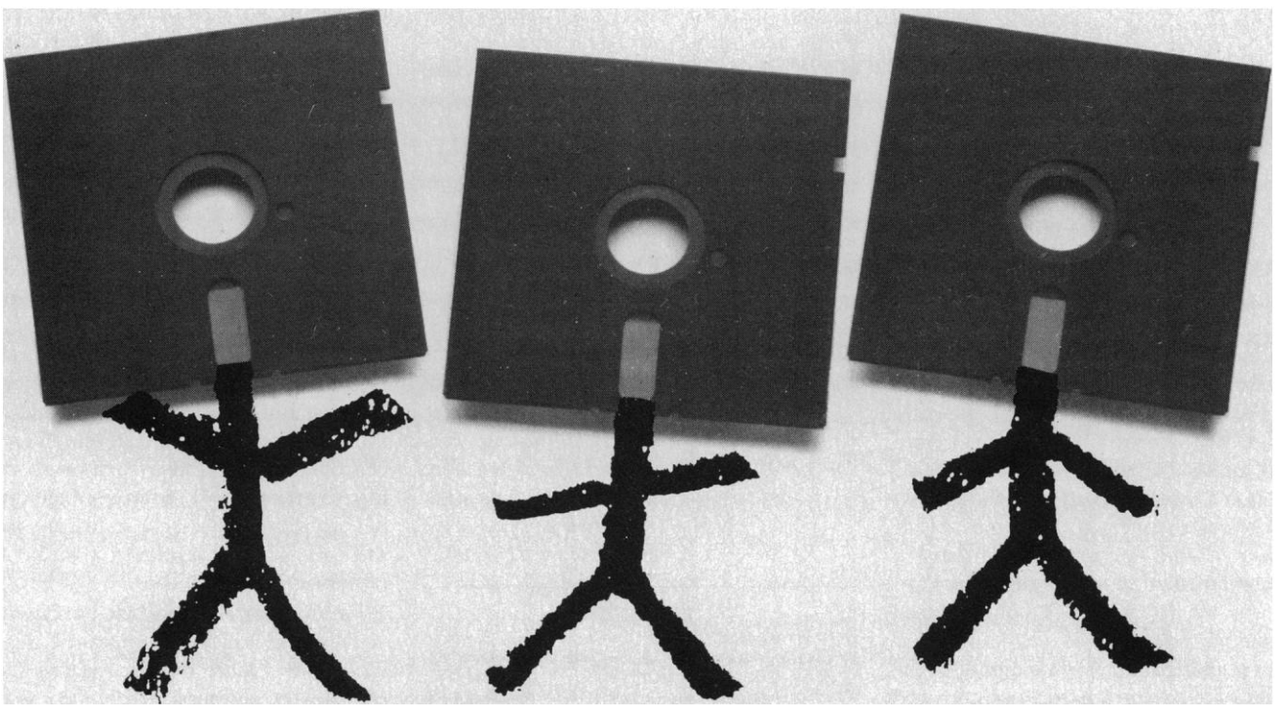

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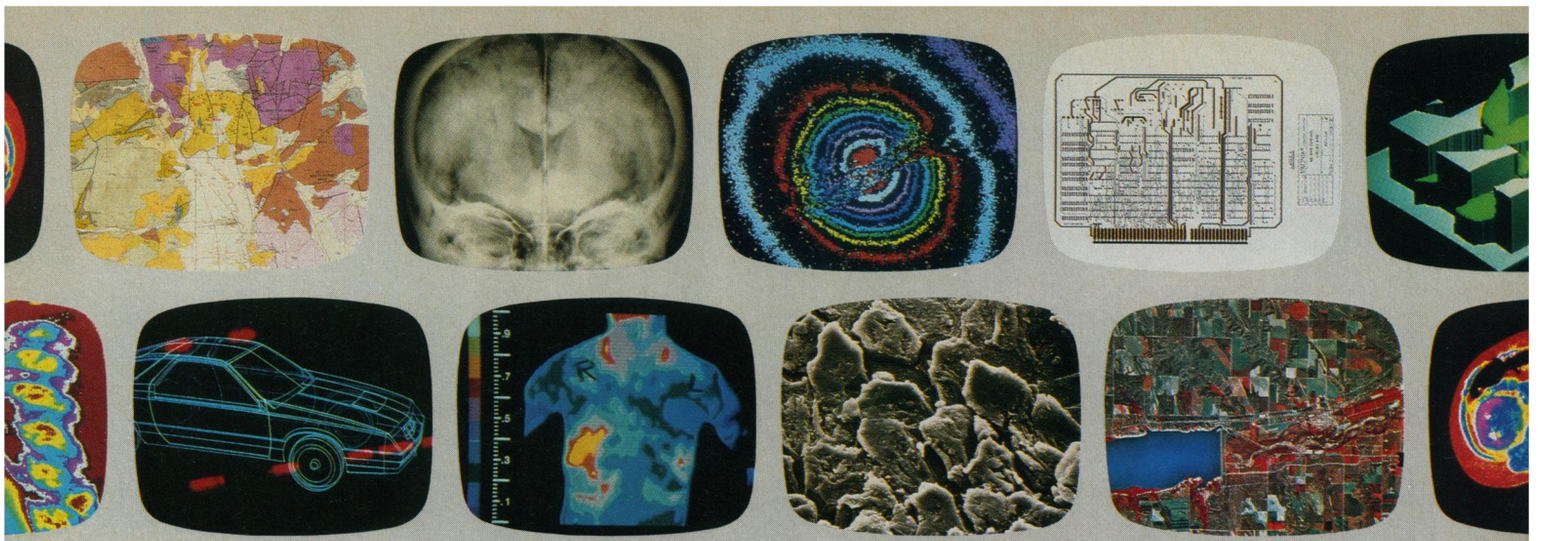

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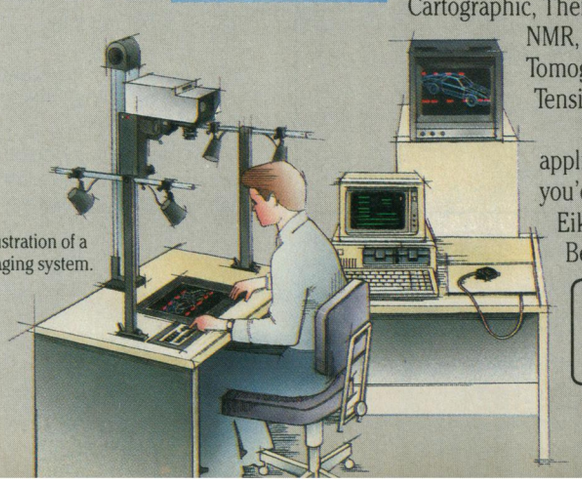

