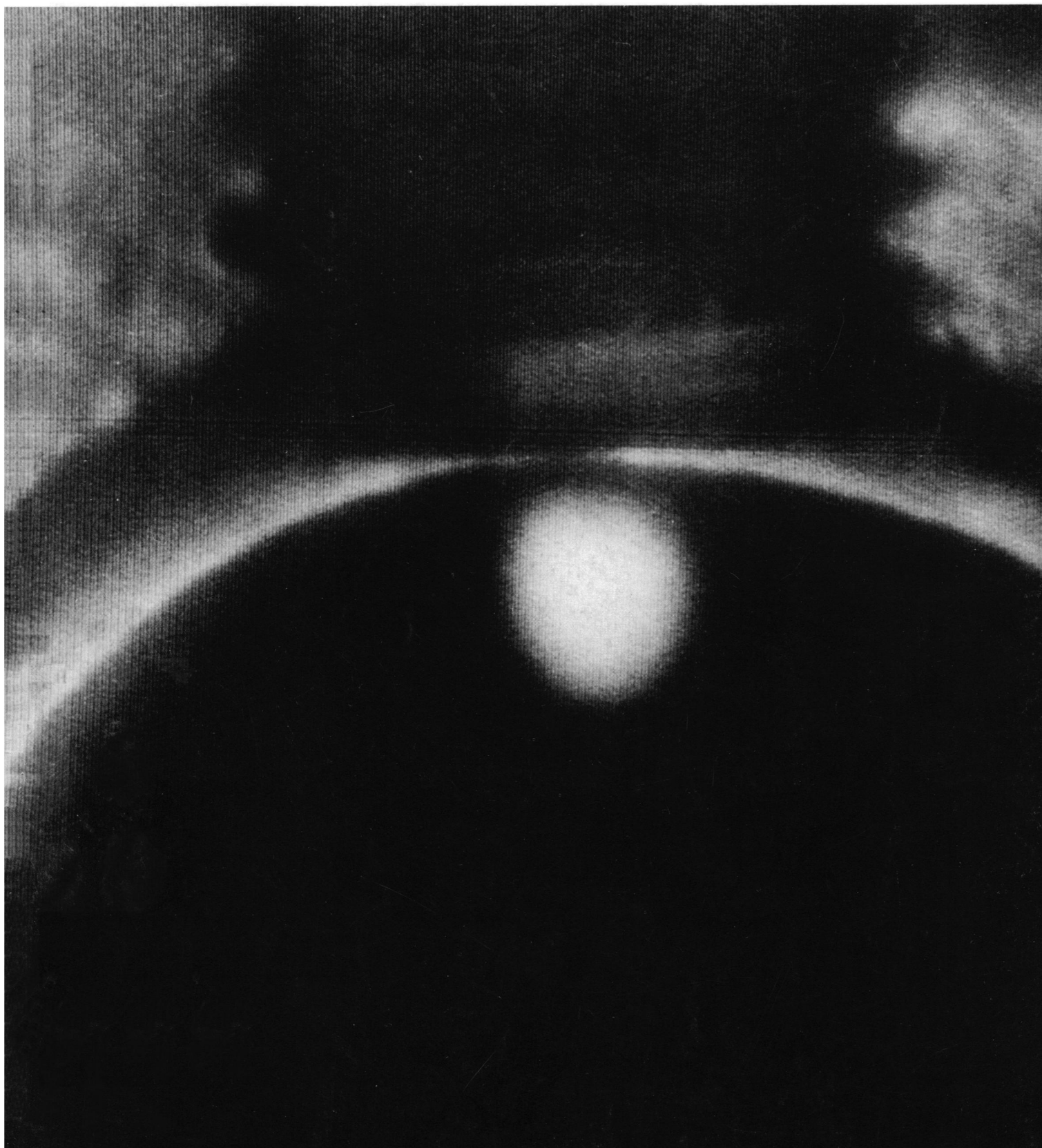


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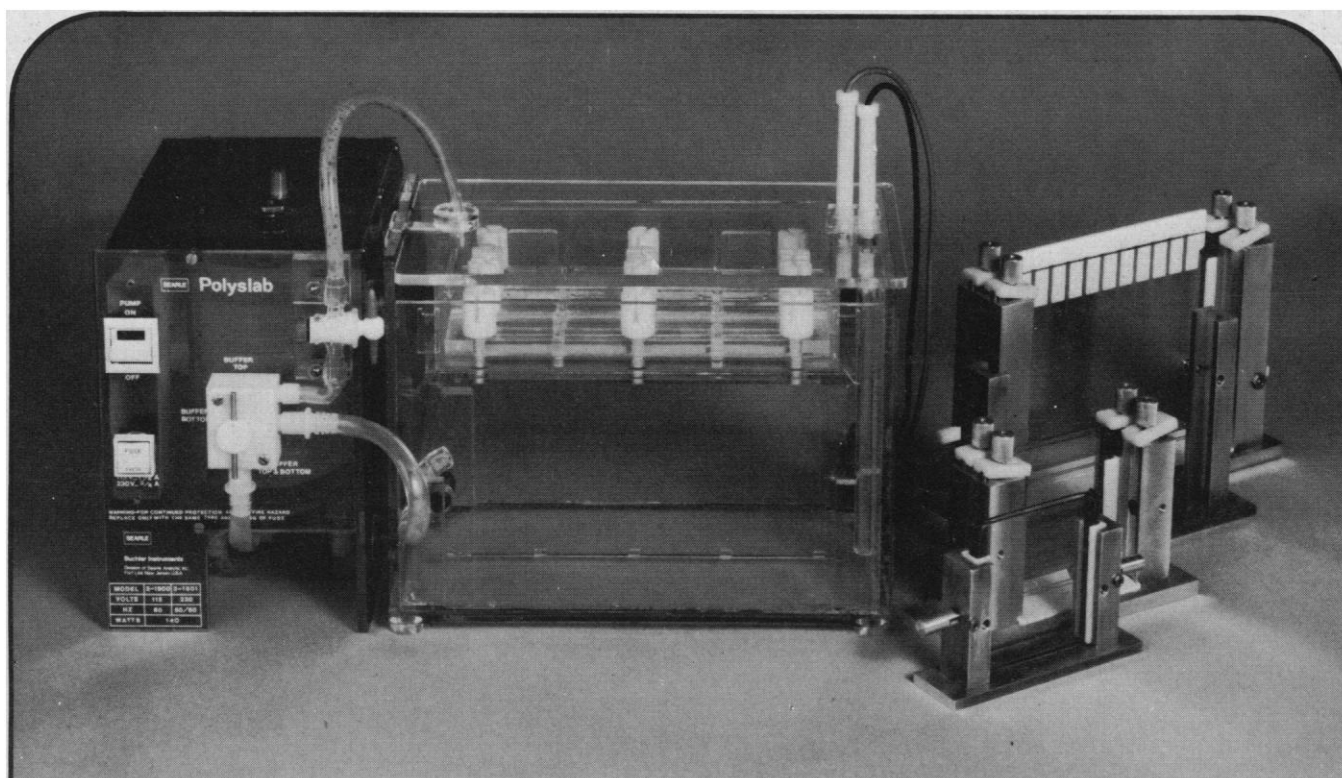


