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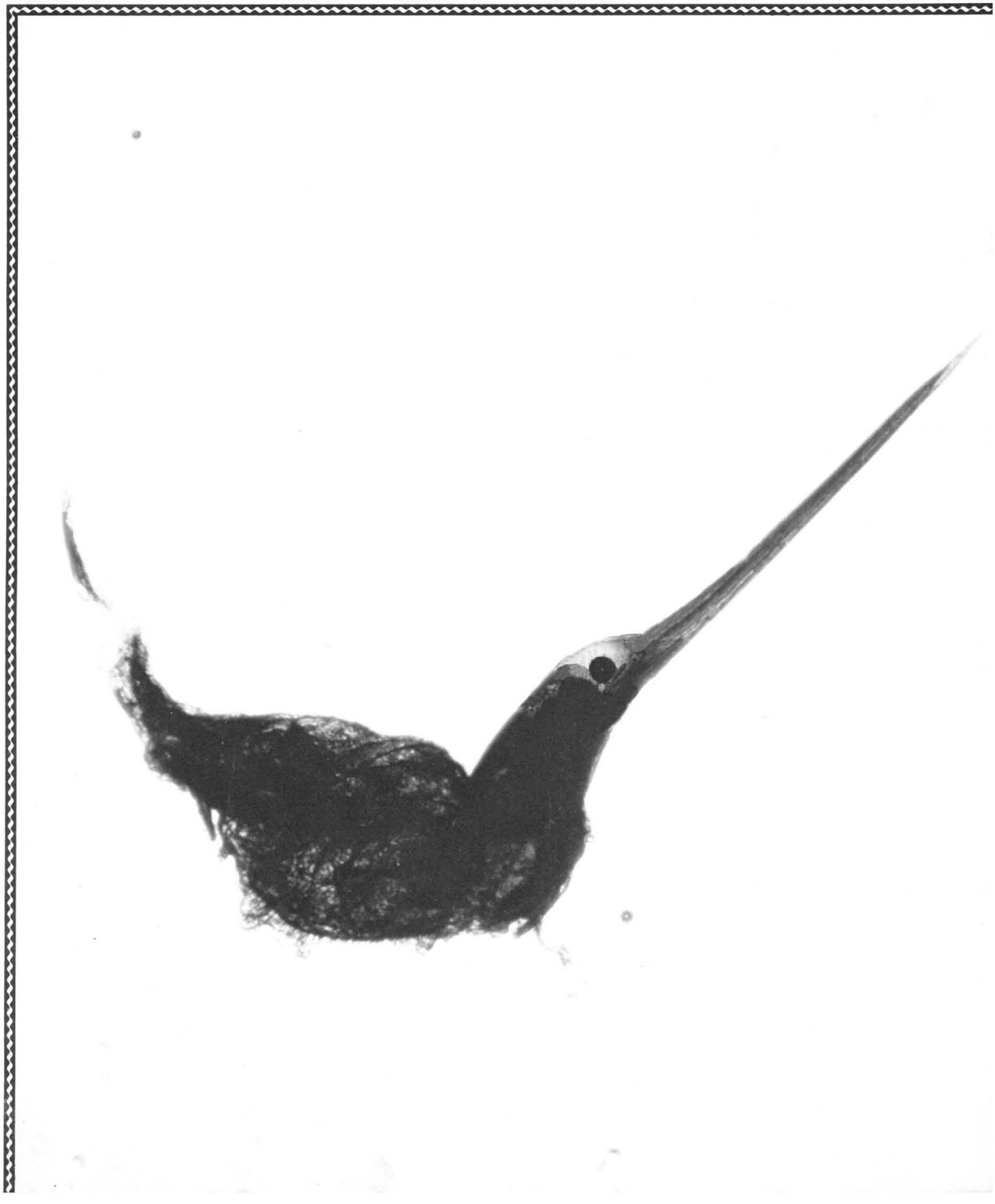

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By **Bruce D. Johnson,** *Brooklyn College, CUNY*

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COVER

Microphotograph of bee sting (× 56). [Courtesy of Charles T. Taylor, National Institute of Allergy and Infectious Diseases, Hamilton, Montana]

These calculators have such special significance for scientists and engineers that we devoted this space to describe them in some detail. Other new instruments and systems stemming from our measurement/computation technologies are being developed: look for them in the coming months.

Three alternatives (two of them brand new) to the drudgery of paper-and-pencil mathematics.