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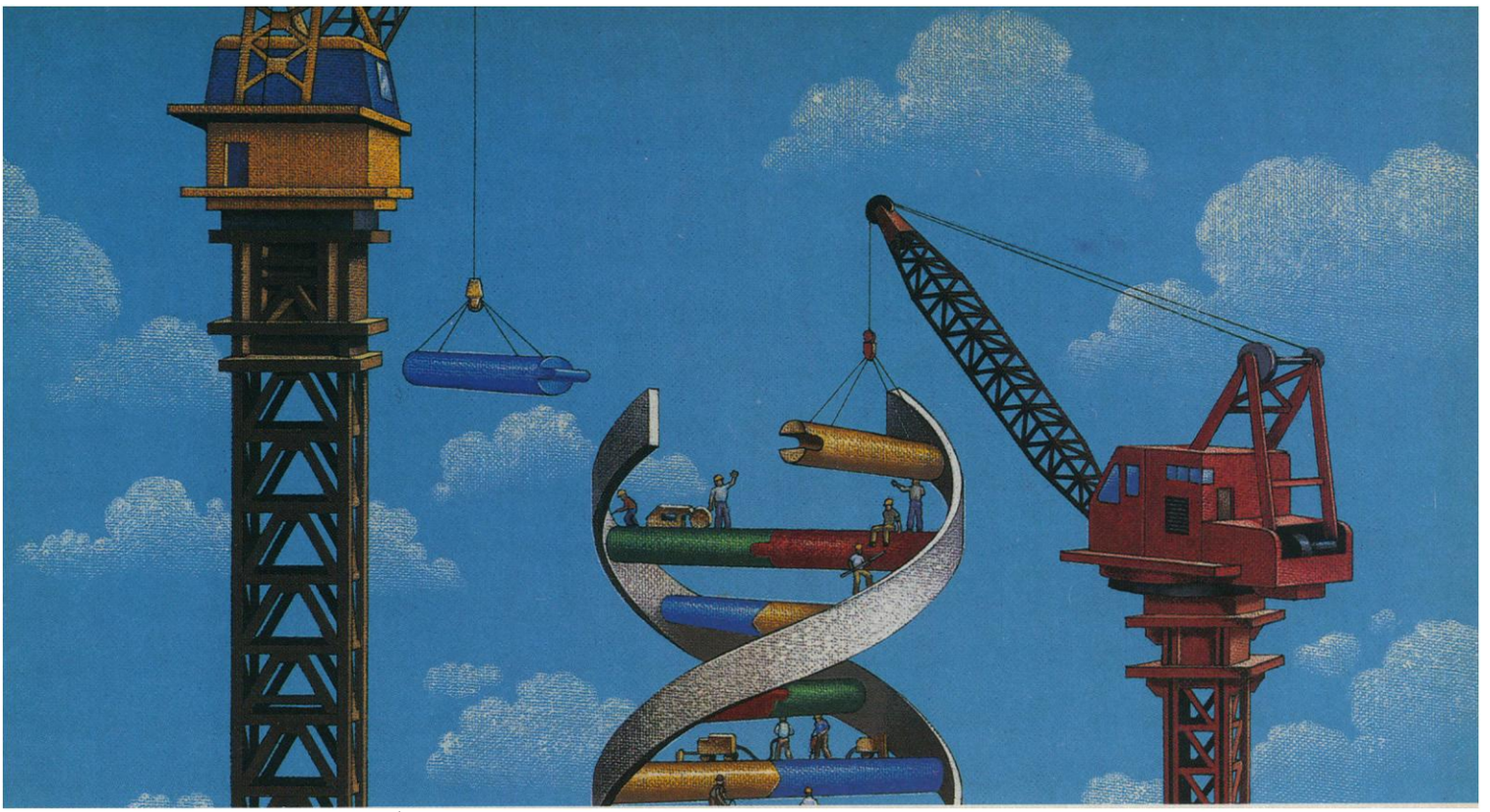

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A U.S. spacecraft orbiting Venus made the first close-up views of Halley's Comet, giving scientists valuable insights into the comet at a time when it was on the far side of the sun and direct observations from Earth were impossible. NASA's Pioneer Venus Orbiter, built by Hughes Aircraft Company and circling Venus since 1978, conducted its investigation a month before five other spacecraft flew by the comet. The Orbiter was delicately repositioned with precise commands from Earth to observe Halley's at its closest point to the sun, a distance of about 55 million miles. The spacecraft measured changes in the comet caused by intense solar heating. It also provided an ultraviolet image of Halley's and its large surrounding hydrogen cloud. Data gathered by the Orbiter helped scientists determine the gas composition of the comet, the rate at which water vaporized, and the ratio of gas to dust in the comet.

The AMRAAM missile may become the next-generation weapon for protecting U.S. Navy surface ships against threats that have slipped through the outer defense shields. Sea AMRAAM, under study for ship self-defense, would be essentially the same as the Advanced Medium-Range Air-to-Air Missile in full-scale development by Hughes for the U.S. Air Force and Navy. However, compared with existing missiles, Sea AMRAAM would increase a ship's firepower because the missile's guidance system is much less dependent on the ship's radars. Many missiles could be fired at different targets simultaneously, and they could home in even if the targets were outside the field of the ship's radar systems. Sea AMRAAM is also faster, more maneuverable, and can fly farther than current ship self-defense systems.

An innovative digital receiver is being developed to alert military aircraft when they are approaching enemy radars and electronic warfare systems, thereby putting them at less risk while on a mission. The device, designed for electronic support measures (ESM), will be approximately 1/20 the weight and substantially smaller than current receivers. It will search for, intercept, record, analyze, and locate sources of radiated electromagnetic energy. The receiver can store this information. Or, if an enemy signal poses a threat, it can pass this information along to another type of electronic warfare system, such as a jamming device. Hughes is developing the receiver with independent research and development funds.

Cellular telephones may take a back seat to a proposed satellite system when it comes to making long-distance calls. The mobile satellite network, consisting of two Hughes HS 393 spacecraft, would relay two-way voice and data communications services directly from airplanes, cars, trains, or remote locations. While cellular telephone systems are limited to areas equipped with fixed antenna networks, mobile satellites would cover the continental U.S. and Canada, and possibly Mexico. Users would have their own mobile ground terminals. Hughes Communications Mobile Satellite Services, Inc. is seeking authorization from the Federal Communications Commission to operate the system.