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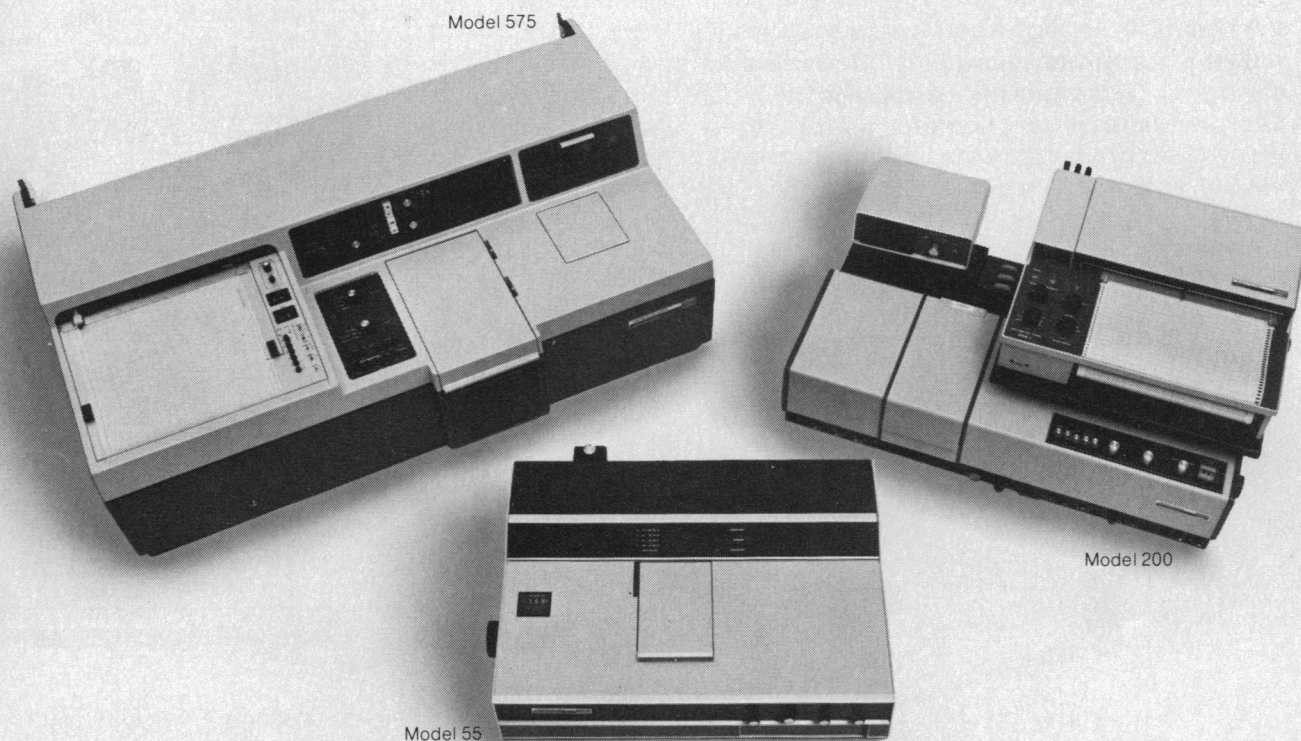
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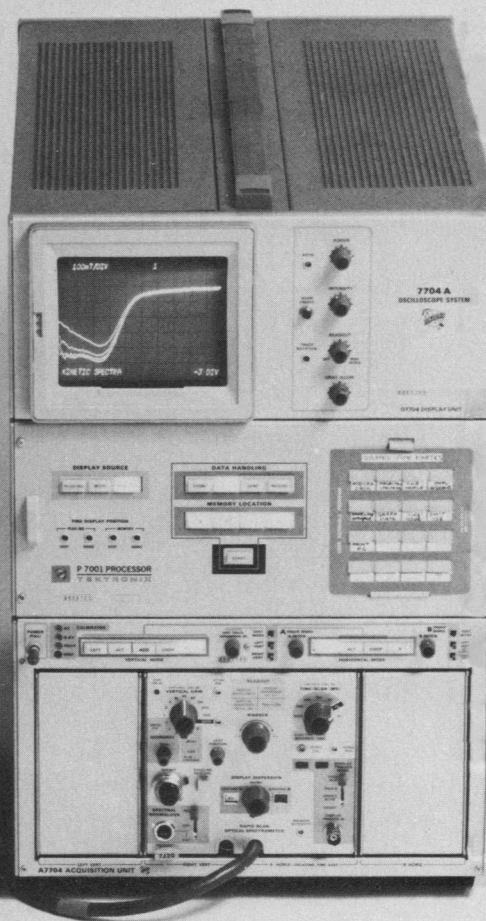
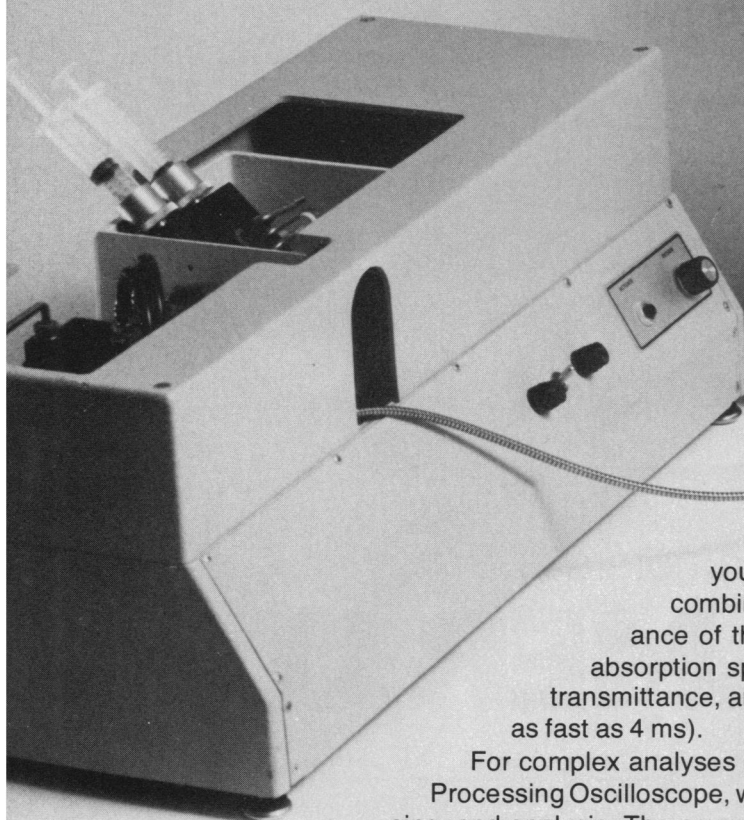
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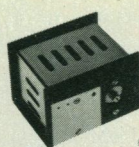
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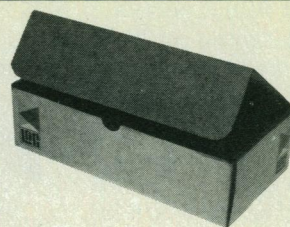
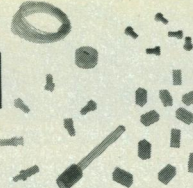