Almost 300 years ago, Gottfried Wilhelm Leibniz wrote, "It is unworthy of excellent men to lose hours like slaves in the labor of calculation." He was right, but how could anyone avoid it then?

Today, in any field of science or engineering, tedious manual calculation is neither wise nor necessary because things have changed significantly for the better, even in the last few months. We're convinced you should never again labor with slide rule, tables, scratch pads and adding machines . . . wasting your creative time getting answers that aren't as accurate as you'd like.

Any of the economical calculators that we describe in this month's message is as easy to operate as an adding machine but incomparably more powerful. All are pre-programmed to perform not only the basic arithmetic operations but also transcendental and statistical functions. All calculate positive and negative numbers throughout a 200-decade range. All automatically keep track of the decimal point and can display answers to the tenth significant digit.

One of the traits that sets them apart from the recent flood of electronic calculators is a four-register operational stack that is solidly based on computer theory. The stack automatically stores intermediate results obtained during your calculations — whether they be serial, chain or mixed chain — and brings them back to the working register when they are needed to complete the calculations. In plain English, the stack relieves you of the necessity to make scratch notes and re-enter intermediate values: it does it for you, automatically and without error.

HP-35.
The electronic slide rule

Small enough so that you can easily carry it around in your shirt pocket — it weighs only 9 ounces including rechargeable battery — the HP-35 is the original electronic slide rule introduced a little over a year ago. It has since become the constant companion of more than 75,000 scientists and engineers around the world.

Due to the economies realized in this long production run, the price of the popular HP-35 has been reduced to $295.*

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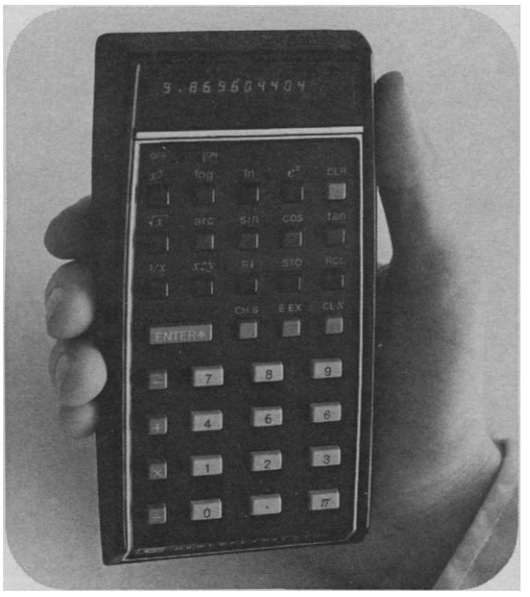


The HP-35 is easier to use, 10 times faster and significantly more accurate than the slide rule. With a single keystroke and in less than a second, it performs trigonometric (sin, cos, tan), logarithmic (log x, ln x, e^x) and other commonly used functions (x^y, $1/x$, $\sqrt{x}$, π) as well as the four arithmetic operations. It also calculates inverse trig functions.

In addition to its computer-like operational stack, the HP-35 has a constant storage register which lets you store any number and recall it as often as you want for repeat operations, without ever having to re-enter it.

The HP-35 comes with owner's handbook, battery pack, AC adapter/recharger, carrying case and travel case.

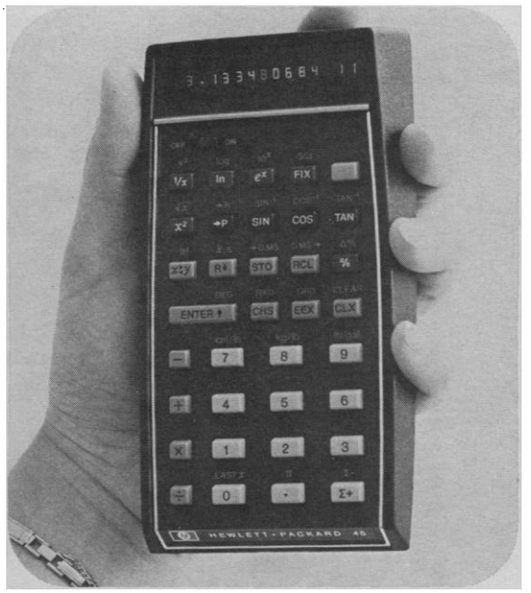
HP-45.
The scientific pocket calculator

A direct descendant of the "electronic slide rule," the new HP-45 packs nearly twice the computational power into the same package. The trick is that it has a unique gold-colored "shift" key that doubles the function of 24 of its 35 keys. Hence it does all that the HP-35 does . . . and then some.