Hughes needs engineers, scientists, and programmers to forge new frontiers in aerospace radars, weapon control systems and avionics, airborne displays, aerovehicle data links, and airborne countermeasures. Current openings are for people experienced in design, development, test and manufacture for systems engineering, project/program management, design of circuits and mechanisms, and bringing these to reality through the application of advanced manufacturing techniques. Send your resume to Hughes Radar Systems Group, Engineering Employment, Dept. S3, P.O. Box 92426, Los Angeles, CA 90009. Equal opportunity employer. U.S. citizenship required.

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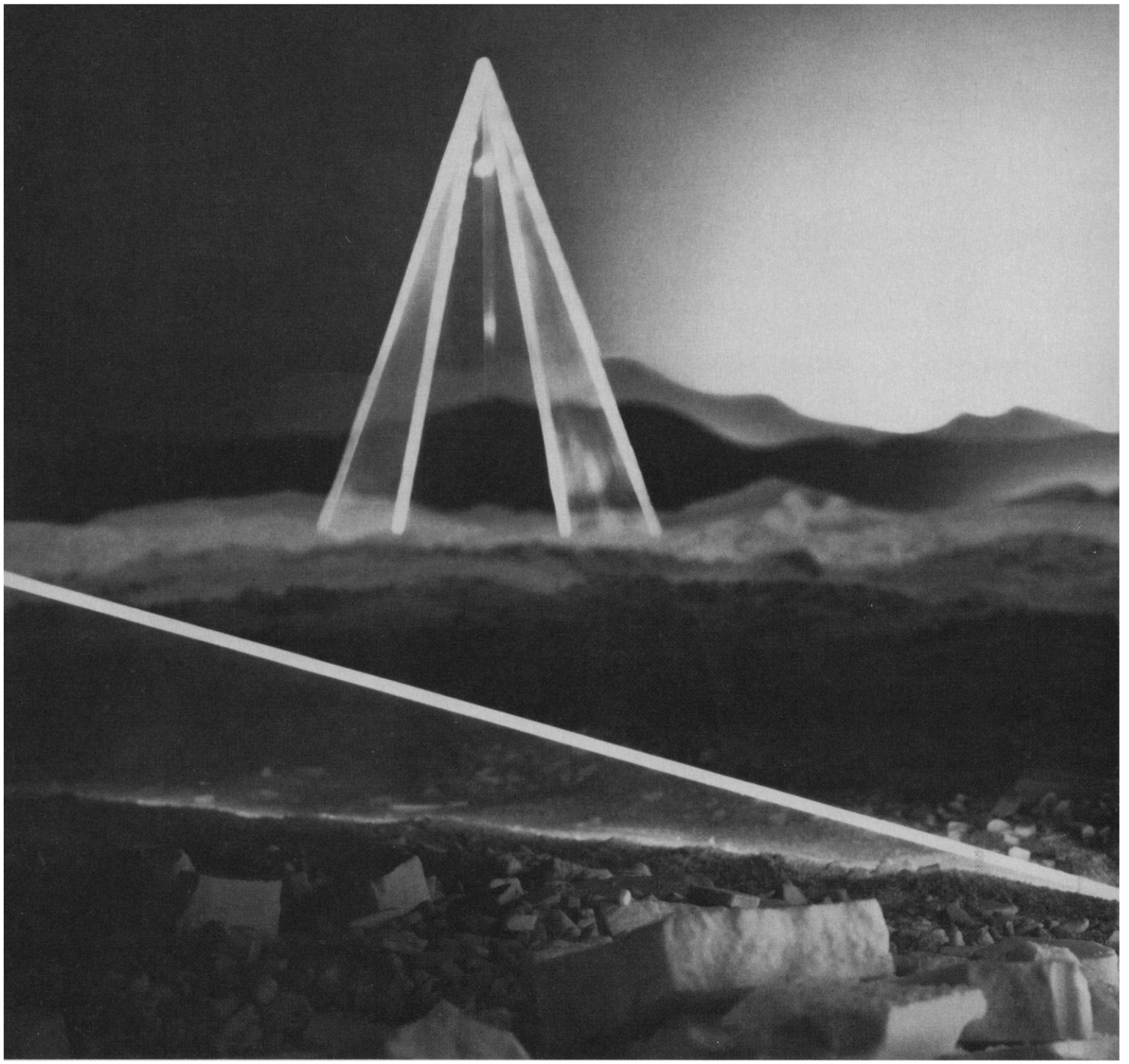