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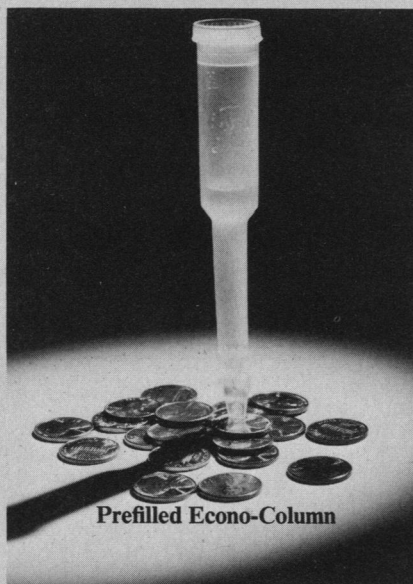
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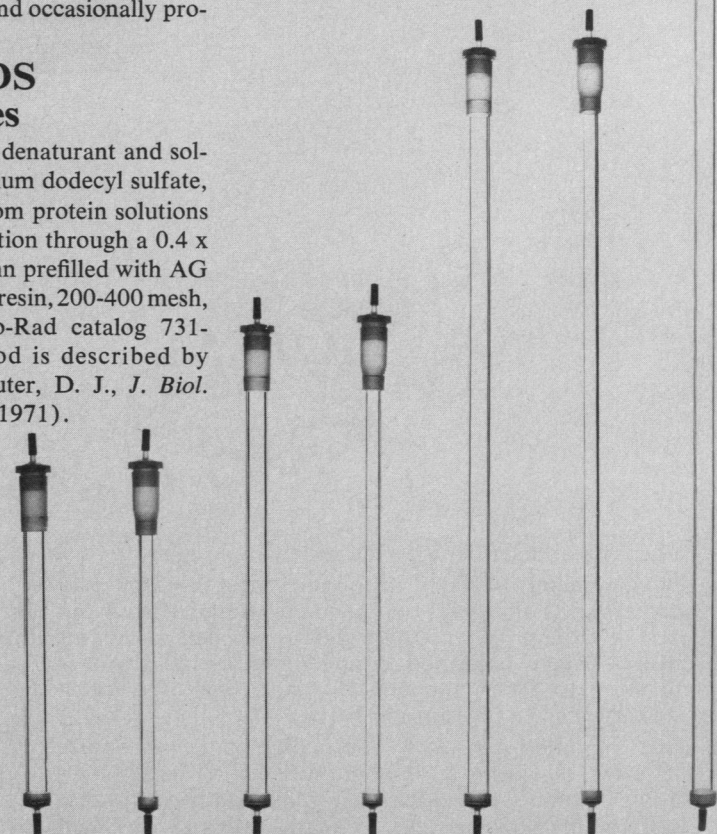
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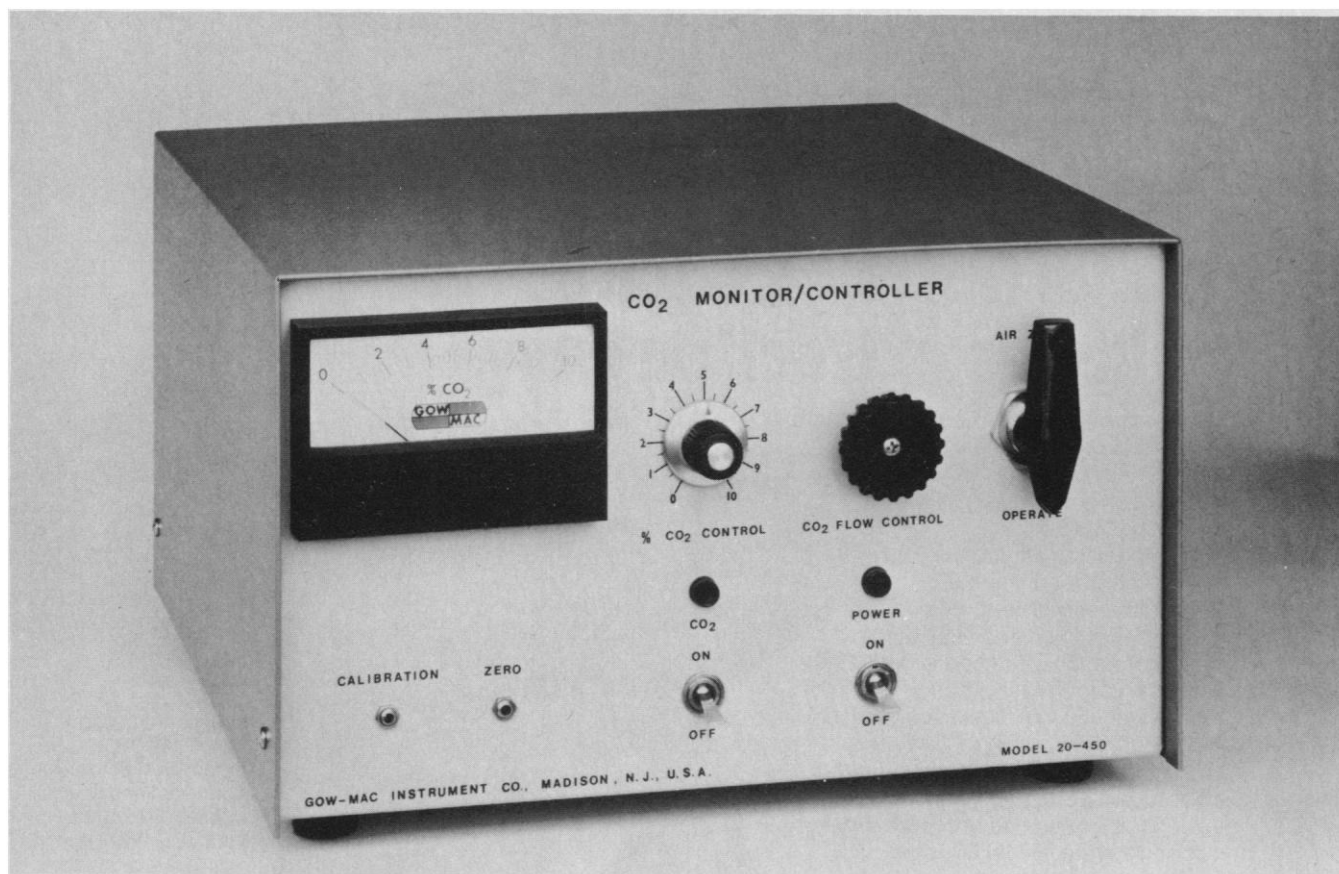
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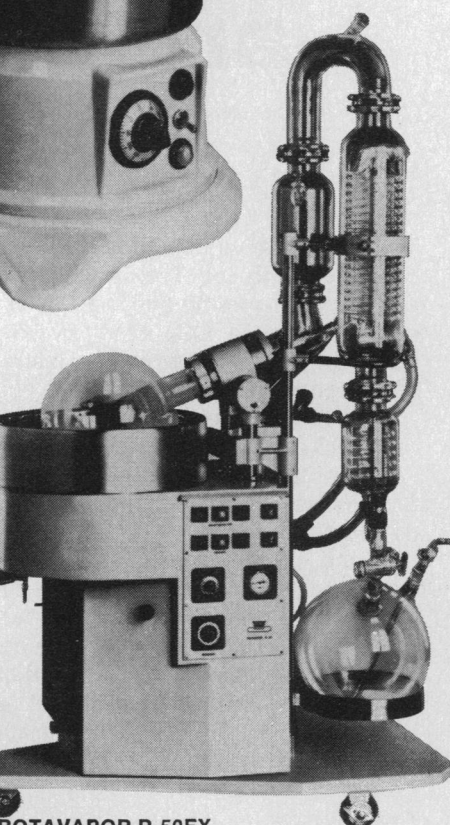
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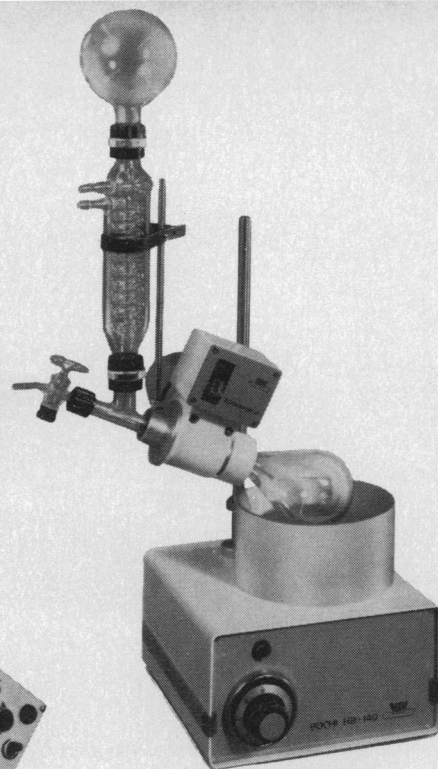
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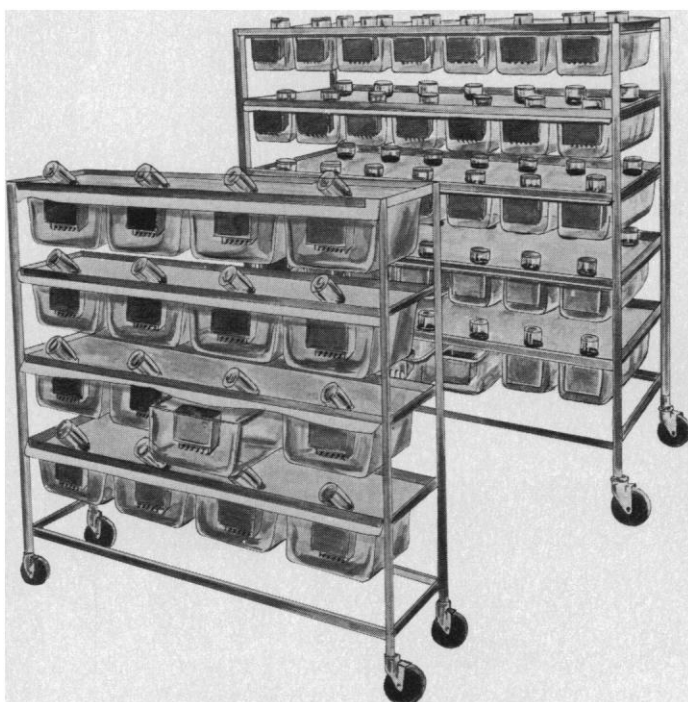
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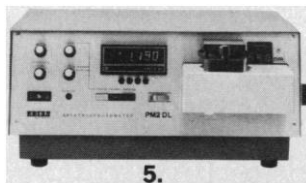
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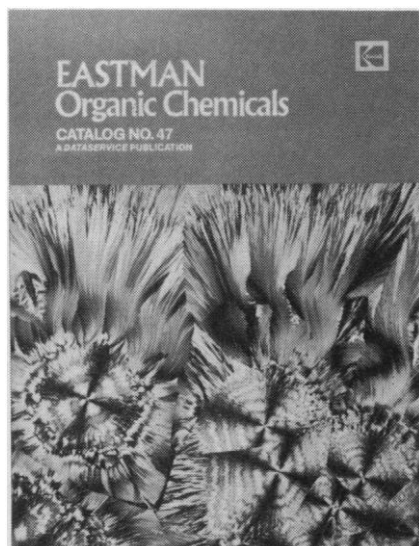
