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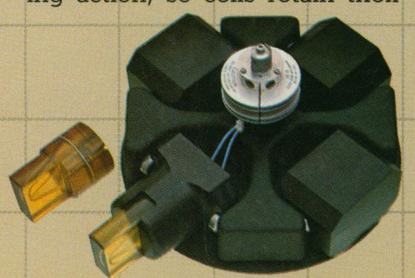

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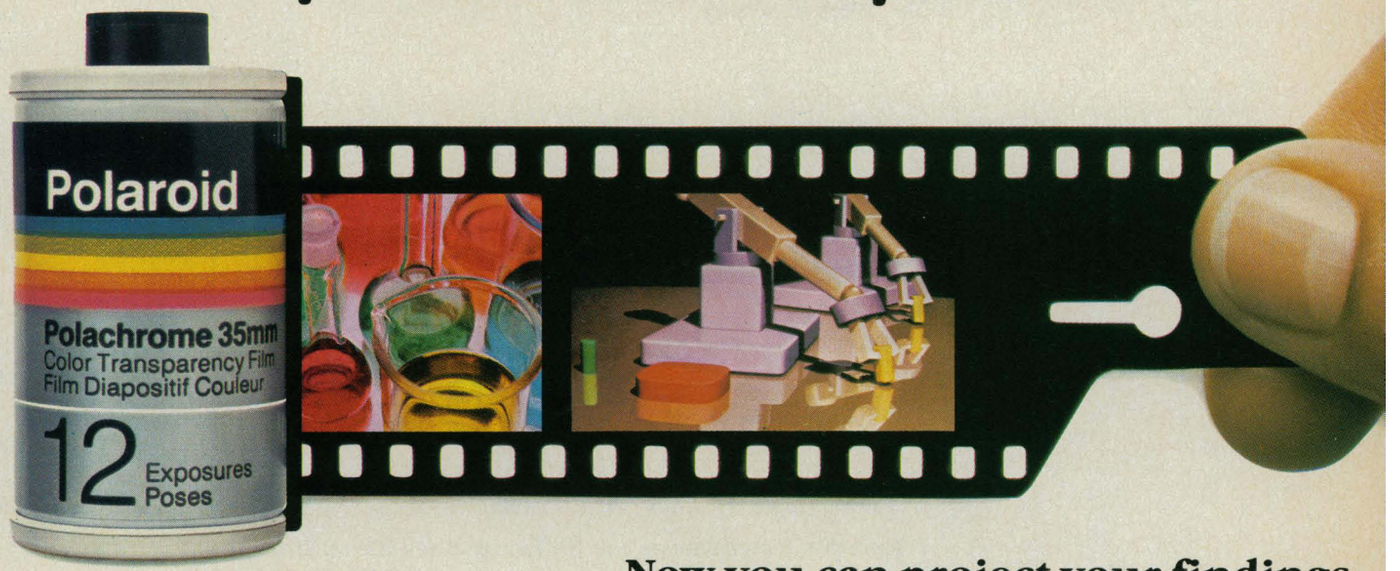

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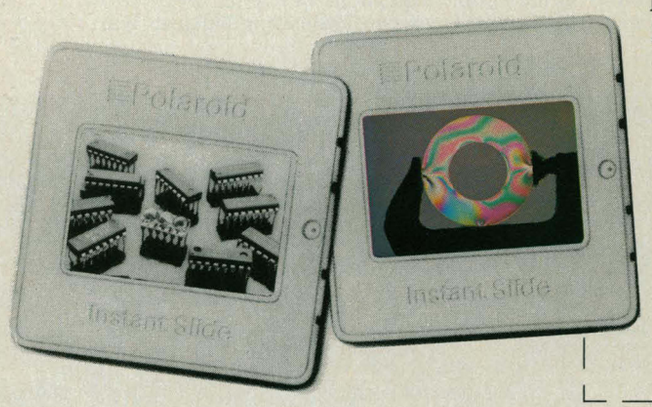