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Repository of Human DNA Probes and Libraries

National Laboratory Gene Library Project

Project:

In order to accelerate the rate of probe production for gene mapping and genetic disease diagnosis, the Office of Health and Environmental Research of the U.S. Department of Energy is funding a collaborative project between Lawrence Livermore National Laboratory and Los Alamos National Laboratory to construct 2 complete sets of chromosome-specific libraries of all 24 different human chromosomal types. The National Laboratory Gene Library Project involves purifying chromosomes isolated from cultured human cells or human chromosome-containing hybrid cells by flow sorting. Once enough chromosomes of a given type are sorted, the DNA is extracted and purified. In phase I of the project, the purified DNA is digested to completion with EcoRI (Los Alamos) or Hind III (Livermore). The digested DNA is next inserted into a bacteriophage lambda vector, Charon 21A. The recombinant molecules are packaged *in vitro* into infectious phage particles and the resultant chromosome-specific library is amplified in an E. *coli* host as infectious phage. The use of two restriction enzymes allows the construction of two distinct libraries for each chromosome. The average length of the human DNA inserts in Charon 21A (accepts 0-9 kb) is about 4 kilobases. Since complete digestion by either restriction enzyme will yield some fragments larger than 9 kb which are not clonable, the construction of 2 libraries means that a sequence missing from one will probably exist in the other.

In phase II, chromosome-specific libraries will be constructed by partially digesting the sorted chromosomal DNA with a restriction enzyme to an average size in the 20-40 kb range. Lambda vectors or cosmids will be selected for library construction which accept inserts in this range. Thus, many complete genes with their flanking sequences will be contained in single clones of the Phase II libraries.

The phase I libraries are of particular value to researchers involved in chromosome mapping and the study and diagnosis of genetic disease, linkage, and pedigree analysis. The phase II libraries, containing larger cloned inserts, should be of special interest to molecular biologists studying gene structure and regulation.

Repository:

In 1983, members of the human genetics community petitioned the National Institutes of Health to develop a reliable and efficient means for researchers to exchange cloned human DNA. At the same time, the National Laboratory Gene Library Project decided to investigate the possibility of establishing a permanent repository for both the chromosome-specific libraries and the information derived from their use. To fulfill these needs, a repository of human cloned DNA segments has been established by American Type Culture Collection (ATCC) in Rockville, Maryland, under contract from the National Institute of Child Health and Human Development (NICHD). Drs. Victor McKusick and Mark Skolnick are serving as advisors to the repository in addition to a board of geneticists assembled by the NICHD. ATCC will collect well-characterized probes from investigators, expand and verify the probes, and store multiple samples that will be distributed to other investigators. Active solicitation and acceptance of important probes has begun.

The human chromosome-specific libraries developed at the Los Alamos and Lawrence Livermore National Laboratories are available from the repository through funding by the NIH Division of Research Resources. The availability of these libraries will greatly increase the rate at which important probes are produced. The phase II libraries will be placed in the repository as they are constructed.

