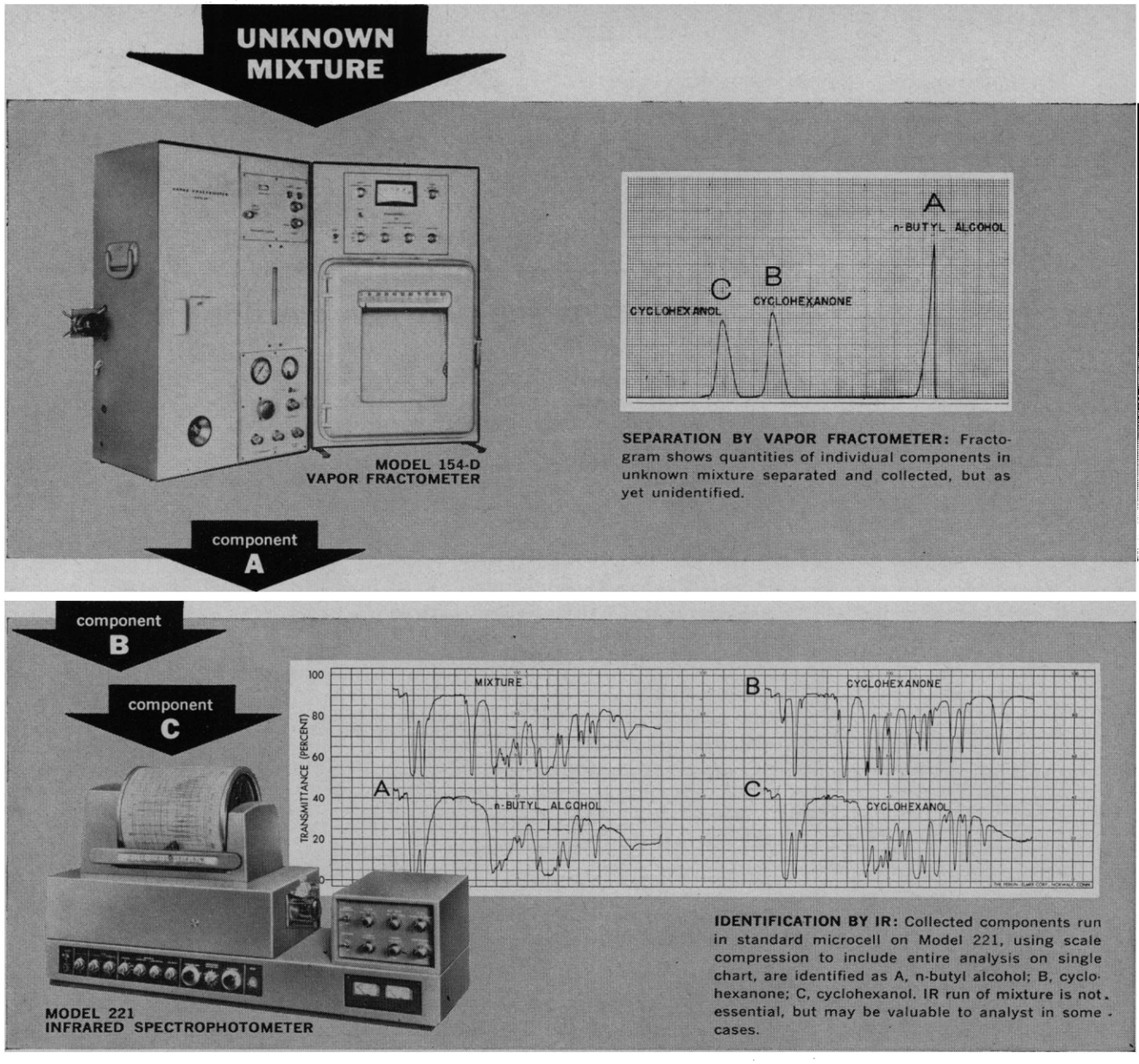
SCIENCE

15 July 1960

Vol. 132, No. 3420

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE is published weekly by the AAAS, 1515 Massachusetts Ave., NW, Washington 5, D.C. Second-class postage paid at Washington, D.C., and additional mailing office. Annual subscriptions: $8.50; foreign postage, $1.50; Canadian postage, 75¢.



SEPARATION BY VAPOR FRACTOMETER: Fractogram shows quantities of individual components in unknown mixture separated and collected, but as yet unidentified.

IDENTIFICATION BY IR: Collected components run in standard microcell on Model 221, using scale compression to include entire analysis on single chart, are identified as A, n-butyl alcohol; B, cyclohexanone; C, cyclohexanol. IR run of mixture is not essential, but may be valuable to analyst in some cases.