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COVER

Extremely rare tyrosinase-negative albino cat (*cc*) which completely lacks melanin pigmentation. Homozygous albinos (*cc*) and normally pigmented cats which carry the recessive allele for tyrosinase-negative albinism (*Cc*) exhibit congenital visual system defects. One to 2 percent of the human population carries a recessive allele for albinism. See page 1395. [Donnell J. Creel, Veterans Administration Medical Center, Salt Lake City, Utah 84148]

AIDS

As many as 1 million people in the United States are estimated to have been exposed to the AIDS (acquired immune deficiency syndrome) virus (page 1352). As of 9 September, 13,074 cases of AIDS in the United States had been reported to the Centers for Disease Control and 12,000 new cases are forecast for the coming year. Curran *et al.* review the epidemiology and natural history of AIDS, a fatal and infectious disease for which there is not any control. Even before their effectiveness can be documented, community education and counseling programs are being recommended to help prevent further spread of the virus from both symptomatic and asymptomatic carriers to susceptible men, women, and children. Among these are programs to explain why certain sexual practices and the use of contaminated needles increase the risk of acquiring AIDS and why pregnancy should be postponed in women with AIDS virus infections. Also recommended is the institution of compulsory testing of all potential organ, blood, and sperm donors for the presence of antibodies to the virus. Studies that may ultimately contribute to development of an effective drug for AIDS and an AIDS vaccine are under way in many institutions. Results from three laboratories are described in this issue. Hoxie *et al.* found that in culture the virus could grow stably for many months in a subpopulation of blood lymphocytic cells for which the virus naturally has a strong tropism (page 1400). This could be an informative model of natural infections in which a long incubation period separates exposure to virus and disease onset. Rabson *et al.* determined the chromosomal locations of two novel genes that may be specific to the retroviruses grouping to which the AIDS virus belongs (page 1388). Veronese *et al.* characterized the outer envelope component of the virus against which most antibody responses seem to be made in infected individuals (page 1402).

3-D structure of the poliovirus

The complete three-dimensional structure of the poliovirus is now known (page 1358). From x-ray crystallographic analysis, Hogle *et al.* constructed a picture of the virus and discussed how pathogenesis is effected at the molecular level, how this and similar viruses are assembled, and how variants of the virus differ structurally. The results will help in interpreting data already available from other types of studies and in the design of future experiments. Baltimore's Perspective (page 1366) explains how knowledge of the structure can be related to the behavior of the virus and how this provides a basis for future experimental approaches.

Changing a river ecosystem

Immediate alterations in the ecosystem of a pristine arctic river took place as a result of addition of a single limiting resource, phosphorus (page 1383). Peterson *et al.* added phosphate to the Kuparuk River in northern Alaska during a 6-week experiment. The organic carbon cycle of the river was quickly changed. In the undisturbed river, most energy is generated through microbial metabolism of either dissolved organic matter leaching from tundra soil or particulate organic material (peat) eroding from the banks. After phosphorus enrichment, the biota shifted toward photosynthetic organisms that synthesize organic compounds from simple inorganic ones. The biomass of photosynthetic algae on rocks quickly increased by a factor of 10, bacterial growth also accelerated, and insect growth increased as a consequence of the increased algal growth. The dramatic effect of phosphorus was visible downstream—increases in the numbers and relative proportions of species of diatoms (a group of algae) and in the composition of the bacterial community showed photosynthesis to be limited by this single element.

Methane increasing in the atmosphere

Atmospheric methane has increased during the last two centuries; its abundance is now about twice what it was 300 years ago (page 1386). The levels since the 1700's were measured at Siple Station in western Antarctica by Stauffer *et al.* by analysis of gas trapped and preserved within bubbles in a 200-meter-long ice core. The increase in abundance may be contributing to the greenhouse effect. The source of this increase may reflect a combination of greater emissions of methane (through activities of the increasing world population) and removal of less methane by hydroxyl radicals. These radicals serve as sinks for methane but are being depleted by combination with pollutants and with gases emitted during the burning of fuels and biological materials.