Human Chromosome—Specific Libraries

CH	ATCC #	National Lab ID Code	Rest Enz	CH Equiv
1	57738	LA01NS01	*Eco* RI	31.0
2	57716	LA02NS01	*Eco* RI	1.8
3	57717	LA03NS01	*Eco* RI	.8
4	57700	LLO4NS01	*Hind* III	.8
4	57718	LA04NS02	*Eco* RI	3.4
4	57719	LA04NS01	*Eco* RI	2.3
5	57720	LA05NS01	*Eco* RI	43.0
6	57701	LL06NS01	*Hind* III	20.0
6	57721	LA06NS01	*Eco* RI	2.4
7	57722	LA07NS01	*Eco* RI	9.2
8	57702	LL08NS02	*Hind* III	20.0
8	57723	LA08NS04	*Eco* RI	1.5
9	57703	LL09NS01	*Hind* III	13.0
9	57724	LA09NS01	*Eco* RI	7.0
10	57725	LA10NS01	*Eco* RI	18.0
10	57736	LL10NS01	*Hind* III	9.6
11	57704	LL11NS01	*Hind* III	4.9
11	57726	LA11NS02	*Eco* RI	2.8
12	57727	LA12NS01	*Eco* RI	27.3
13	57705	LL13NS01	*Hind* III	1.3
13	57728	LA13NS03	*Eco* RI	4.2
14	57706	LL14NS01	*Hind* III	135.0
14	57739	LA14NS01	*Eco* RI	36.0
14/15	57707	LL99NS01	*Hind* III	30.0
15	57729	LA15NS02	*Eco* RI	20.4
15	57737	LL15NS01	*Hind* III	4.4
15	57740	LA15NS03	*Eco* RI	4.0
16	57708	LL16NS02	*Hind* III	20.0
16	57730	LA16NS02	*Eco* RI	2.0