HOW GAS CHROMATOGRAPHY AND INFRARED TEAM UP TO ANALYZE DIFFICULT MIXTURES FAST... ACCURATELY

Extend your analytical capabilities by teaming up Perkin-Elmer gas chromatography and Perkin-Elmer infrared spectroscopy to take advantage of the special features of each. This combination gives you greater speed and accuracy—both qualitative and quantitative—than either technique alone, in analyzing such mixtures as close boilers, isomers and similar hard-to-separate compounds.

In practice, an unknown mixture is separated into pure fractions by a P-E Model 154-D Vapor Fractometer as it records a fractogram, giving quantitative peaks for the separated components. The individual components, cold-trapped or collected in a solvent as they elute from the instrument, are then run in an infrared spectrophotometer such as the Perkin-Elmer Model 221. The IR spectrum of each of the collected samples provides positive qualitative and quantitative identification.

Both the Model 154-D and the grating Model 221 are the most advanced instruments of their type, each offering unusual versatility, speed and accuracy. And special P-E accessories further enhance their usefulness. For example, capillary columns (U.S. Patent No. 2,920,487) and ionization detectors for gas chromatography, plus accessory beam condensers for IR examination of micro-samples, allow analyses of small samples beyond the scope of conventional equipment.

For complete information on these new P-E instruments, and how they team up to form an even more powerful analytical system, write to us today.

INSTRUMENT DIVISION
Perkin-Elmer *Corporation*
NORWALK, CONNECTICUT

15 July 1960, Volume 132, Number 3420

SCIENCE

Cover A cross section through the gullet region of the ciliated protozoan *Paramecium bursaria*. The round dark objects are the symbiotic alga *Chlorella*. The numerous clear ellipsoids below the surface are the trichocyst bodies, and the irregularly shaped dark body near the center is the macronucleus. The food-intake passage is lined by about 1000 cilia arranged in 12 columns. The row of 12 shown in the picture is composed of three groupings, with four cilia to each group spaced 0.46 microns apart on centers. See page 115. [Photograph by L. E. Roth, Argonne National Laboratory, Lemont, Ill., from C. F. Ehret and E. L. Powers, "The cell surface of *Paramecium*," *Intern. Rev. Cytol.* **8**, 97 (1959)].

Letters

Abbreviated Reference Citations

May I make a plea for considerably more sparing use of abbreviations when citing references to scientific periodicals? I believe this practice originated at a time when periodicals were far fewer in number, and when references were commonly placed in footnotes, its purpose being presumably to prevent the 'footnotes' occupying too much space.

Nowadays, few are familiar with the titles of the majority of periodicals, and references are usually listed at the end of each article. The amount of space saved by abbreviation of titles is negligible, and the obscurity thereby introduced may well be considerable for some readers, especially when such heights of esotericism are reached as *B.A.N.* for *Bulletin of the Astronomical Institutes of the Netherlands* or *Röfo* for *Fortschritte auf dem Gebiete der Röntgenstrahlen*. Sometimes, as in abstract journals, where condensation is of great importance, the practice of abbreviating titles may be tolerated, but for the most part it gains nothing and merely sets the reader a more or less difficult conundrum whenever he wishes to trace a reference so cited.

J. B. SYKES
46 NorthCourt Road, Abingdon, Berkshire, England

Native Peoples of South America

Leeds' review of *Native Peoples of South America* [*Science* **131**, 94 (8 Jan. 1960)] calls for comment regarding responsible reviewing rather than reply to particular points.

First, I must mention that what are absurdly called "unnecessary errors" refer mostly to works published after the manuscript was in press and to works *not yet published*. For example, Leeds knows that his own research among the Yaruro had not yet been started in December 1957, when I worked on a final revision of the manuscript, for at that time he asked me for advice regarding where to work in the field. I received Moore's study of Inca property and law for review about the time *Native Peoples* was published. Murra's work on the Inca is, so far as I know, still unpublished.

An author is obligated, of course, to keep reasonably abreast of the published literature. At the same time, it is rather pointless for the reviewer to carp about omission of published and unpublished research done after the book was written. If the reviewer believes that the research makes an important difference in scientific understanding, rather than in descriptive minutiae, he should spell out his point, preferably in an article of his own or in "Notes and Comments."

Second, Leeds seems not to have read the book carefully, for he makes the incredible assertion that it merely follows the culture area divisions of the *Handbook of South American Indians* [(Bureau of American Ethnology, 1948), vols. 1–6], which I edited. The *Handbook* is based upon four culture areas; *Native Peoples,* upon eight cultural types and 11 subtypes, which correspond only partly to areas. The book explains repeatedly that this typology is evolutionary in being based upon structure and developmental process rather than upon the traditional descriptive and historical taxonomy used in the *Handbook*.

