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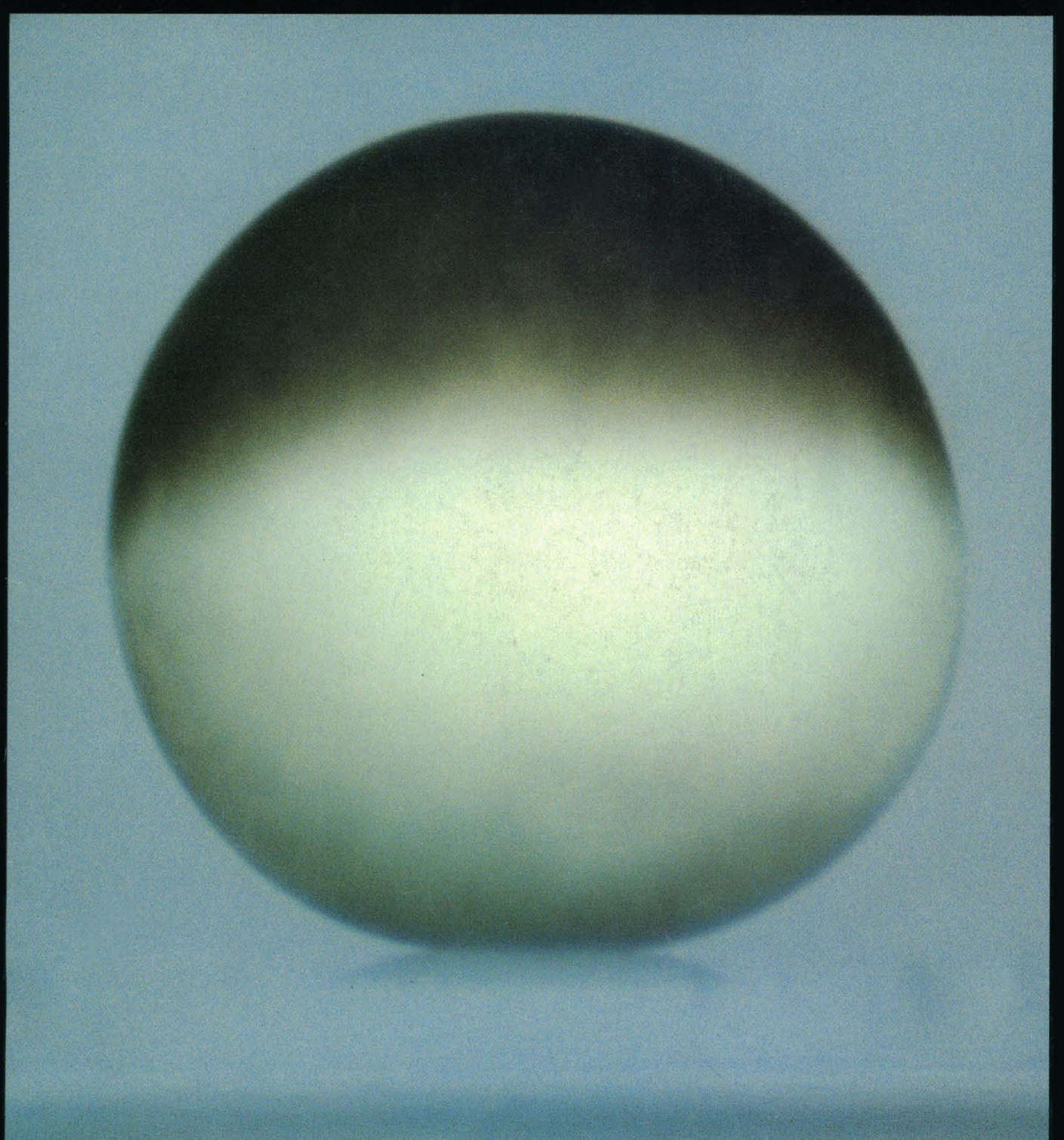

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COVER An egg of the frog, *Xenopus*, previously injected with messenger RNA for the M1 muscarinic acetylcholine receptor, undergoing cortical contraction after exposure to acetylcholine. Application of acetylcholine after introduction of the receptor into the egg membrane initiates this and other responses similar to those normally initiated by sperm (×110). See page 464. [Douglas Kline, University of Connecticut Health Center, Farmington, CT 06032]