17	57709	LL17NS01	*Hind* III	1.3
17	57741	LA17NS03	*Eco* RI	7.9
18	57710	LL18NS01	*Hind* III	72.0
18	57742	LA18NS04	*Eco* RI	19.0
19	57711	LL19NS01	*Hind* III	30.0
19	57731	LA19NS03	*Eco* RI	10.5
20	57712	LL20NS01	*Hind* III	20.0
20	57732	LA20NS01	*Eco* RI	1.4
21	57713	LL21NS02	*Hind* III	20.0
21	57743	LA21NS01	*Eco* RI	137.0
22	57714	LL22NS01	*Hind* III	13.0
22	57733	LA22NS03	*Eco* RI	11.0
X	57734	LA0XNS01	*Eco* RI	8.2
Y	57715	LL0YNS01	*Hind* III	27.0
Y	57735	LA0YNS01	*Eco* RI	11.5

1. National Lab ID Code Prefix: LA designates a library constructed at the Los Alamos National Laboratory and deposited by Dr. Larry L. Deaven. LL designates a library constructed at the Lawrence Livermore National Laboratory and deposited by Dr. Marvin Van Dilla.
2. The average size of the human DNA inserts in the libraries is 4 kb.

For more information, contact ATCC at the address below.

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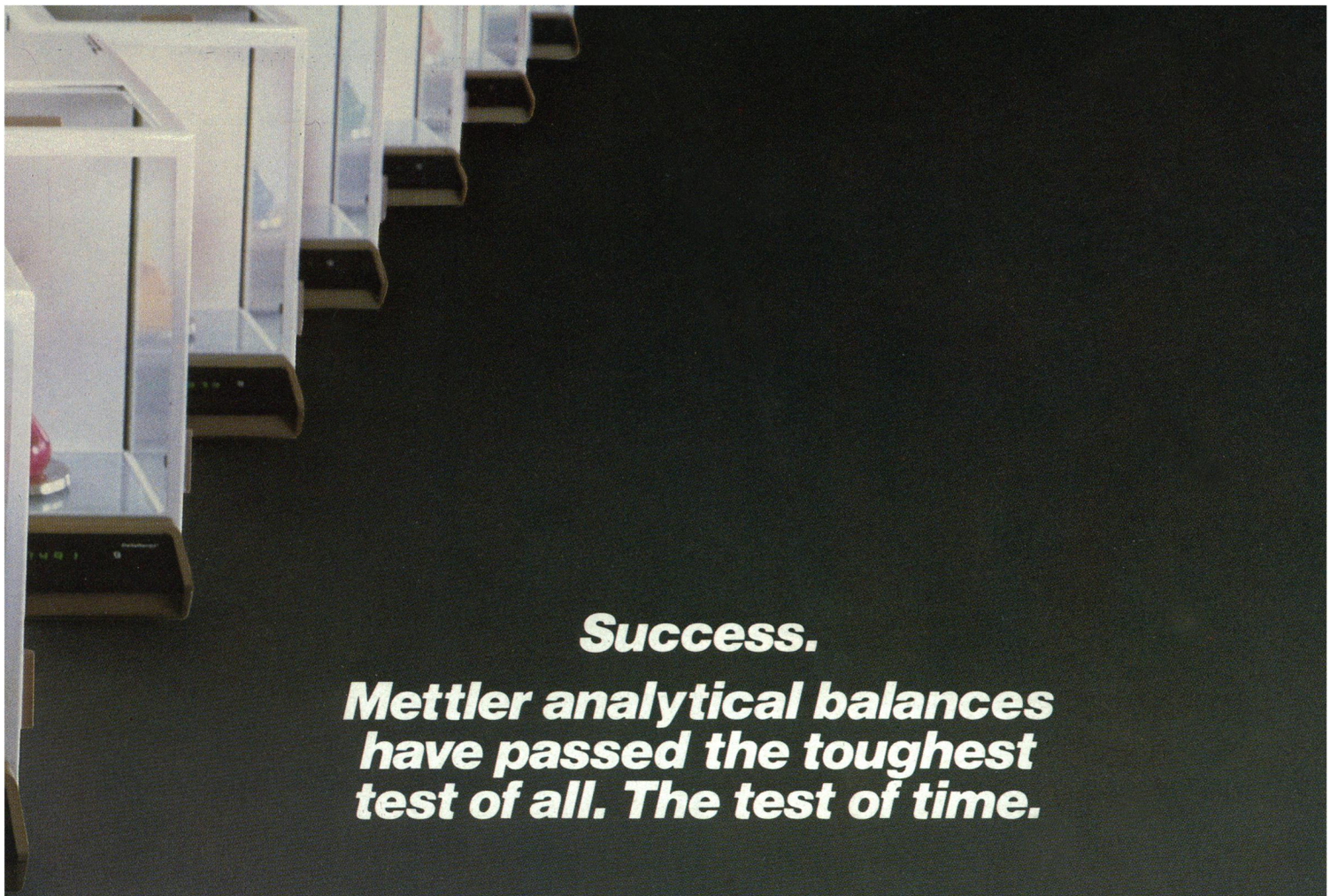