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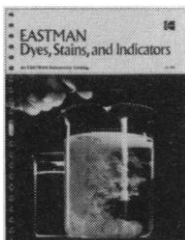
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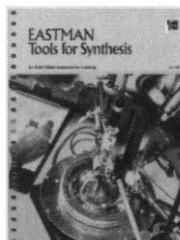
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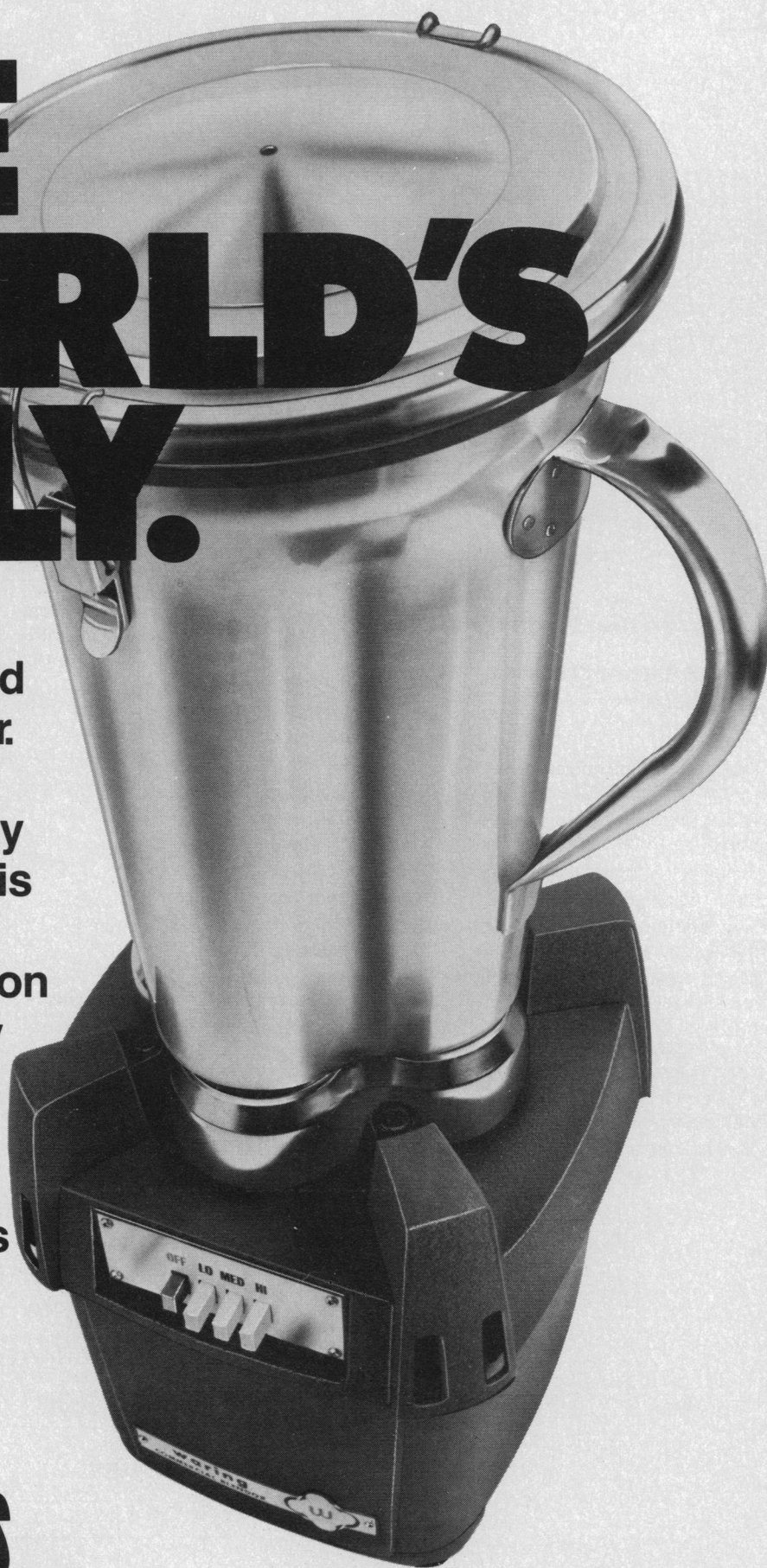
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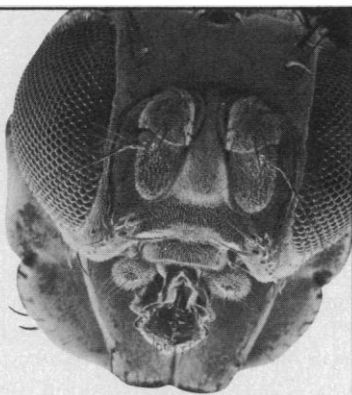
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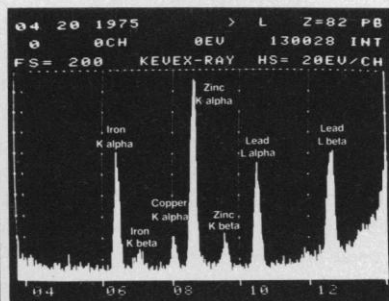
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lightly plowed or harrowed the seed under. In backward areas poor peasants might have hacked it in by hand after a fallow, without manure. Manuring was sometimes provided by "folding" sheep on a different acre each night. Otherwise any available manure was spread broadcast or "sprinkled" aboveground before seeding (4).