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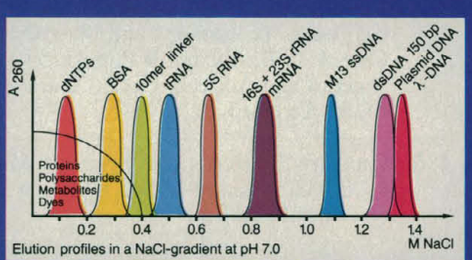

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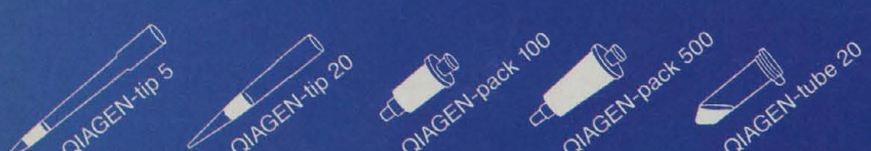

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This Week in SCIENCE

Antarctic ozone hole

How much extra radiation from the sun hits Antarctica as a result of the ozone hole, and how does the solar irradiance there compare with the amount of ultraviolet light reaching the earth elsewhere? Each year in September (the start of spring in the Southern Hemisphere), the ozone hole begins to develop, in October ozone levels drop to a minimum, and in November the hole dissipates. Frederick and Snell calculated and compared ultraviolet irradiance at the earth's surface at McMurdo Station in Antarctica and levels at Miami, Florida, which is representative of a low to mid-latitude location (page 438). At McMurdo Station the sun is low in the sky (and has a high zenith angle), whereas over Miami the sun is high (and has a low zenith angle); thus, even when the ozone levels are most depleted, the amount of ultraviolet radiation reaching Antarctica is not much different from the amount that hits Miami at the summer solstice. Nonetheless, the increased radiation over Antarctica and the effective "longer summer" brought on by the ozone hole may cause problems for indigenous plants and animals that have adapted to a different environment.

Gulf Stream in the glacial age

First, a thick continental ice sheet formed, altering atmospheric circulation and global wind patterns; this led to a shifting of polar waters southward, causing the North Atlantic sea-surface temperature to cool, and, as a marker of these changes, the Gulf Stream flowed almost straight eastward toward Gibraltar (page 440). This is the sequence of events that, according to the atmospheric model of Keffer *et al.*, changed the global climate during the last ice age, which reached a maximum 18,000 years ago. The Gulf Stream today flows southwest to northeast from Hatteras off the Carolinas to the Norwegian Sea; the Gulf Stream and its extension, the North Atlantic Current system, demarcate the boundary between circulation patterns in the northern ocean (the subpolar gyre) and the more southern subtropical gyre. According to the model, the role of the ocean in the initiation of continental glaciation was a passive one.

Heart and sole

Eskimos in Greenland and villagers living in fishing communities in Holland and Japan have especially low incidences of cardiovascular disease; the fish oil in their diets has been credited with this health advantage. Fox and DiCorleto propose that when fish oils are ingested, plasma lipids are modified and then inhibit the production of a protein, platelet-derived growth factor–like protein (PDGFc), by endothelial cells (page 453). This proposal is supported by a study of the in vitro effects of fish oil extracts on endothelial cells, the cells in the artery wall that act as conduits for the exchange of material and information between the blood and the tissues. Endothelial cells that were treated with a fish oil extract stopped making PDGF. In vitro PDGF stimulates smooth muscle cell proliferation, and, therefore, if PDGF were inactivated in vivo, the proliferation of smooth muscle cells might be reduced; as a result, blood vessels would not thicken as they do in atherosclerosis and other cardiovascular diseases.

Fertilization events

Biochemical events that take place at the time of fertilization are similar to those that occur when a cell is activated by a neurotransmitter, a hormone, or light. This has been illustrated by experiments in which receptors for neurotransmitter are inserted into oocyte membranes (page 464). Messenger RNA molecules for one of two neurotransmitter receptors were injected into oocytes and, within a few days, the receptors were expressed on the oocyte surface. After the oocytes had been matured to eggs (a process brought about by addition of the hormone progesterone), stimulation of the egg with the matched neurotransmitter induced several electrophysiologic and morphologic phenomena that usually accompany fertilization (cover). Kline *et al.* propose that the neurotransmitters (experimentally) and the sperm (naturally) bind to receptors on the surface of the oocytes and cause an interaction with G proteins in the egg (by analogy with reactions that take place after other neurotransmitter-receptor interactions) that initiates the series of steps that produces activation.