While anthropologists will not be misled by the carelessness of this review, the general reader might conclude that *Native Peoples* has little new to offer.

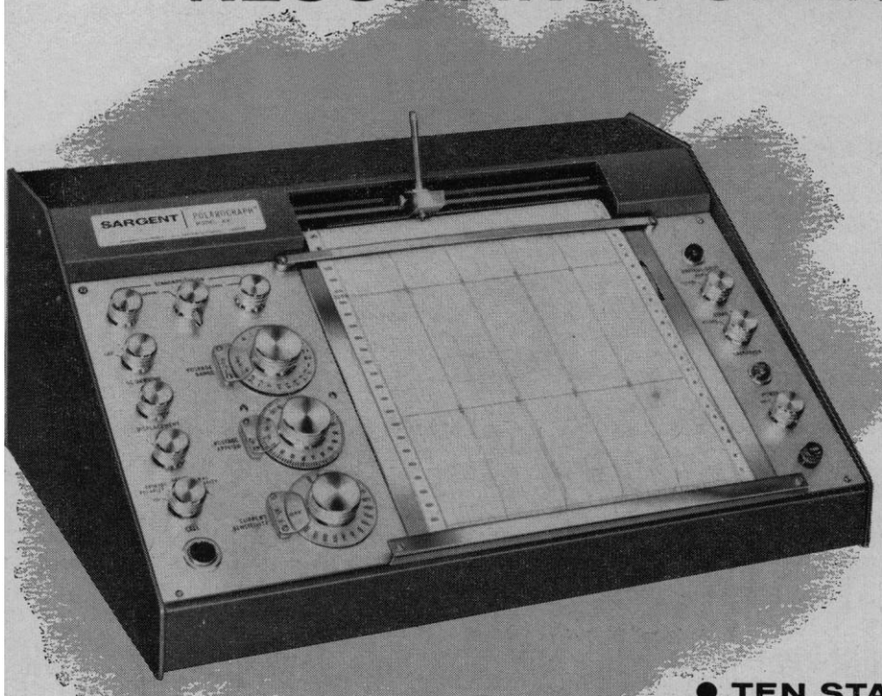
JULIAN H. STEWARD
University of Illinois, Urbana

Steward's reaction surprised me, as I still feel my review was favorable. I pointed out that the book constitutes a "useful compendium . . . for professionals and students alike," and has originality respecting historical reconstructions from linguistic affiliations, American Indian acculturation, and trans-Pacific diffusion. Further, the review listed all eight culture types Steward mentions.

However, to me, responsible book reviewing, as Steward's own reviews suggest [for example, *Am. Anthropologist* **62**, 144 (1960)], means more than mere repetition of contents. The reviewer must make a critique according to his view of the truth. Hence, I called the present classification a "refinement" of the *Handbook* classification because I felt it was already largely suggested there. Hence, too, I made criticisms of two kinds. The first concerned explanatory principles. Similar phenomena suggest using common explanatory principles. If common principles are inapplicable, this, too, must be shown. I felt the authors failed to do either regarding warfare, for example, thus possibly missing aboriginal evolutionary regularities. The second concerned the "unnecessary errors" which referred to *facts,* for which I gave sources, all published in, or before, 1957, 2 years before the book's publication, including one on the Yaruro [Le Besnerais, *J. soc. américanistes* (1954)]. "Unnecessary" implies that *standard* interpretations of data exist. Unless these are reinterpreted with relevant rationales and new data, as was

(Continued on page 156)

The New SARGENT Model XV
RECORDING POLAROGRAPH®



offers you—

- **FULL 10 INCH CHART**
- **1/10% ACCURACY OF MEASUREMENT**
- **TEN STANDARDIZED POLARIZING RANGES**

This new Sargent Polarograph gives you a large 250 mm (10 inches) chart and the highest accuracy and current sensitivity at the lowest price of any pen writing polarographic instrument on the market.

It offers you optimum specifications based on over twenty years of leadership in design, manufacture and service in this specialized field of analysis.

The polarographic method is capable of reproducibility to 1/10% and analytical accuracy to ½%. To make use of this facility, the instrument must be accurate to 1/10% and chart space must be provided for recording large steps to achieve measuring precision. We strongly advise against the purchase of any polarographic instrument using miniature (5 inch) charts and low gain balancing systems in the 1% order of precision.

This Model XV is adaptable to 10^{-6} M determinations with the S-29315 Micro Range Extender.