Moreover, in war-torn, hungry, 16th- and 17th-century Europe, the practice of manuring land with whole fish, unless spoiled, appears highly improbable. Food for humans was too scarce. It was for food, oil, and profit, not manure, that Basque, Breton, and English fishermen undertook the laborious and dangerous voyage to the Grand Banks. Out of their return cargo, fishheads and fins might have been spread on the land; in the case of pilchards (sardines), once the valuable oil was extracted, the waste may have been "laid upon the fields to enrich them." Yet few are the agricultural writers of the period who even mention fish as manure.

Where in his travels could Squanto have learned fish-in-hill fertilization of maize or Indian corn? Only in Spain's recently conquered Peru was fish manuring practiced. Is it conceivable that the Spanish Conquistadors had brought back fish-in-hill maize culture from South America's Pacific shore and somehow taught it to captive Squanto; that he was so impressed that on recrossing the Atlantic he in turn taught the Pilgrims?

Could Squanto have learned it in cool, damp England, where maize was not grown, or in northerly, often fog-shrouded, Newfoundland? Maize requires week upon week of hot sunshine for its grain to mature. One could easily be misled by the habit of English writers of using the word "corn" in a generic sense for all small grain—wheat, rye, barley—adding the prefix "Indian" only if maize was indicated. The documents that Prowse's *History of Newfoundland* (5) quotes show that the "corne" that fisher-farmers attempted to grow there was rye, oats, barley (and in one case, wheat), not Indian corn. As late as 1845 the island's crops were reported as only oats and hay (6).

Ceci's suggestion that Squanto might have picked up his knowledge of fish-corn fertilization from the early agricultural attempts of sailors visiting the New England coast appears unlikely. Of the seven recorded stirrings of New England soil previous to 1620, Captain John Smith's appears to have been the lengthiest. His Monhegan Island garden off the Maine coast, so he says, "served us for sallets in June and July" (7), too early for Indian corn.

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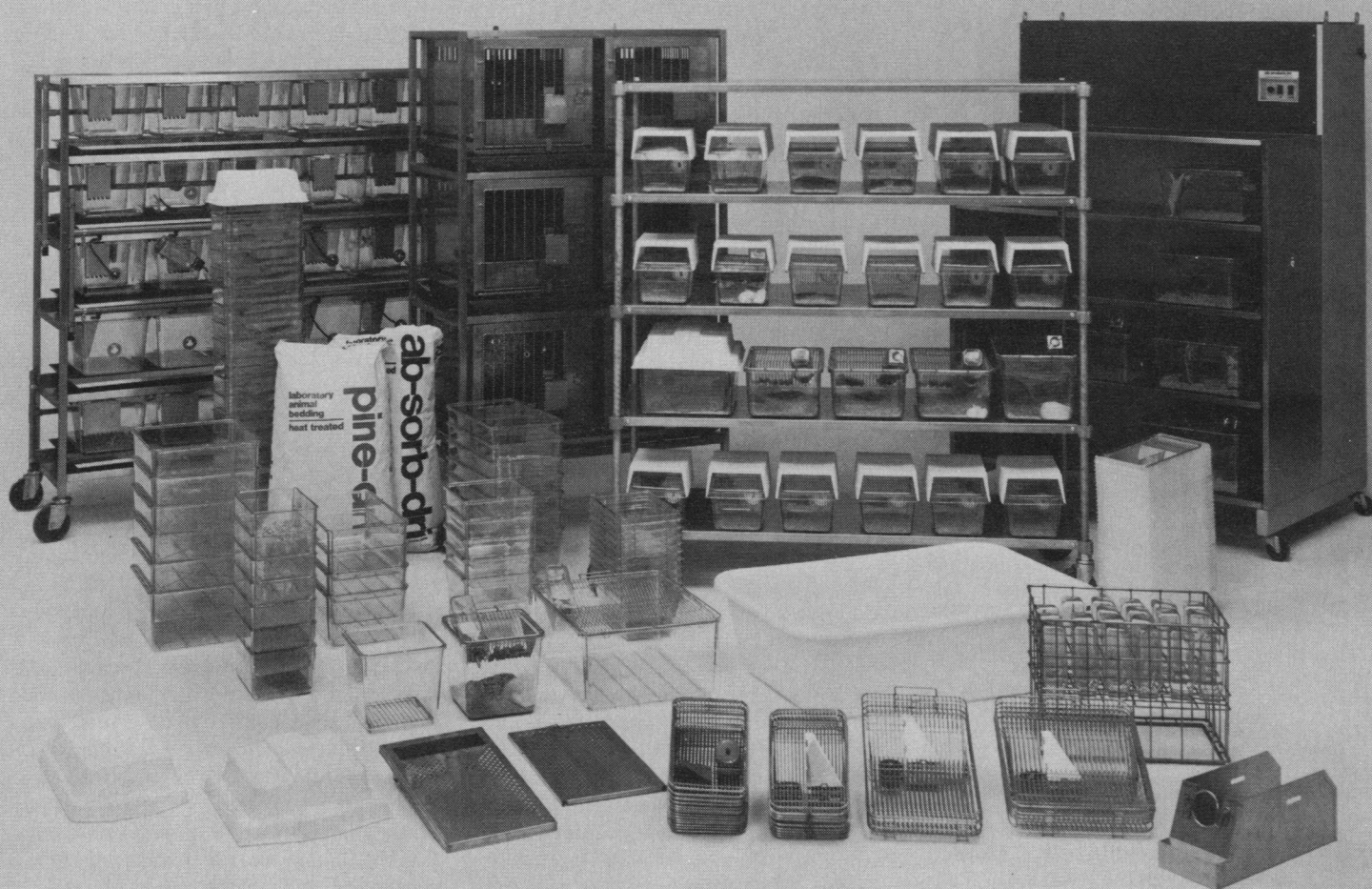
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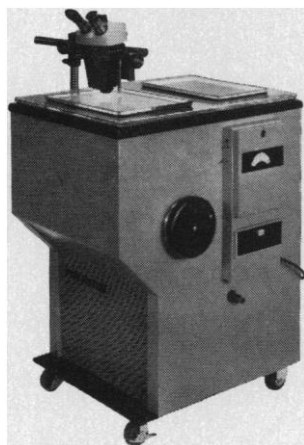
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gues that Squanto (and later the Pilgrims) could not have learned the value of fish fertilizer earlier in locations where a hilled and nonbroadcast seeded plant like maize, or maize itself, was not also present. However, the notion of a complex imposes restrictions on learning processes that seem arbitrary, and Russell's survey of European husbandry is insufficient to conclude that, without exception, Squanto could not have seen one or more of these features on European farms. His point that maize may have been grown in Spain is one possible and important example. Mason's 1620 description (4) of farming in Newfoundland is another. For here, Squanto could have observed fish fertilizer used not only with "Sommer and Winter corne . . . Wheate, Rye, Barlie, Oats, and Pease," but with nonbroadcast seeded plants such as "Garden herbes . . . Roots: as torneps, Pasnepes, Caretts, and Radishes" (4, p. 149).

If Squanto had simply seen how fish dressings generally improved crop productivity in England (5) or Newfoundland, couldn't he have learned the critical information necessary for the sound agronomical advice he was to pass on to the next group of English farmers he met?