Ecdysone as insecticide

The actions of ecdysone, the steroid hormone that induces molting in many invertebrates, can be mimicked with the insecticide RH 5849 (pages 467 and 470). Wing and colleagues report that, in cultured *Drosophila* cells and cell extracts and in larvae of tobacco hornworms, the actions of RH 5849 and ecdysone are qualitatively the same, and RH 5849 binds competitively to the ecdysone receptor. In the tobacco hornworms, RH 5849 was even more potent than ecdysone in inducing molting, either because it is more efficiently absorbed, more easily transported, or more stable than the natural hormone. Because RH 5849 can induce a premature and lethal molt, it or analogs could prove to be powerful "third generation" insecticides. In addition, these new nonsteroid substances are easier to synthesize than steroids and should be of use in studying the mode of action of ecdysone and the structure, function, and distribution patterns of ecdysone receptors.

The bottom lines

Black holes are now filling the silver screen. A simulation with the Cornell University supercomputer shows sequential stages by which clusters of movie stars collapse to form black holes (page 421).

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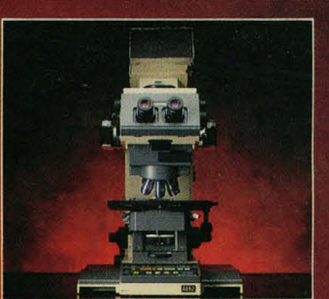

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SCIENCE

22 JULY 1988
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Space Science: Past and Future

A symposium and a substantial number of recent publications have provided a basis for estimating the past performance and the prognosis for the U.S. space effort (see Research News, 8 July, p. 162). Once this country enjoyed enormous prestige for both its manned presence in space and its excellent scientific achievements. Its present position and its future status are less favorable. A crucial weakness in the NASA program has been excessive emphasis on man in space. The great adventure of visits to the moon won universal attention and admiration. But in this era and in the future, repeated travel to a space station near the earth becomes monotonous, with excitement mainly stirred by stunts and by the possibility of a tragic accident. A principal justification for the space station, then, is its potential role in scientific and biomedical research. That is not negligible, but it does not match the past accomplishments of unmanned missions or their potential if unleashed. The robotic missions are much less costly, are flexible, can be conducted more rapidly, and can probe phenomena inaccessible to the human presence. They have a superior record of leading to practical applications and will probably stir increased interest as concern about the environment mounts.

In terms of prestige and science and engineering, the planetary missions were exemplary. That was particularly true of the Voyager missions. The engineering achievements involved in the Voyagers were magnificent, including durability of the craft, their flexibility in responding to earth-borne commands, and the capability of the system to convey information to distant earth.

For the present and the future, some of the most important observations from space will relate to the earth and sun. Changes in stratospheric ozone and potential greenhouse phenomena urgently require steady monitoring. Observations of ocean currents that give rise to El Niño and related climate and weather phenomena are of practical importance. Changes in vegetation worldwide can best be followed by sensors on satellites. Phenomena in the sun and solar-terrestrial relations will be of enduring importance.

The capabilities of satellite sensors are impressive. They can be used to obtain vertical temperature profiles in the atmosphere and to determine concentrations of many important trace gases in the atmosphere and their variations with altitude. Visible and near-infrared imagery are important in weather forecasting as well as in the estimation of marine resources. A striking example of the potential of a space mission in physical science is the Laser Geodynamics Satellite, which was built at a cost of $6 million (1987 dollars). Reflectors allow ground-based lasers to track the position of the object with centimeter accuracy. This capability has led to improved knowledge of post-glacial rebound and of electromagnetic coupling between core and mantle.

In following developments regarding the atmosphere and oceans, it is desirable to maintain time series of measurements. The outlook for some of the most important observations is chancy. We are highly dependent on the Nimbus 7 satellite that has long outlived its expected usefulness. A gap in ocean color observations has already occurred, owing to termination of the coastal zone color scanner measurements on Nimbus 7. Global stratospheric ozone measurements with high spatial resolution are also likely to become unavailable. No firm plans have been made for a follow-on mission to the Nimbus 7 total ozone mapping spectrometer.

Earlier, when operation of the space shuttle was expected, our great national capability of expendable launch vehicles was destroyed. Launches of satellites were assigned to the shuttle. This led to delays and to costly extra requirements for quality control.