Visual anomalies and albinism

From 1 to 2 percent of the human population may have visual anomalies associated with the inheritance from one parent of a recessive allele (one of the alternative forms of a given gene) for albinism (page 1395). True albinism is rare in humans, but the heterozygous state is not. Albinism genes cause visual anomalies, including distortion of the visual field and reduced depth perception, in humans and cats (cover) that are homozygous for this condition. The anomalies can be attributed to the misrouting of an unusually large number of retinal cell axons to the wrong side of the brain, resulting in abnormal representation of the visual field. Leventhal *et al* show by histochemical staining techniques and electrophysiologic measurements that simliar, although less extreme, abnormalities are present in heterozygous pigmented cats that are progeny of one normally pigmented and one albino parent. Similar genetically determined anomalies in humans carrying a recessive allele for albinism may be more widespread than has been assumed.

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LETTERS

The Granting System

In his editorial, "Modest proposals for the granting system" (19 July, p. 231), Daniel E. Koshland, Jr., notes that better priority scores are being awarded, on the average, to the National Institutes of Health grants in 1985 as compared to those in 1975. This is ascribed to attempts by members of panels to outguess the system and help their fellow scientists. From personal experience on one such panel I can say that part of the "score inflation" is due to the fact that many of the weaker applicants have given up, so that the average quality of applications has improved substantially. Not only are we getting stronger applications, but a much smaller fraction of those received is being funded.

Serious consequences are the disruption of good laboratories and the discouragement of the most competent prospective young scientists. The situation can be remedied only with more funds or, in part, by shifting available funds to the support of investigator-initiated applications.

ALFRED NISONOFF

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I applaud Koshland's editorials (21 June, p. 1387; 5 July, p. 9; 19 July, p. 231) on the "gentle changes" that might make the granting–peer-review system more economical and equitable. I am afraid, however, that what we smugly call "peer review" has much in common with the spoils system we claim to want to avoid. Proposals are written with an anxious eye toward those who will be deciding their value. Since those who decide value have their own ideological allegiances, objectivity is a hard commodity to come by. The structure of scientific change has always involved a struggle of the new against the entrenched, and the peer-review system can hardly be expected to be exempt from these dynamics. But we should try to minimize their damages. Some suggestions follow.

First, the principal investigator of a project *owes* it to the academic community to exercise a responsible degree of restraint concerning salary requests. Among the few proposals I have personally been asked to referee, I have seen salary expectations extravagant enough to qualify for Senator Proxmire's "Golden Fleece" awards. When one adds to this largess the overhead percentage that must then flow to the university coffers, the fact that there is not enough money to go around follows as ineluctably as the night the day.

Second, simplifications are needed. Where academics are concerned, the government that governs least is most certainly the one that governs best. The government-academic complex is such a labyrinth of special-interest groups that it is a wonder science is ever accomplished at all. It may be, as Koshland says, that scientists do not feel they write too many proposals. It is most definitely certain that they wish they did not *have* to write so many. Track records should count for far more than specificities in methodology—which, if taken literally, can only prove to be Procrustean beds for the creative process. Besides, detailing what one might know about a subject in 2 years is not only silly and pretentious, it subtracts from time available for real research.

Another small and quite workable way to debrutalize the grant industry is simply to lessen the pressure for *having* a grant. One such pressure is the universal presumption, perhaps an ivory-tower hangover from the Great Society optimisms of the 1960's, that everyone who publishes regularly *does* have a grant. This presumption is reflected in those well-intended but infernal postcard requests for "this and related work"—at the expense of the sender. I am all for the dissemination of research results. But the costs in photoduplications, postage, and sheer address-writing, envelope-licking *time* involved in accommodating hundreds of such requests year after year is burdensome for someone not in the grant-money lane. Peer-review assessments of worth notwithstanding, unfunded researchers continue to do their work and turn out results. Why should those researchers, or their schools, have to underwrite the edification or simple curiosity of the rest of the community? Why not apply the same standards of consumer responsibility that every other aspect of life demands to the information business and require that one pay for what one gets?