The original text of Winslow's 1621 letter does not rule out this possibility: "We set the last Spring some twenty Acres of *Indian Corne*, and sowed some six Acres of Barly & Pease, and according to the manner of the Indians, we manured our ground with Herings, or rather Shadds . . ." (3). Deletion of the critical passage about sowing barley and pease (see Russell's version) creates the impression that fish fertilizers were restricted to hilled maize plants—a false impression that confirms Russell's notion that the practice was a linked complex. That the Pilgrims used this fertilizer for more general farming, indeed with some of the very same crops grown in Newfoundland, weakens the argument for a complex and for the point that Squanto could not have learned the value of fish fertilizer used with plants other than maize.

Other statements bring into question Russell's methods of interpretation. For example, the above letter continues: "we had a good increase of *Indian Corne*, and our Barly indifferent good, but our Pease not worth the gathering, for we feared they were too late sown, they came up very well, and blossomed, but the Sunne parched them in the blossome." From this citation, Russell concludes that "indifferent good" for the barley meant "almost complete failure" and that lack (see above) of fish fertilizer was somehow involved in the supposed failure of the barley and the peas.

Many other of Russell's statements can-

not be evaluated as evidence because they are either unreferenced or, like that suggesting Squanto had worked in the cornfields with his mother, literary extensions of missing primary data. He ignores the length of the 1606–1607 French colony in Maine and Nova Scotia in the statement about Smith's brief visit having been the "lengthiest" opportunity for New England Indians to learn about European food producing technology. The making of butter and cheese by Indians of Maine in 1605 (6) indicates that such "unlikely" possibilities could occur. Given this and the considerable data on early European contact, the many practices assumed to be "native" must be carefully researched before the possibility of European influence can be ruled out.

Warden's arguments for the Indian practice of fish fertilizer are not served by his data. If, as he suggests, a reduced Indian population after 1615 would not have depleted soil nutrients needed for maize cultivation (a questionable hypothesis given the citations for fallowing), then absence of documentation for an Indian reliance on fertilizer reflects the real absence of the practice. Yet later Warden implies that Indians *did* use fertilizers but that its usage went undocumented because observers felt guilty about having no "defensible legal title" to Indian lands. If there is one quality that is uncommon in early settlers' writings, it is guilt concerning the usurpation of Indian lands or ill treatment of Indians. For after all, most settlers believed they had *divine* (if not Royal) title to the lands, and if they did not feel too guilty to describe an illegal use of "fire and sword" (7) to destroy whole villages of Indians, whence came the qualms about describing Indians using fish as fertilizer?

Warden's demographic data support my explanation for the absence of documentation. His population density figures—0.10 to 0.20 persons per square mile after 1615 and (by interpolation) 0.27 to 0.53 before 1615—correspond to those estimated for "pre-farming" (8) societies, nonsedentary groups who rely primarily on wild foods that may be seasonally distributed in various ecological zones. If maize had comprised as much as half their subsistence, the population density before 1615 should have been more than double (9) that given. If the Indian population was then so thin and maize production played a relatively minor role, it would have been unnecessary, if not maladaptive, to establish fixed planting fields (near the coastal sources of fish) that had to be kept permanently productive with annual applications of fish.

That I "overestimated" the "sophistication of technology needed for . . . using fish fertilizer" is quite wrong. Agronomist

R. Lucas (10) pointed out to me that my citation of 360 cornhills per acre must be in error since it would have resulted in spacings 11 feet apart—surely too wide. Additional research on cornhill spacing among Indian cultivators produced figures of 2½, 3, 4, and 6 feet (11). Spacings of these sizes would produce 1210 to 6970 cornhills per acre. If each were dressed with 2 to 4 fish, the numbers of fish required would not be the 720 to 1440 originally calculated but more like 2420 to 27,880.

With so great an agricultural task before them, I do not understand the basis for the claim that Indian tools “sound much more efficient than the clumsy, expensive, manufactured implements used by Europeans.” W. Wood, closer to the relative efficiency of the day, would probably have challenged Warden, for in 1634 he wrote that one plow “could teare up more ground in a day, than the [Indian] Clamme shels could scrape in a month” (12).

Most disturbing is Warden’s comment that I “did not prove conclusively that the Indians of New England were ignorant or incapable of using fish for fertilizer.” To construe that a cultural analysis of native cultivation was an attempt to slur the capabilities of early Native North Americans reveals a basic misunderstanding of how or why anthropologists study cultural adaptiveness. It also unfairly introduces a notion of ethnic bias and nonscientific motivation into my research. My conclusion that fal-lowing was the more adaptive cultivation practice for Northeastern Indians implies no value judgment on my part regarding the capabilities of Indians, nor should any scholar interpret it as such.

In sum, neither reply to my article contains substantive evidence to show that (i) any early Indians other than Squanto knew about fish fertilizer, or that (ii) the practice would have been adaptive to or even consistent with the known cultural system of the Indians involved. These remain the principal issues to challenge the lovely legend.

LYNN CECI

*Department of Anthropology,
Graduate School and University Center
of the City University of New York,
New York 10036*

References and Notes

1. “In addition to his ministerial labours, Eliot taught them to improve their wigmans, and to fence their grounds with ditches and stone walls.” J. Small, in J. Eliot, *The Indian Primer* (Eliot, Edinburgh, 1877), p. xi.
2. J. Winthrop, *Collect. Mass. Hist. Soc.* 6 (Ser. 4), 515 (1863).
3. W. Bradford and E. Winslow, *Journal of the English Plantation at Plymouth* (University Microfilms, Ann Arbor, Mich., 1966), p. 60. This reference is an unedited, photoreproduced copy of the original work.
4. J. Mason, in *Captain John Mason*, J. W. Dean, Ed. (Franklin, New York, 1967).
5. According to C. Jones (personal communication), the practice of using fish fertilizer was “standard”



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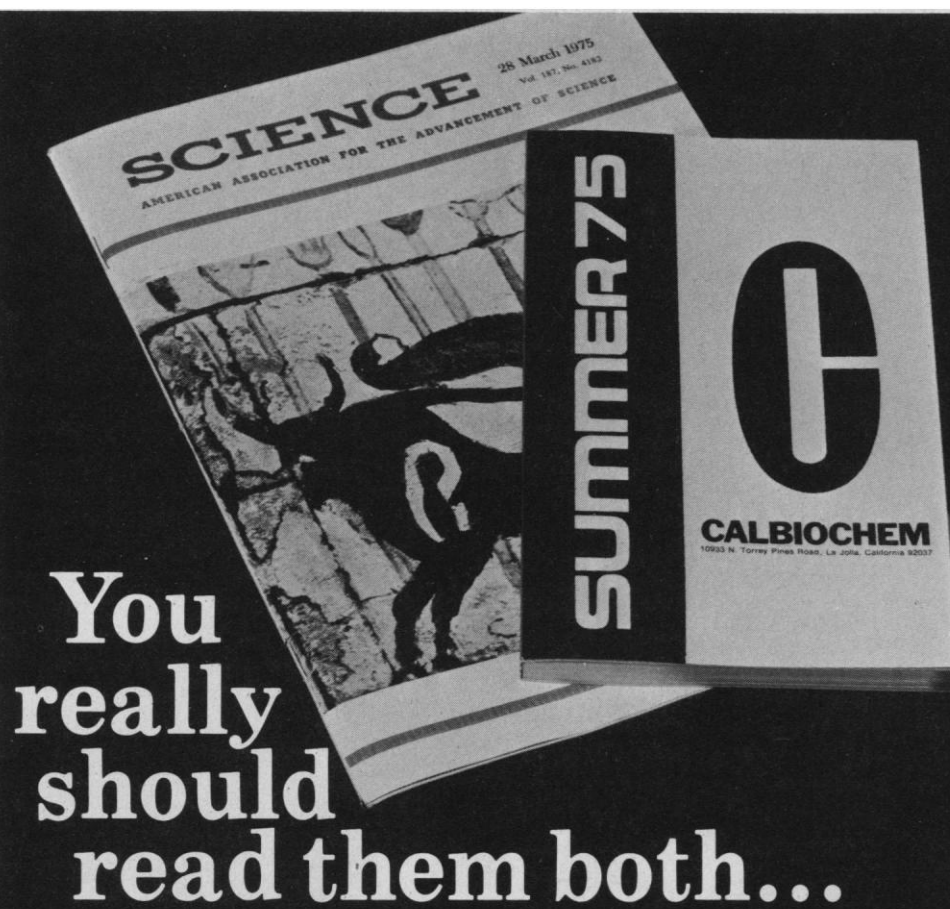
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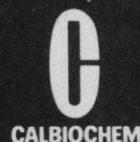