The HP-45 is the first pocket calculator with *nine* addressable memory registers besides its operational stack. You can store data in each one — any number that appears on the display — and recall it to the working register whenever you want. (Let your imagination picture the calculating horsepower of this feature for register arithmetic, conversions, continued products, payrolls . . .)

The HP-45 also has a 14th register, called "Last X" in which the last input argument is auto-

HP-45



matically stored. You can recall this number by pushing the "Last X" key . . . then proceed to correct it or to perform calculations with it.

There's more. The HP-45 lets you do trig calculations in any of three angular modes (degrees, radians or grads) and converts angles in any mode to degrees/minutes/seconds instantly, and vice-versa. It lets you convert polar coordinates to rectangular and vice-versa, at a single keystroke. Add or subtract vector components in polar or rectangular coordinates. Perform two dimensional accumulations for vector calculations. And convert U.S. units of length, weight or volume to metric, and vice-versa . . . to 10-digit accuracy.

The HP-45 costs $395* including owner's handbook, quick reference guide, battery pack, AC adapter/recharger, carrying case and travel case.

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The scientific printing calculator

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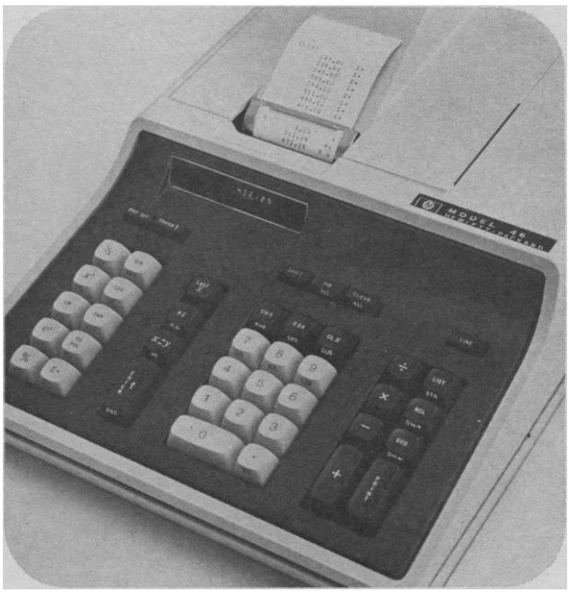

calculations. The HP-46 prints easy-to-read symbols with all operations you perform, and clearly labels the results. Its printout thus constitutes a complete permanent record.

For example, when you calculate the mean and standard deviation of a series of numbers, the printer lists each entry with a $\Sigma+$ symbol. Then, after you push the $\bar{x}$, s key, it prints the results, in order: the number of entries, the calculated standard deviation and the mean . . . each clearly labeled.

On command, the printer will also record the contents of the operational stack or the 9 addressable memory registers, each also clearly labeled. Should you make a logical error in data entry or call for an improper calculation, the printer will make an error note with a reference to an explanation contained in the operating manual.

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Objectives of Agricultural Research

The state of social science research in the U.S. Department of Agriculture (USDA) and the state agricultural experiment stations is indeed disappointing, as the Hightower report (*1*), the Pound report (*2*), and Nicholas Wade (News and Comment, 18 May, p. 719) point out. Even more disappointing is that there is little evidence of improvement. The lack of increase in financial and executive support for social science research in the agricultural research system is difficult to understand when compared with repeated pronouncements of interest in social problems, including rural community development.

Wade places primary blame on Congress, especially on Congressman Jamie L. Whitten (D–Miss.) for the paucity of support for social science research in the "agricultural establishment." While some blame rests there, it is too easy to blame Congress for actions or inactions that disappoint us. Part of the blame must rest with decision-makers in USDA and the Office of Management and Budget. For many years they either failed to see the need for a stronger research program in the social sciences or feared to go to appropriations committees with meaningful requests.

Part of the blame also rests with social science researchers and their program administrators. We have not convinced budget-makers in the Executive Branch or members of appropriations committees of the value of our work. I know of no way to *prove* the value of social science research. Yet, if we cannot convince people of its usefulness, how can we expect them to support it?

While Hightower's *Hard Tomatoes, Hard Times* and the Pound report deplore the state of social science research in the agricultural establishment, administrators in USDA and state experiment stations have not been callously blind to social and economic problems of farmers and other rural people. Their agencies and institutions are supported by the public, so they do—generally very well—what the public pays them to do. If the public appropriates money to build chicken houses, administrators would be stupid indeed to use such money to build homes.