In the future, major U.S. earth monitoring activities will involve polar orbiters, but these have not yet been included in the budget. Present indications are that these satellites will not be launched before the late 1990s. In the meantime, other countries are proceeding with a variety of programs for earth observations, and they will provide strong competition for leadership in the field. The United States has embarked on a program of restoring its launch capabilities. That effort should be expedited, and correspondingly faster schedules of unmanned missions should be established.—PHILIP H. ABELSON

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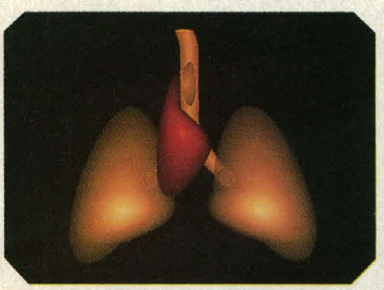

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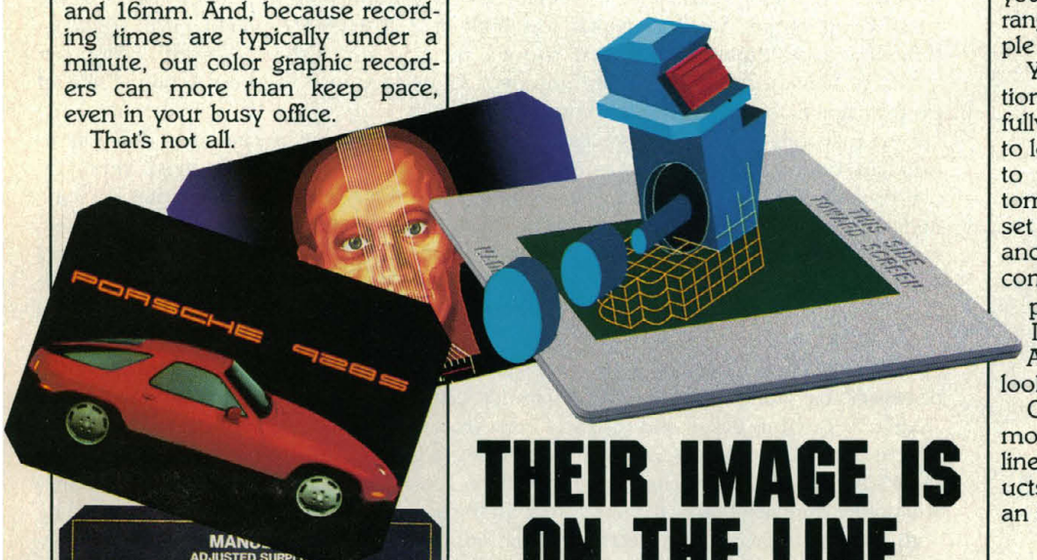

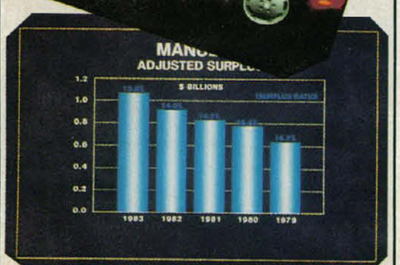

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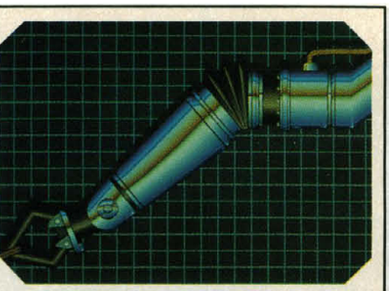

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women is about twice that in men. The actively metabolizing tissue is the lean body mass, and an experiment carried out by medical students in this university on themselves showed that sex differences in resting oxygen consumption when related to surface area, and of the order of those given by Fischer, disappeared when expressed in terms of lean body mass (*2*).

DONALD S. MCLAREN
Department of Medicine,
University of Edinburgh,
The Royal Infirmary,
Edinburgh, Scotland EH3 9YW

1. M. Kleiber, *The Fire of Life: An Introduction to Animal Energetics* (Krieger, Huntington NY, 1975).
2. M. G. MacMillan, C. M. Reid, M. Shirling, R. Passmore *Lancet* **i**, 728 (1965).