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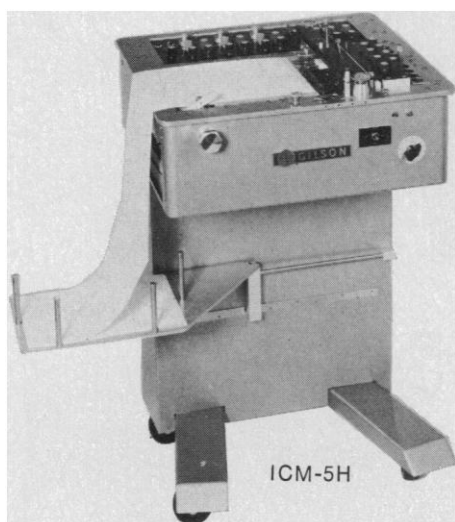
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Freedom of Inquiry

The First Amendment to the Constitution explicitly forbids the Congress from abridging the freedoms of speech and of the press. It imposes no comparable constraint abridging freedom to learn, to teach, or to inquire; yet these may be construed to be implicit freedoms and indeed seem to be of a comparable quality. All of these freedoms are, in fact, abridged from time to time, subject to the test of a real and present danger. In the absence of such demonstrable danger, the accepted position is and should be jealously to guard the constitutionally guaranteed freedoms, both those expressed and those implied.

Abridgments of freedom of speech and of the press have frequently occurred and have been contested. News media report movements in many communities to limit freedom to teach, especially in areas such as sex education. Analogously we encounter today serious questions, arising in part from scientists themselves, about the appropriateness of pursuing certain lines of scientific inquiry.

Some of the consequences of constraining freedom of inquiry are well known. Jacob Bronowski recently reminded us that the loss of Italy's lead position in the Renaissance of science followed immediately upon and doubtless was caused by the adverse judgment of the Inquisition against Galileo, which forbade certain lines of inquiry. In an otherwise impressive forward march of science in the Soviet Union, a generation of genetics research was lost by the constraints resulting from Lysenkoism. Such losses must enter into the cost-benefit analysis in determining whether to encourage, permit, discourage, or forbid a particular line of investigation.

Among the lines of research against which voices have recently been raised are the following:

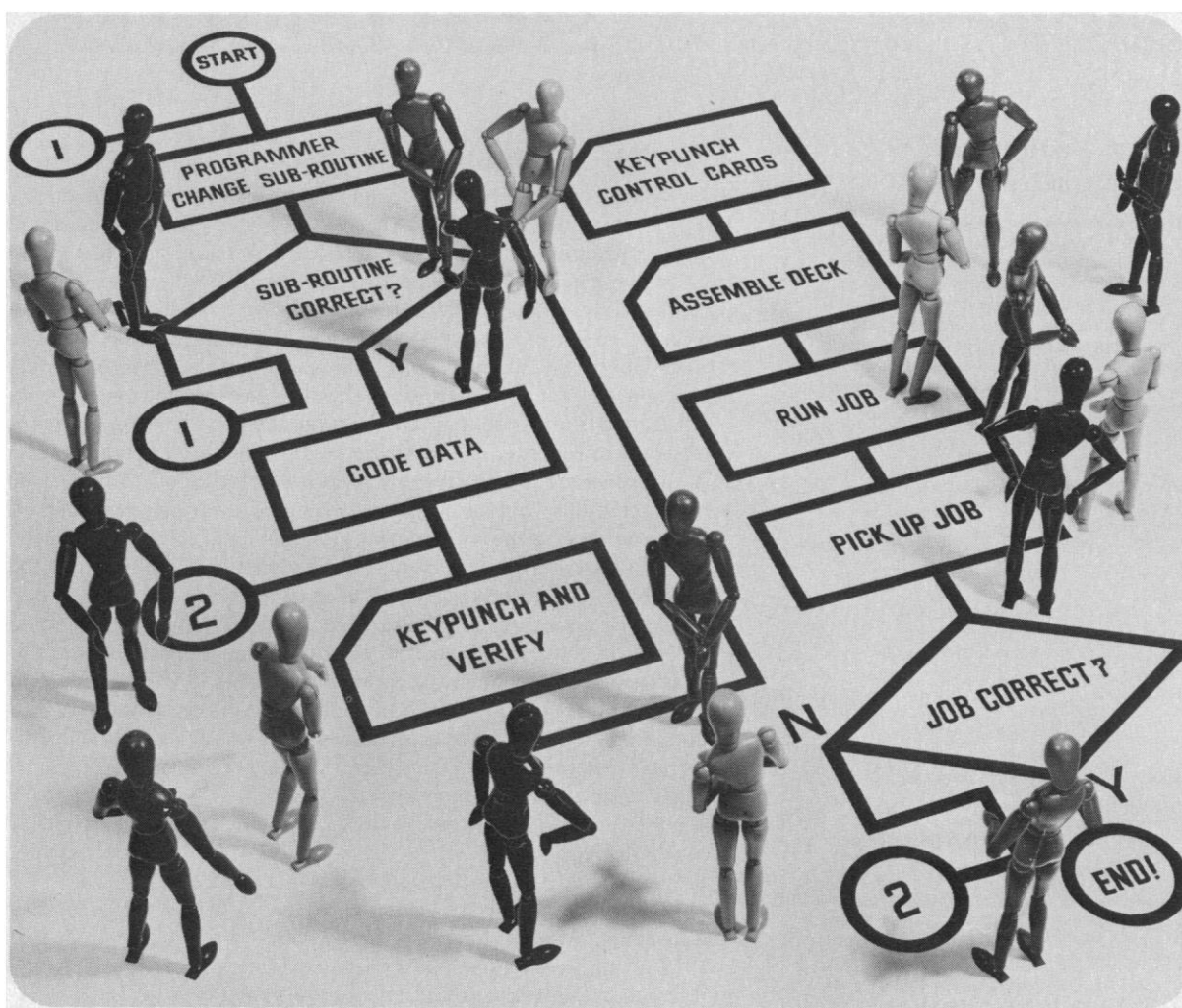
- 1) What are the genetic contributions to intelligence?
- 2) What kinds of experiments may properly be performed on informed consenting adults? Minors? Fetuses? Prisoners?
- 3) May one screen infants for a variety of genetic defects, some with known, others with currently unknown clinical consequences?
- 4) Under what circumstances may one tamper with the genetic process, as by the introduction of foreign genetic material into the genome?
- 5) When may one meddle with human conception and pregnancy as by artificial insemination, abortion, cloning, in vitro fertilization, or the use of surrogate mothers?

In arriving at considered judgments on these and a number of other problems, it is suggested that we treat freedom of inquiry as we have learned to treat freedom of speech—that is, agree to abstain when there is a real and present danger. By this test, the fact that the problem may be difficult, or that its solution may prove politically embarrassing or unpopular, is insufficient ground for invoking constraint. Indeed, a science that shies away from a line of inquiry merely because the result may be difficult to manage is in a sorry state.