Until we can demonstrate that social science research is at least as useful as

research on boll weevils, I fear it will continue to be "oppressed and poverty stricken."

M. L. UPCHURCH
Institute of Food and Agricultural Sciences, University of Florida, Gainesville 32601

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1. J. Hightower, *Hard Tomatoes, Hard Times* (Schenkman, Cambridge, Mass., in press).
2. *Report of the Committee on Research Advisory to the U.S. Department of Agriculture* [PE 21338 (main report), PE 21339 (appendices), National Technical Information Service, Springfield, Va., 1973].

It appears that the *Report of the Committee on Research Advisory to the U.S. Department of Agriculture* (*1*) was incomplete. One of the four questions which the committee was supposed to answer (*1*, p. 2)—"the extent to which the scientists in the basic disciplines relate their research to agriculture"—does not seem to have been answered. My own answer to the question is that, with very few exceptions, the scientists in the basic disciplines have *not* related their research to agriculture.

I am a practical geneticist, a corn-breeder. I routinely scan journals like *Plant Physiology, Genetics, Heredity, American Naturalist*, and the *American Journal of Botany* for research reports of practical consequence to those whose business it is to breed and grow better crop plants. I have waited 20 years for a molecular biologist to suggest ways in which the Watson-Crick hypothesis could alter our plant-breeding techniques. I have been looking for 15 years for suggestions from researchers in plant physiology about how the Krebs cycle could be manipulated, genetically perhaps, in ways to increase crop yields or to improve other attributes. I have even thought that the tremendous advances in cytology brought about by electron microscopy could point out key organelles in cells that could be monitored while the corn plant—or another agriculturally important plant—was constructively altered.

But I have been disappointed. The leading figures in biological research have not pointed out how their results might be used agriculturally. Or if they have, they did so in meetings I don't attend, or in journals I don't read, or in a language I don't understand. The general impression I get is that, so long as their funds are sufficient, the leading biological scientists have no concern at all with agriculture and whether or not it can use their findings.

This is not to say that these basic researchers *ought* to have communicated with agricultural scientists or have been interested in the agricultural implications of their research results. The conventional view is that the proper end of basic research is the furtherance of its own investigations and that practical applications are incidental to this end. Nevertheless, because the top-flight basic researchers make little or no effort to communicate with agricultural scientists, they have failed to stimulate the buildup of programs in agricultural research in those areas with the most promise of spin-off to key agricultural needs.

The basic researchers' ignorance of agriculture and its needs must be recognized as an important reason why funds for agricultural research are not now being used to support much topflight basic research.

DONALD N. DUVICK
6837 North West Beaver Drive, Johnston, Iowa 50131

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1. *Report of the Committee on Research Advisory to the U.S. Department of Agriculture* [PE 21338 (main report), National Technical Information Service, Springfield, Va., 1973].

Nicholas Wade's recent appraisal of agricultural research (News and Comment, 1 June, p. 932) is one more perspective on the elephantine set of circumstances that have contributed to both the successes and problems of this research effort. He obviously talked with a lot of people and collected many of the personal observations that have been expressed among agriculturists for several years. His commendable intentions in making these many-sided observations part of the public domain should be acknowledged.

However, the emphasis on negative, controversial, and inflammatory issues to the near exclusion of the positive, harmonious, and productive ones has resulted in overly restricted conclusions regarding the motivation of recent changes and the prognosis for future changes. When Wade states that the recent reorganization of the Agricultural Research Service (ARS) was "undertaken for political reasons," he is confusing means with objectives. As one who had considerable responsibility for that reorganization, I can say that the primary objective was to *increase* the capability of ARS to meet rapidly

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changing problems that required agricultural research. A second objective was to *increase* the ability of ARS to work closely with the state agricultural experiment stations on mutual research responsibilities. That there were "political" and administrative activities related to achieving these objectives is to be expected but does not make those activities a substitute for the objectives. To leave the impression that this reorganization was solely "politically" motivated does a disservice to the many ARS employees who view the reorganization as an opportunity to make improvements in the system and who have responded with dedication in trying to do so.