®Registered Trade Mark, Patents Pending

Current Ranges:	19, from .003 to 1.0 μA/mm.
Current Sensitivity:	standard specifications, 10^{-4}μA/mm.
Polarizing Ranges, volts:	0 to −1; −1 to −2; −2 to −3; −3 to −4; +.5 to −5; 0 to −2; −2 to −4; +1 to −1; 0 to −3; +1.5 to −1.5.
Balancing Speed:	standard, 10 seconds; 1 second or 4 seconds optional.
Bridge Drive:	synchronous, continuous repeating, reversible; rotation time, 10 minutes.
Chart Scale:	current axis, 250 mm; voltage axis, 10 inches equals one bridge revolution.
Current Accuracy:	1/10%
Voltage Accuracy:	¼%
Chart Drive:	synchronous, 1 inch per minute standard; other speeds optional.
Writing Plate:	10½ x 12½ inches; angle of slope, 30°.
Standardization:	manual against internal cadmium sulfate standard cell for both current and voltage.
Damping:	RC, four stage.
Pen:	ball point; Leroy type optional.
Suppression:	zero displacement control, mercury cell powered, 6 times chart width, upscale or downscale.
Potentiometric Range:	2.5 millivolts, usable as general potentiometric recorder.
Finish:	case, enameled steel; panels, anodized aluminum; writing plate, polished stainless steel; knobs and dials, chromium plated and buffed.
Dimensions:	23 x 17 x 10.
Net Weight:	65 pounds.

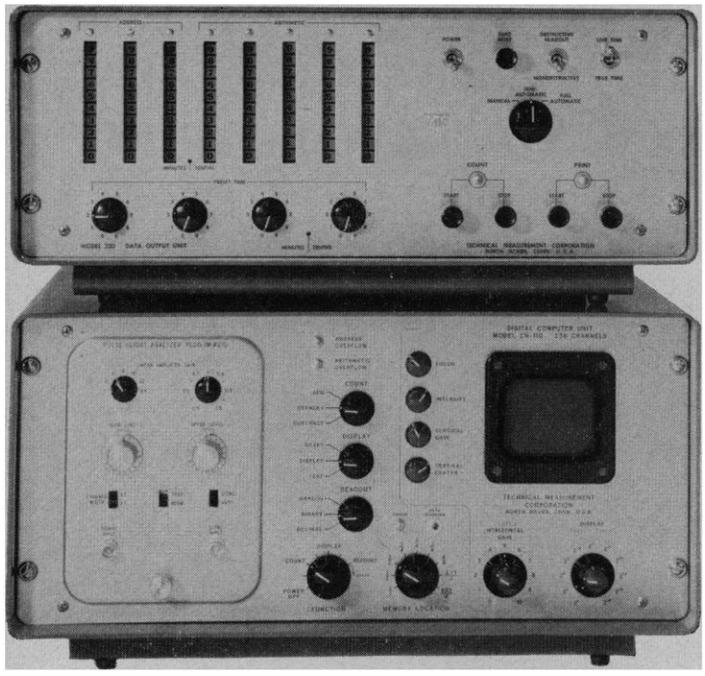
Catalog number **S-29310** with accessories and supplies. . . . **$1585.00**

For complete information write for Sargent Bulletin P

SARGENT *SCIENTIFIC LABORATORY INSTRUMENTS • APPARATUS • SUPPLIES • CHEMICALS*

E. H. SARGENT & CO., 4647 W. FOSTER, CHICAGO 30, ILLINOIS
DETROIT 4, MICH. • DALLAS 35, TEXAS • BIRMINGHAM 4, ALA. • SPRINGFIELD, N.J.

256 THE TMC 256-CHANNEL PULSE ANALYSIS SYSTEM

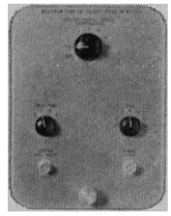


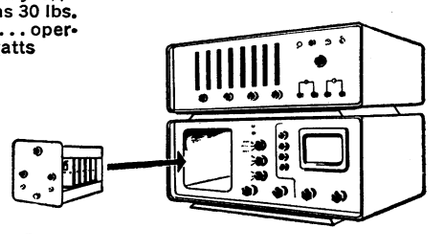
#220 DATA HANDLING UNIT usable as an active timer, event counter and readout device ... effective or actual counting times may be selected from 0.1 to 999.9 minutes in 0.1 min. steps ... manual, semi- or fully automatic operation, destructive and non-destructive readout.