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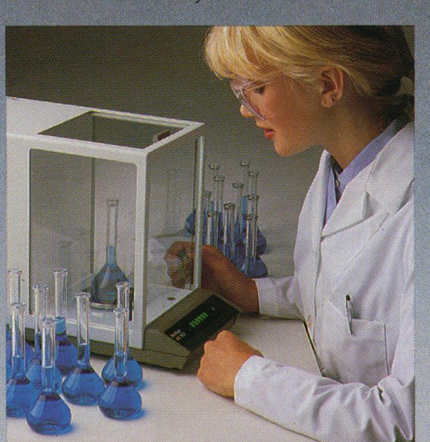

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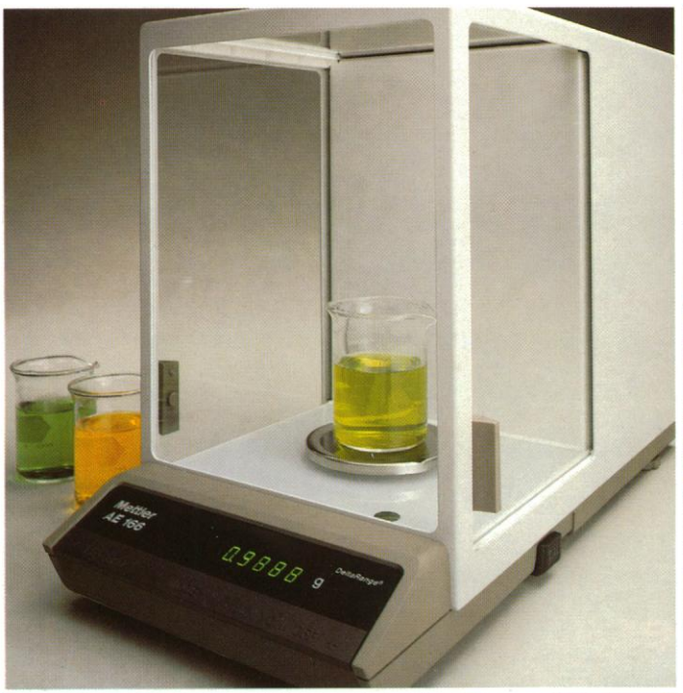