Similarly, the conclusion that "Things will have to become a lot worse before they get any better" does not acknowledge a growing cognition among agricultural scientists, among both state and federal research administrators, and among members of the Congress of a need for changes in the system. That one could obtain differences of opinion on what those changes should be is obvious because of the wide-ranging activities and disciplines of agricultural research. However, these differences and the sharpness with which they are expressed is, to many of us, real evidence of the interest in bringing about improvements.

Knowing the large number of institutions and people involved, the consequent potential variations in responsibilities, and the progress which has been made in identifying and moving cooperatively toward coordinating mutual responsibilities, I cannot help but be encouraged and optimistic about the present attitudes and efforts for changes in agricultural research. Such changes will ensure future successes comparable to the many achieved in the past.

NED BAYLEY

Office of the Secretary,
U.S. Department of Agriculture,
Washington, D.C. 20250

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1. *Report of the Committee on Research Advisory to the U.S. Department of Agriculture* [PE 21338 (main report), PE 21339 (appendices), National Technical Information Service, Springfield, Va., 1973].

The Blind Technique

At a recent meeting at the National Academy of Sciences entitled "Conference on carcinogenesis testing in the development of new drugs" (23 to 25 May), it was suggested by Robert Elashoff, a statistician, that pathology specimens be sent to the pathologist blind (unidentified). A spirited discussion ensued between proponents and opponents of this viewpoint. The response of the audience clearly indicated a polarization either for or against the viewpoint proposed. Any discussion of this important matter should take into account a number of philosophical considerations which are familiar to pathologists but may be less well known to other scientists.

1) Many statisticians consider the examination of pathology specimens and slides analogous to the examinations in a double-blind clinical study. There are, however, important differences. The placebo factor in treating patients who are easily influenced by psychological factors and expectations

20 July 1973, Volume 181, Number 4096 **SCIENCE**

Science and Man in the Americas

The international meeting arranged by Consejo Nacional de Ciencia y Tecnologia (CONACYT) and the American Association for the Advancement of Science (AAAS) and held in Mexico City 20 June through 4 July was successful beyond the organizers' expectations. The average quality of the sessions surpassed those of a typical meeting in the United States. Audiences were attentive and appreciative. Questions were numerous, discussion was spirited. Success of the venture led to numerous suggestions that subsequent, similar hemispheric meetings should be arranged.

The majority of the credit for the happy outcome should go to the Mexicans. As hosts, they were responsible for the innumerable logistic arrangements that must be made on such an occasion. In addition, they shared in formulating the intellectual content of the meeting. The tasks of the CONACYT group were eased by the participation of President Luis Echeverría as honorary cochairman of the meeting.

As the title for the meeting suggested, the content of the sessions related to urgent human needs. Thus most of the presentations dealt with technology or with research directed toward applications. The organizers selected major themes of particular interest to Latin Americans and areas in which they are active.

Some of the sessions involved a mutually useful interchange of scientific information. Other symposia, such as that on transfer of technology, were more controversial. Such sessions underlined the existence of deep differences in the viewpoints of the participants. Nevertheless, the discourse was civil and, while few opinions were reversed, the principals departed with a clearer concept of each other's position.

An airing of grievances, while sometimes a prelude to accommodation, is not as dependable a basis for a continuing collaborative effort as is knowledge shared to mutual advantage. At any rate, this auditor felt that enthusiasm on the part of the participants and the audience was most manifest at sessions devoted to energy, food, and resources.

A symposium on deserts and arid lands evoked much interest. These terrains constitute about one-third of the earth's continental areas, and their intelligent management is an interesting challenge that has had comparatively minimal attention. It is now clear that both man and nature can be much better served through practices based on scientific knowledge, and the carrying capacity for animals can be increased without deleterious effects.

At another symposium, devoted to food and nutrition, a Brazilian scientist told of research in his country that is leading to much better practices in the distribution of fruit. Previously about two-thirds of the harvest was lost. A series of studies on controlled environments for storage has been outstandingly successful. At another session, improved methods for food processing were described. These are leading toward minimizing waste and attendant pollution, while making available nutritious materials that previously had been lost.

Enlightened leaders in Latin America are coming to realize that the destinies of their lands are tied to wise utilization of technology. Essential to this objective is a vigorous scientific establishment. In earlier years, scientists received little encouragement or support; that situation seems to be changing.

Scientific cooperation of the United States with Latin America is likely to take many forms—for example, through the National Academy of Sciences, the Organization of American States, and the Agency for International Development. In this effort, AAAS can have a most useful role. The recent meeting in Mexico City may well prove to be an historic moment in a changing relationship.—PHILIP H. ABELSON


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