There are two ready possibilities for implementation. One would be reasonable postage-and-handling charges made out to the researcher's place of affiliation. Another would be for journals to direct reprint requests to themselves for a profit-yielding charge. The second alternative would have the double benefit of easing the considerable financial stress under which most journals seem perpetually to operate, while relieving

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Biotechnology and the Biosphere

There may be another dimension to the case of the ice-nucleating bacterium *Pseudomonas syringae* that was not mentioned in Gina Kolata's article "How safe are engineered organisms?" (Research News, 5 July, p. 34). According to Russell Schnell (*1*) of the National Oceanic and Atmospheric Administration Laboratory in Boulder, Colorado, *Pseudomonas syringae* enhances rainfall. It seems that the lipoprotein coats of this and other species of bacteria found on plants and in detritus when shed and wafted up into the clouds form ideal nuclei for ice formation that is absolutely necessary for rain to fall. Furthermore, contrary to what was previously thought, recent studies show that particles without organic materials derived from bacteria and plants (that is, "clean dust") are useless as nuclei for the formation of raindrops (raising the possibility that the Sahel drought could be prolonged by the absence of organic nuclei).

If *Pseudomonas syringae* does indeed have a beneficial role in enhancing rainfall, then the ecologist's concern about possible secondary or indirect effects of releases of genetically altered organisms is vindicated—incredibly, at the very first major controversy over release of engineered organisms. To the agriculturist the ice-nucleating bacteria are viewed only as pests, something to destroy or at least neutralize. But before such action is taken we should try to find out if the organisms in question have other functions that are of redeeming value. Reduction in rainfall due to lack of ice-nucleating capacity could be a lot worse than crop loss due to frost. At least we ought to consider such possibilities and assess indirect as well as direct impacts before we conclude that the alteration is "benign" (as inferred for current proposals in Kolata's article). Essentially, this is the position of the ecologist when it comes to proposals for genetic alteration in open systems; it is not an "alarmist" position but just commonsense caution when one is dealing with complex environmental systems that are poorly understood.

Since microorganisms play major roles in maintaining earth's life-support systems, we need to be especially careful about tinkering with decomposition and other recycling processes. Unlike the life-support system of a spacecraft, which is mechanical and man-made, the biosphere is bioregenerative and self-regulating. Since we did not build it we don't know much about how it really works, and we have shown little interest in studying it at the necessary large scale until recently, when malfunctions have begun to appear due to human impacts. The case of the ice-nucleating bacteria is an excellent example of the need for a more holistic assessment that allows for consideration of roles and functions other than the one that seems undesirable.

What is needed now is a reasonable procedure for assessment at the ecosystem level that leans to the side of caution when there are a lot of unknowns. Accordingly, there is urgent need for increased support for research in environmental microbiology (that is, microbial ecology) and ecosystem science.

One consequence of the industrialization of agriculture is that food tends to become a market commodity rather than something to nourish us (that is, a life-support necessity). While a strong market economy is necessary for efficient food production, enthusiasm for biotechnology should not lead us to treat all organisms merely as "commodities" to be manipulated for short-term economic gain when there are nonmarket values and long-term consequences to be considered.

It is high time we became concerned with the health of the biosphere. A new technology for benefit-cost assessment could balance in an objective manner the short-term economic (market) benefits and the long-term costs in terms of damage to nonmarket goods and services that might be affected by proposed alterations. Advances in biotechnology should be accompanied by advances in the technology of ecosystem impact assessment if we are to minimize mistakes and disappointments.