Dolphin Research

I write in response to the article "The social lives of dolphins" by William Booth (Research News, 3 June, p. 1273). First, the last sentence of the article mistakenly attributes to me the idea that "large brains may have something to do with the amount of sexual behavior that is pursued outside of any reproductive context." This was not my idea. Second, Booth implies a disagreement between myself and Randy Wells concerning comparisons between primate and dolphin social systems. We do not disagree; I concur with Wells that dolphin-terrestrial mammal comparisons should proceed on a broad front and not focus exclusively on chimpanzees or any other single species. Finally, Andrew Richards is the unnamed "third graduate student" mentioned in paragraph 7 of the article. He has been closely associated with the Shark Bay dolphin research for 5 years.

BARBARA SMUTS
Departments of Psychology
and *Anthroplogy, University of Michigan,*
Ann Arbor, MI 48109-1346

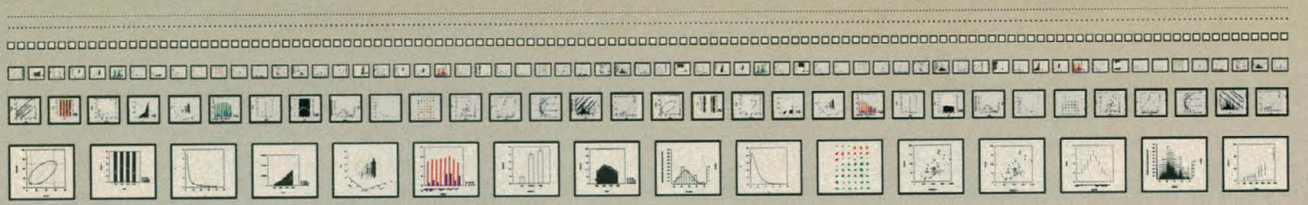
Is *Science* "Gender-Blind"?

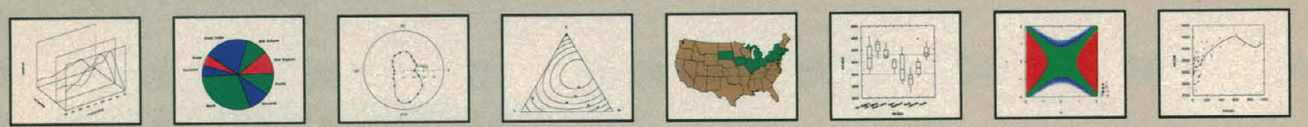
In response to Daniel E. Koshland, Jr.'s editorial "Women in science" (25 Mar., p. 1473), I would like to point out yet another way in which the scientific community ignores the value of women members—by limiting their participation on editorial boards and boards of reviewing editors (25 Mar., p. 1469). Koshland is correct when he states that the "old boys" system "has been only partly eradicated": only 8% of the *Science* boards' members are women. I would bet that the percentage of women actually reviewing manuscripts is much greater. Women don't choose to sit in the wings; they are an untapped resource. Women don't need role models; they need opportunities.

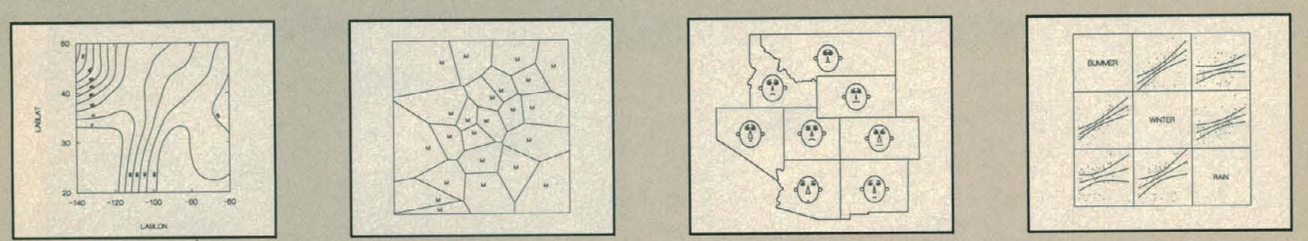
BERNADINE J. WISNIESKI
Department of Microbiology,
University of California,
Los Angeles, CA 90024