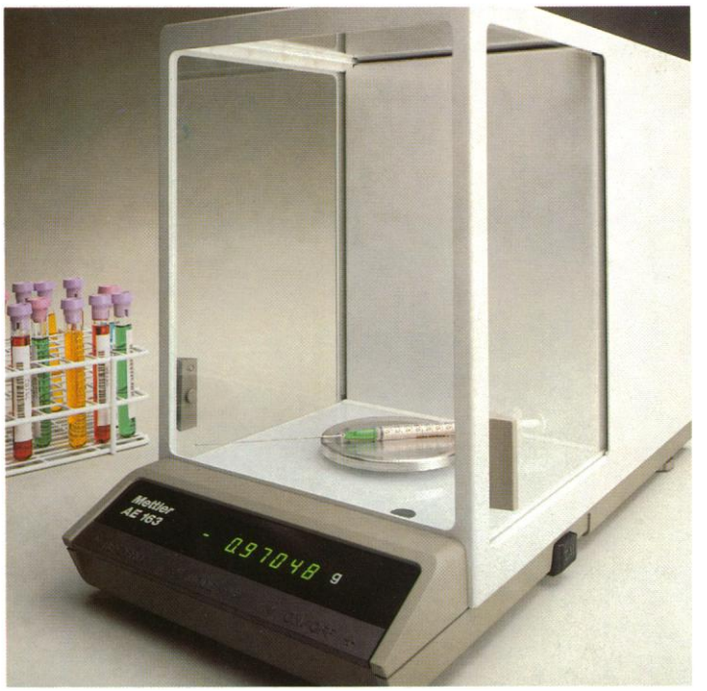

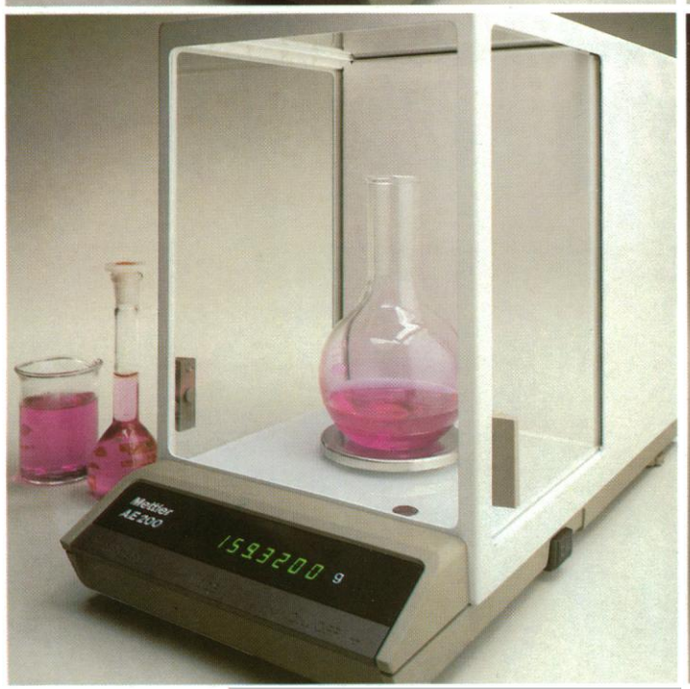

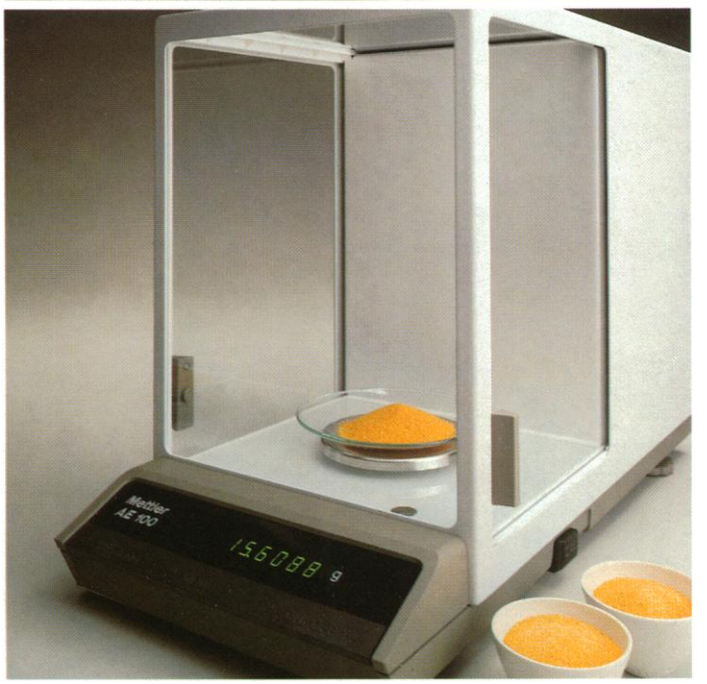

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Deadline: 10 October 1986

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:

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

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