EUGENE P. ODUM
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References

1. S. Weisburd and J. Raloff, *Science News* **127**, 282 (1985).

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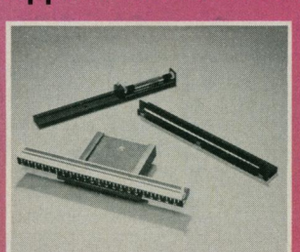
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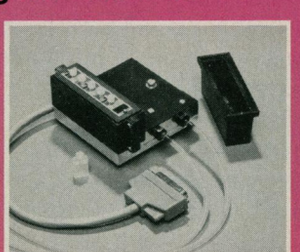
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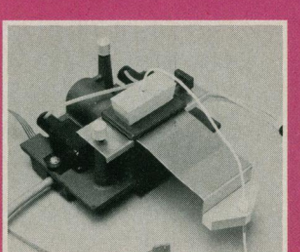
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Large dual-range meters	–	Y	Y	Y	Y	Y
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Safety Interlock	–	–	Y	Y	Y	Y
Electrical Safety	Y	Y	Y	Y	Y	Y
Adapts to any cell	Y	Y	Y	Y	Y	Y
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Constant Power (W)*	–	200	300	30	–	200
Voltage Limit Control	–	Opt	Opt	–	–	Y
IEF Endpoint Detection	Y	–	–	Y	–	–
Automatic crossover	–	Opt	Opt	Y	–	Y
Digital LED readout	–	–	–	Y	Y	–
Large dual-range meters	–	Y	Y	–	–	Y
Hi-lo range switching	–	Y	Y	–	–	Y
Safety Interlock	Y	Y	Y	Y	Y	Y
Electrical Safety	Y	Y	Y	Y	Y	Y
Adapts to any cell	Y	Y	Y	Y	Y	Y
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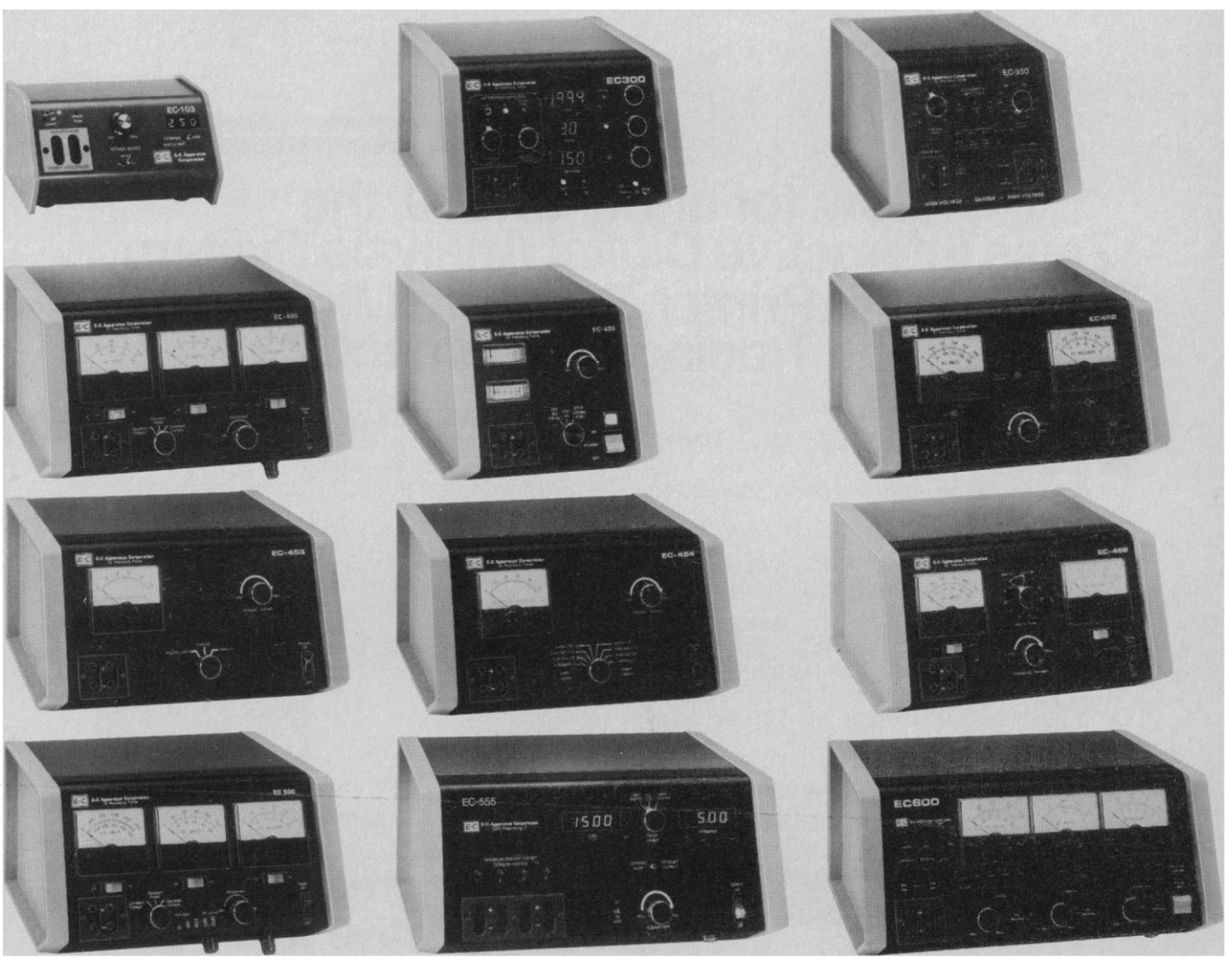
(*)=maximum (†) not Constant