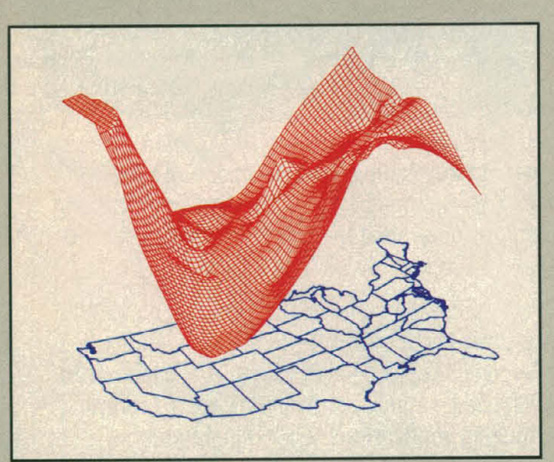
Response: The main point of my editorial was that we should increase the representation of women in the scientific community. We checked our reviewers for the past 3 months as a result of Wisnieski's letter and found the number of women to be 10%. It is noteworthy that both this number and the percentage of women on our boards are comparable to or slightly higher than the percentage of women on U.S. science faculties (for example, women make up 4% of U.S. chemistry faculties). If the total number of women scientists increases, these percentages will undoubtedly go up.

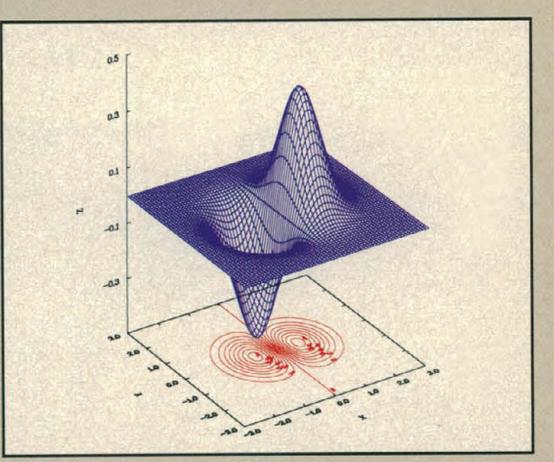
—DANIEL E. KOSHLAND, JR.











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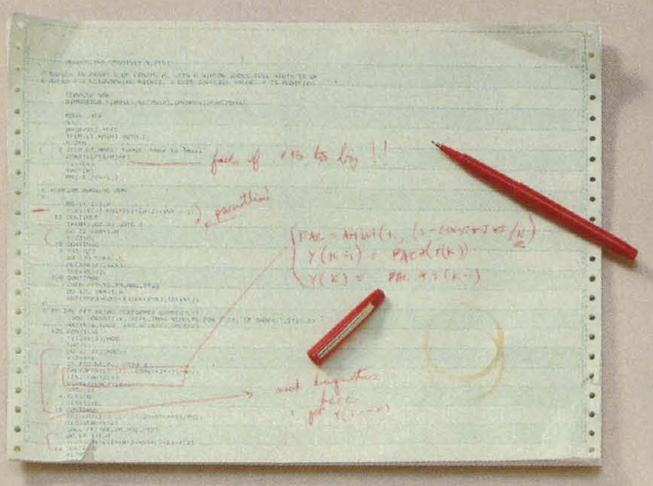