Each man or woman will assess whether a real and present danger exists in each particular line of inquiry. The judgment will be difficult but not entirely unfamiliar. It is the same judgment we make in assessing every instance of censorship that comes to our attention. Is the danger in pursuing a particular line of research of such a magnitude that, in another context, we would willingly abdicate freedom of speech?

Judgments will surely be individual. For example, I acknowledge the danger inherent in some of the scenarios composed for the fabrication of certain types of DNA recombinant molecules. On the other hand, it strikes me that screening infants for abnormal karyotypes presents only such difficulties and problems as practicing physicians cope with on a daily basis. The wise physician must try to minimize the adverse consequences of unfavorable diagnosis.

It is fashionable to criticize the ethics and humanity of scientists, as in other times we have criticized the writers or painters. If history is any guide, this too shall pass. Then we may arrive at the balanced state where all questions may be asked save those which pose a real danger to the community, the environment, or the individual.—DEWITT STETTEN, JR., *Deputy Director for Science, National Institutes of Health, Bethesda, Maryland 20014*



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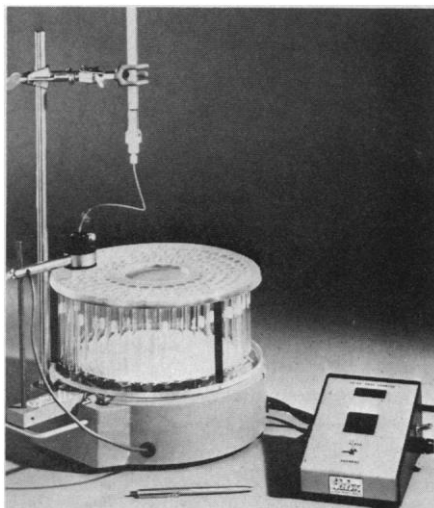
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Literature

Fluorescence Detector for Liquid Chromatography is devoted to the FS 970. It provides illustrations and design specifications and discusses applications. Schoeffel Instrument. Circle 697.

Liquid-Handling Systems includes pipettors, dispensers, dilutors, micropipettes and samplers, solution transfer systems, syringes, and disposable tips. Oxford Laboratories. Circle 699.

Carrier Ampholytes for Isoelectric Focusing are available in nine different ranges including a general one from pH 2 to 10. Brinkmann Instruments. Circle 700.

Laboratory pH includes an article on the measurement of pH in theory and practice. The text is incorporated in a catalog of instrumentation for conductivity and pH. Markson Science. Circle 701.

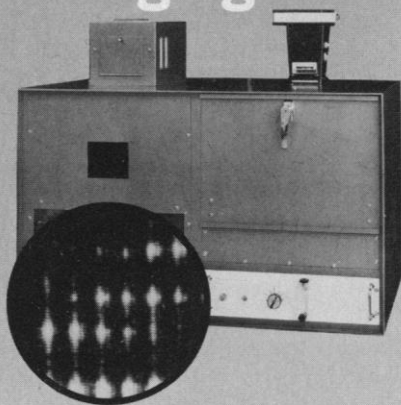
Carbon 14 and Tritium Labeled Compounds lists over 450 different compounds for biological studies with radioactive tracer methodology. A brief introduction defines nomenclature and specifies purity, specific activity, and radioactive decomposition. Research Products International. Circle 702.

Infrared Accessories features items for transmission, micro sampling, reflectance, gas chromatography, pyrolysis, and other accessories and crystals in over 40 pages. Wilks Scientific. Circle 703.

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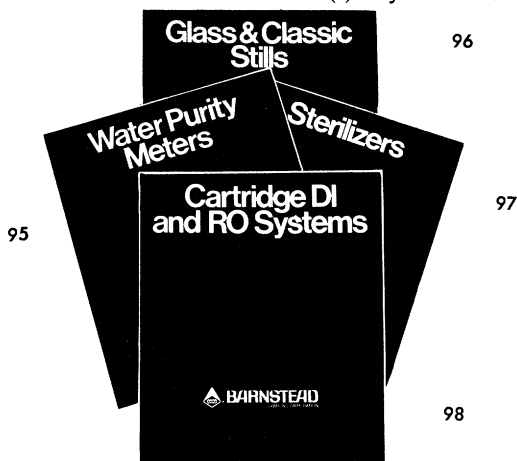


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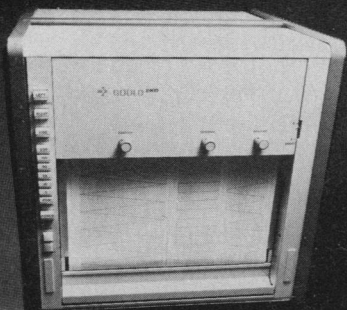
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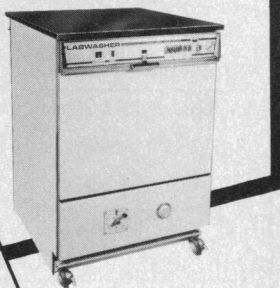
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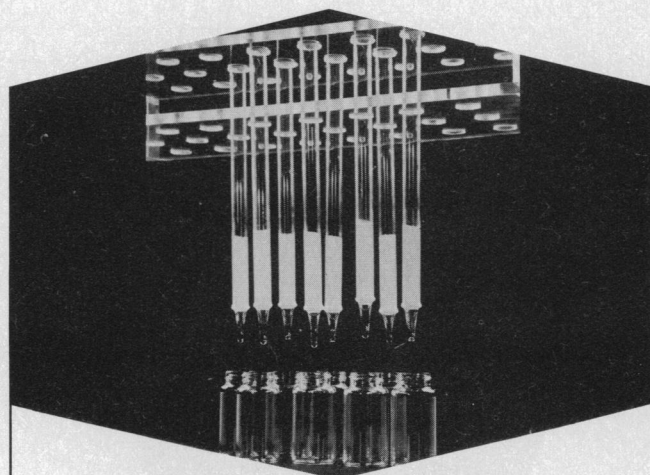
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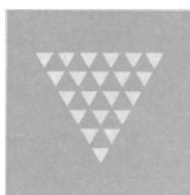
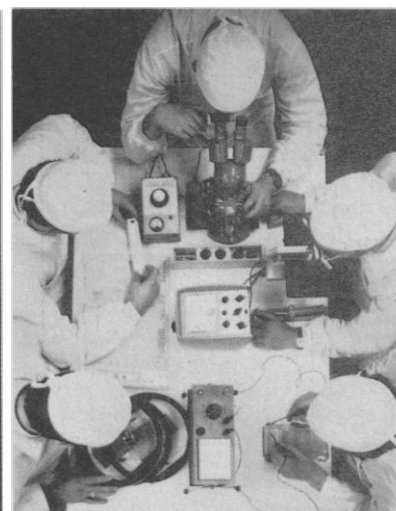
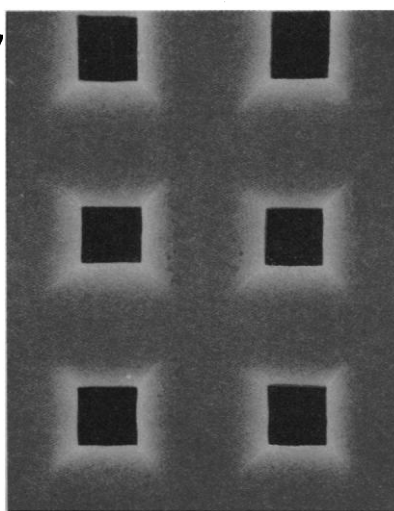
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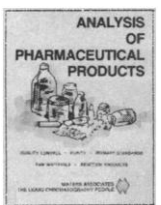
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