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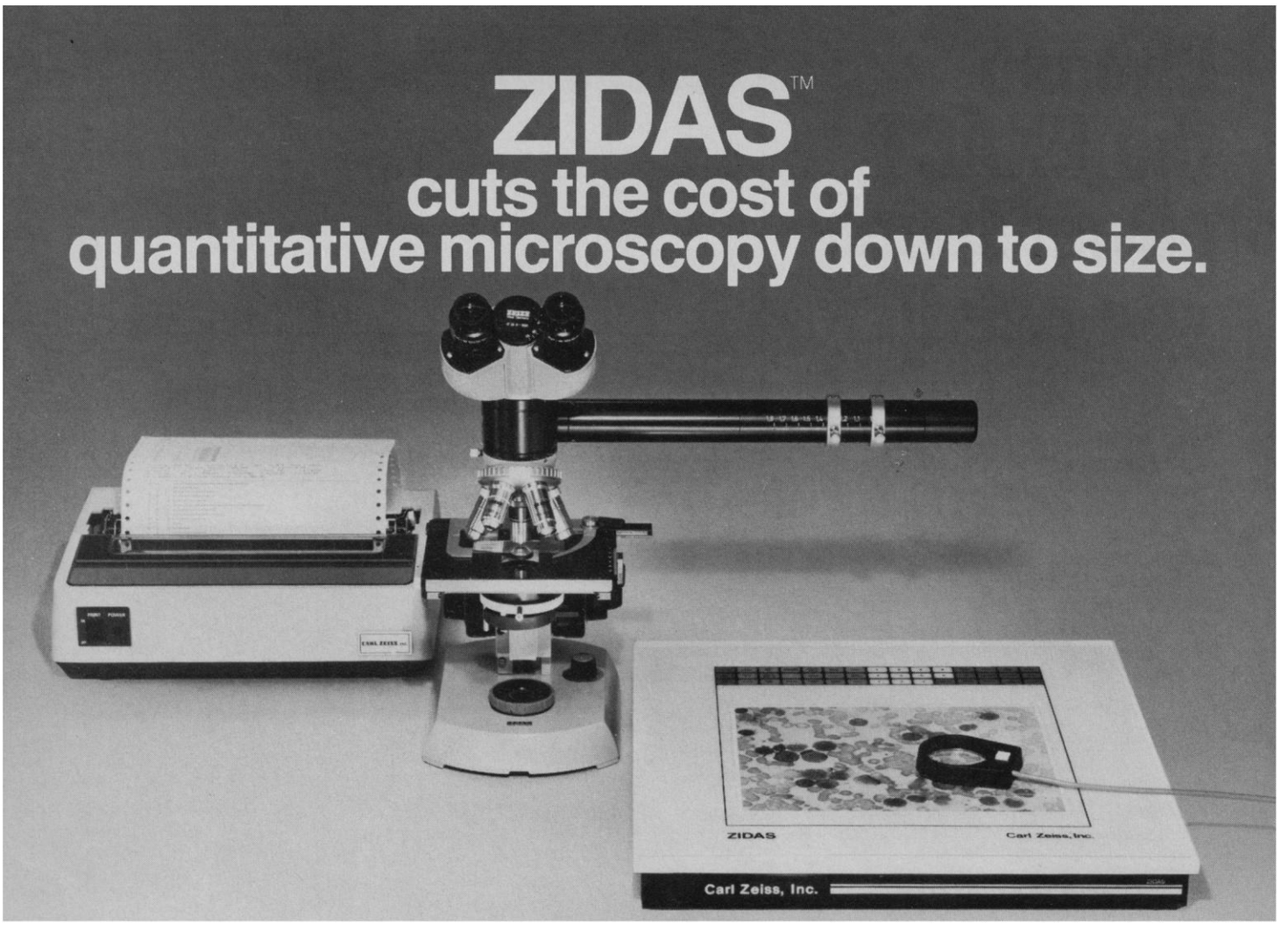