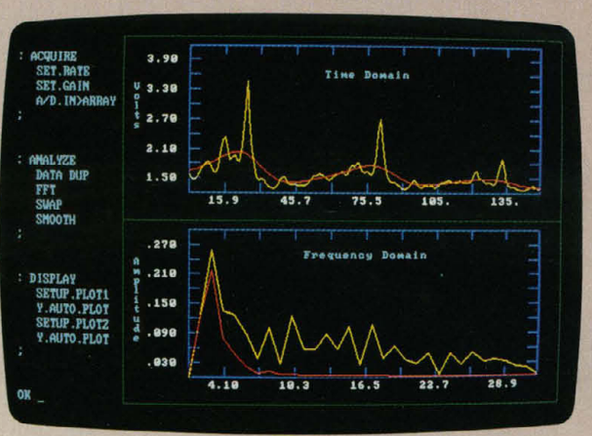

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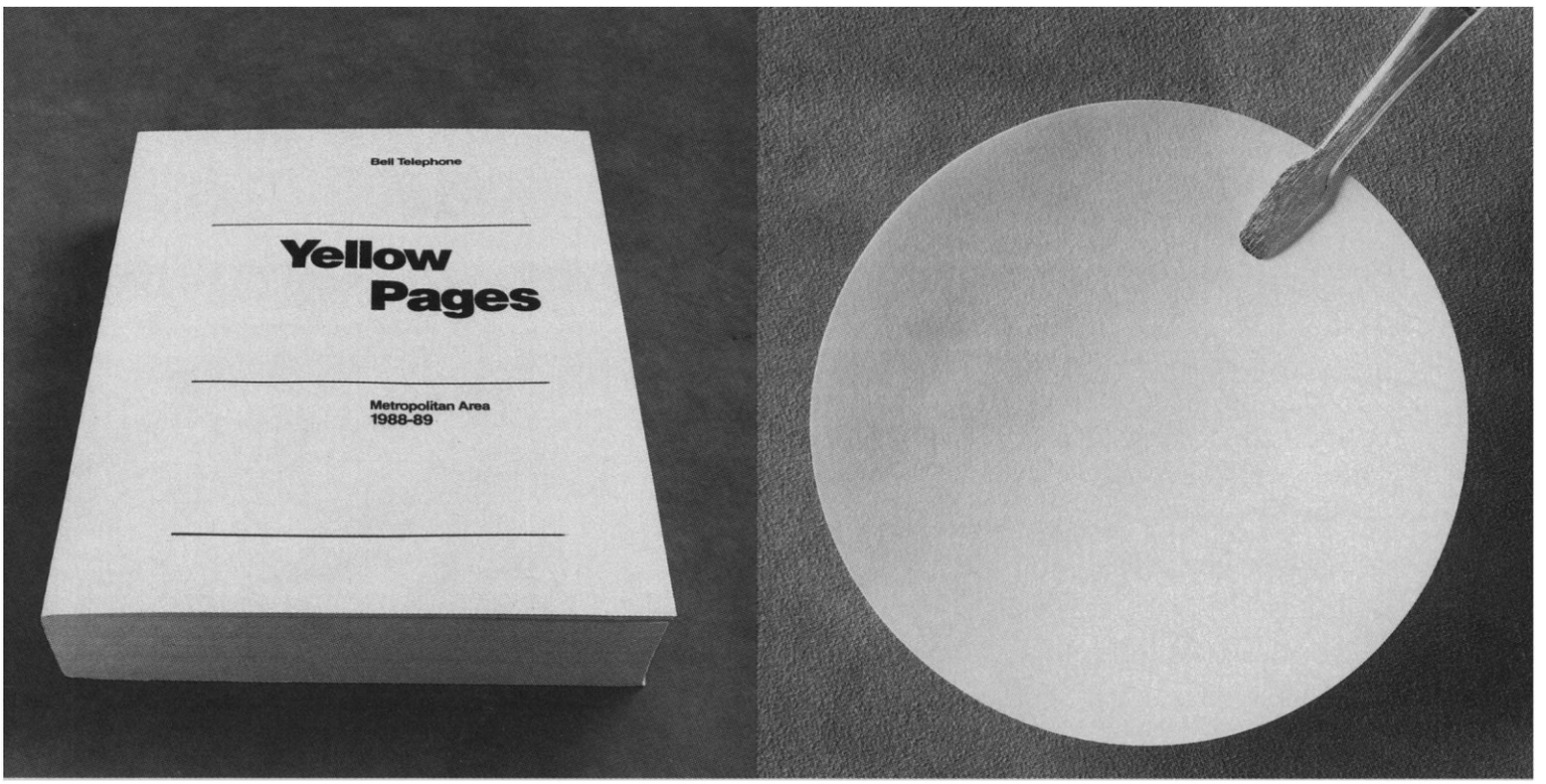

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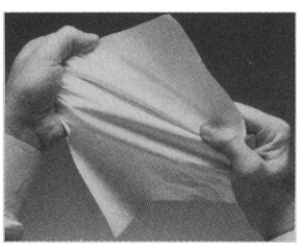

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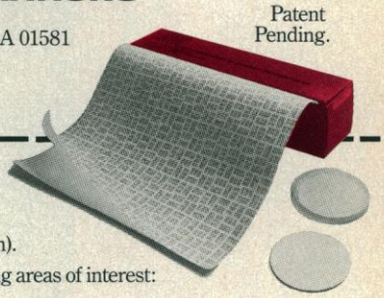

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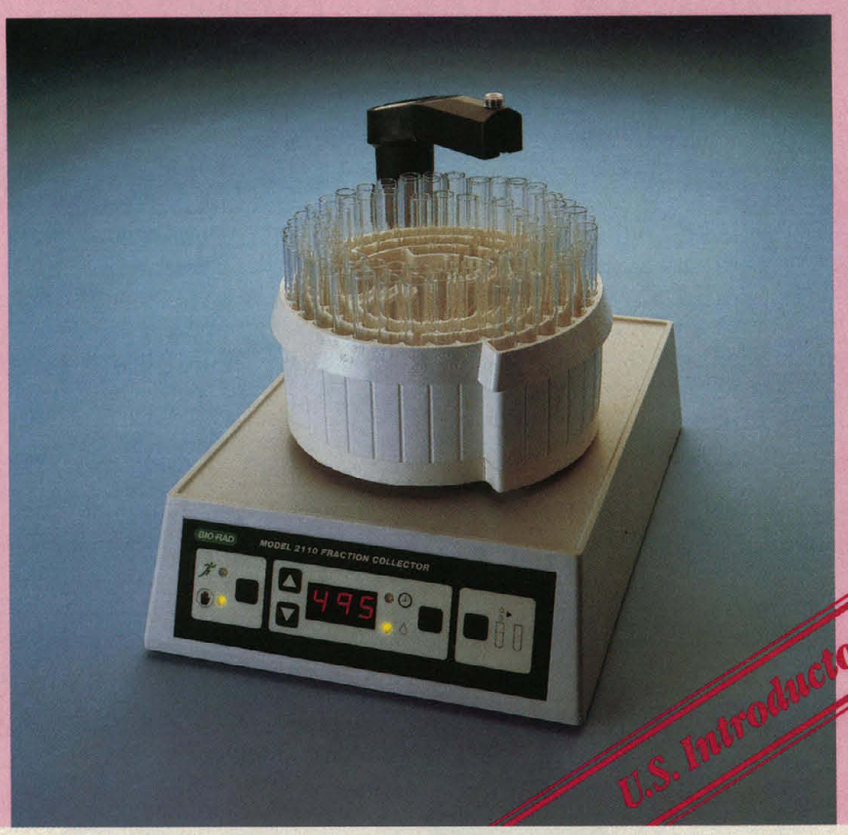

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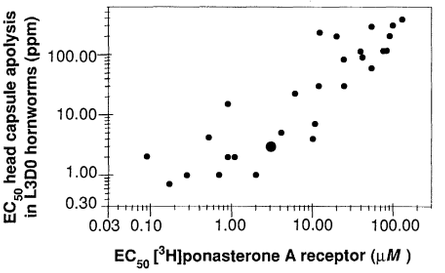

Fig. 4. Relation of apparent K_c cell ecdysteroid receptor affinity and induction of premature molting in L3D0 *M. sexta* larvae for 28 RH 5849 analogs. [^{3}H]Ponasterone A receptor displacement assays were as described (*1*). Premature molt induction of L3D0 *M. sexta* was measured by admixing different concentrations of analogs in 0.5% DMSO:acetone (1:1) into artificial diet, then allowing the larvae to feed for 48 hours (ten individuals per treatment). The concentration to elicit a 50% of maximal response (ED_{50}) was determined by plotting percentage of the treatment population bearing a prematurely slipped head capsule as a function of dose in the diet. The linear relation is highly significant ($P < 0.001$). The enlarged data point represents RH 5849.

nists may exert a negative feedback inhibition on hormone biosynthesis, as has been suggested for *Pieris brassicae* pupae (*10*).

We have observed the induction of premature head capsule apolysis by RH 5849 in all larval stages of *M. sexta*. This phenomenon has also been observed in larval Lepidoptera of the families Noctuidae, Pyralidae, and Pieridae. RH 5849 controls dipteran larvae (both houseflies and mosquitoes) and certain coleopteran larvae and has been shown to inhibit ovariole development in all three orders (*11*). This latter activity is consistent with its putative ecdysonergic mechanism of action (*12*).

The 1,2-diacyl-1-alkylhydrazines are thus a novel class of "ecdysonoids" and are representative members of the third generation insecticides having their genesis in insect hormones (*13*). C. M. Williams coined the term "hyperecdysonism," an experimentally induced state first described in *Samia cynthia* pupae (*14*); clearly, many of the phenomena reported here for RH 5849 are aptly described by this term. Other modes of action may be encountered in these compounds; for example, we have noted significant neurotoxic symptoms in certain Coleoptera in vivo and housefly larval muscle in vitro (*15*). However, it is clear that RH 5849 and its analogs are behaving as nonsteroidal ecdysone agonists in *Drosophila* K_c cells and in hornworm larvae, and it is anticipated that these findings may be extended to other invertebrate systems utilizing ecdysones.

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