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27 September 1985, Volume 229, Number 4720 SCIENCE

Use of and Research on Pheromones

This editorial was written in response to the stimulus of an interesting symposium on pheromones and to stories in the media about a large-scale infestation of gypsy moths in northeastern United States. The symposium, held at the annual meeting of the AAAS, dealt with some of the current frontiers of research on the physiology and regulation of pheromones.* Enthusiasm of the participants was contagious and led to a scan of some of the literature and to a telephone stroll to tap the knowledge and judgment of some of the leaders in the field.

During the past 20 years, more than 1000 insect sex attractants have been identified. Many have been synthesized in the laboratory and tested. The pheromones of some of the insects are single, optically active compounds. Other pheromones are made up of closely controlled mixtures of several compounds. Sometimes both enantiomers of a compound are employed, but in other cases a racemic mixture is ineffective.

The early enthusiasm about the use of pheromones to control insect populations has dwindled. Although there is a consensus that pheromones are excellent baits for traps, their successful application has been largely confined to monitoring, for which they are highly useful. Experience with the gypsy moth in the Northeast is illustrative. In the area of maximum infestation, populations of moths greater than 10,000 per hectare have been noted. When a female moth emerges, she is close to a large number of males. Under these circumstances, almost all the females are mated before they can begin to emit pheromones. Therefore, the use of the attractant in traps is of little help. In contrast, when populations of gypsy moths are limited, the attractant has a major role. Today the Department of Agriculture maintains 400,000 traps in areas of the country that are currently not infested. These have served an alerting function that has led to eradication or control of local infestations.

A notable success in control of agricultural pests has involved the use of a pheromone for monitoring and trapping coupled with application of pesticides. In North and South Carolina, cotton farmers participate in a program against the boll weevil. The numbers of insects are monitored in 250,000 traps, and insecticides are applied only when needed to hold down the population. As a result, the amount of fertilizer used has been decreased by about 70 percent, and costs of control have dropped.

Infestation of conifers by beetles leads to large-scale destruction of trees. In forests, the use of pesticides is not practical, and the best hope is trapping, disruption of the beetles' behavior by the use of attractants or repellents, or fostering natural enemies of the beetles, including predators and pathogens. Large-scale use of pheromones in about a million traps in forests in Norway and Sweden during a massive infestation by spruce beetles was accompanied by a decrease in the number of insects, but experts are unsure about the relative roles of traps and natural enemies.

Some of the current research frontiers include studies of modes of biosynthesis of pheromones, mechanisms of their modes of action, and attempts to discover amines that mimic in structure natural neuroamines employed by insects. Some of the questions being asked are: What are the pathways of synthesis of pheromones? How do genes regulate specific blends? What are the genetic controls on reception and perception? Is the system tightly controlled or plastic? Can the pheromone system mutate? When a male moth is flying on the plume of a pheromone emitted by a female, the sensory detection apparatus must be very efficient, and once a molecule has been detected, the molecule must be destroyed if sensitivity is to be maintained. Studies with a moth that uses an ester have shown that the sensors contain an esterase that quickly degrades the ester. Are related phenomena active in other insects?—PHILIP H. ABELSON

*"Bio-organic Chemistry of Insect Hormones and Pheromones," symposium arranged by G. D. Prestwick at the AAAS annual meeting, Los Angeles, Calif., 29 May 1985.

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