PULSE HEIGHT ANALYSIS – #210 plug-in ... built-in linear amplifier, pulse generator ... 10-74 μs. dead time ... ±0.5% linearity

The Model CN-110 digital computer assembly ... only 8¾" high ... weighs 30 lbs. with plug-in ... operates on 25 watts

TIME-OF-FLIGHT MEASUREMENT #211 plug-in ... built-in delay of 0, 1, 2, 3 times address cycle ... choice of 9 channel lengths from 0.25 to 64 μs. ... automatic channel advance

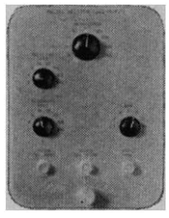




ONE BENCH-TOP INSTRUMENT...

Becomes a different pulse analyzer every time you change the logic

PULSED NEUTRON MEASUREMENT – #212 plug-in ... analysis channel lengths from 10 to 2560 μs. ... 10 μs. storage time ... (a high speed arithmetic scaler is supplied with the CN-110 at no extra charge when the 212 unit is purchased with it)



With just one CN-110 in your laboratory you have 256 channels of the pulse analysis you need – whether it's pulse height, time-of-flight, pulsed neutron or a special program. When you plug in the logic network, the instrument becomes a ready-to-use analysis system for that program. And you can change them in the time it takes to loosen a thumbscrew. Total weight is only 30 lbs., all circuits are transistorized – making this today's most versatile, compact pulse analyzer for research, field work or regular laboratory use. *They are now in production and deliveries are being made.*

THE BASIC UNIT IS A COMPLETE DIGITAL COMPUTER with all the circuitry for a 256-channel magnetic core memory and has the advantages of completely enclosed, plug-in memory ... choice of memory sub-groups ... pushbutton data transfer ... instantly selected analog, binary or digital readout.

FOR DATA HANDLING, a readout instrument has been designed specifically for use with the CN-110. The compact #220 data handling unit can be used as a live-timer during data gathering and as a readout system afterward. The #220 can be used with various types of paper tape printing and punching instruments.

Other readout devices that you can use with the CN-110 include strip chart and X-Y recorders, magnetic computer tape, punched paper cards.

Write for the new 6-page bulletin which contains complete details of the CN-110 and all accessories.

TECHNICAL MEASUREMENT CORPORATION TMC **441 WASHINGTON AVE., NORTH HAVEN, CONN.**

15 July 1960, Volume 132, Number 3420

SCIENCE

SCIENCE, which is now combined with THE SCIENTIFIC MONTHLY, is published each Friday by the American Association for the Advancement of Science at National Publishing Company, Washington, D.C. The joint journal is published in the SCIENCE format. SCIENCE is indexed in the *Reader's Guide to Periodical Literature*.

Editorial and personnel-placement correspondence should be addressed to SCIENCE, 1515 Massachusetts Ave., NW, Washington 5, D.C. Manuscripts should be typed with double spacing and submitted in duplicate. The AAAS assumes no responsibility for the safety of manuscripts or for the opinions expressed by contributors. For detailed suggestions on the preparation of manuscripts and illustrations, see *Science* **125,** 16 (4 Jan. 1957).

Display-advertising correspondence should be addressed to SCIENCE, Room 740, 11 West 42 St., New York 36, N.Y.

Change of address notification should be sent to 1515 Massachusetts Ave., NW, Washington 5, D.C., 4 weeks in advance. If possible, furnish an address label from a recent issue. Give both old and new addresses, including zone numbers, if any.

Annual subscriptions: $8.50; foreign postage, $1.50; Canadian postage, 75¢. Single copies, 35¢. Cable address: Advancesci, Washington.

Shades of the Sacred Grove

The animistic habit of thought, which attributes human purposes and characteristics to nonsentient organisms such as living plants, is widely followed by primitive man. The trees of the sacred groves of ancient Europe were thought to have souls and to be sensitive to pain; severe penalties were imposed on anyone who cut off a branch or injured the bark of a sacred tree; propitiatory rites were often enacted to gain a tree's forgiveness if it became necessary to fell it. Similar views were also commonly held about nonliving things. Darwin, in his account of the voyage of H.M.S. *Beagle*, tells of an amusing incident that illustrates the distinction between a scientific and an animistic explanation of an event. When he and his guides were camping at an elevation of about 11,000 feet in the Chilean Andes, they attempted to cook potatoes by boiling. Even boiling overnight was unsuccessful. The scientific explanation was, as Darwin knew and pointed out to his readers if not to his uneducated guides, simply that water boils at low temperature at high altitudes. The guides had another explanation, which was "that the cursed pot (which was a new one) did not choose to boil potatoes."

Animism, prescientific though it is, is still with us. The gambler entertains animistic thoughts about dice and slot machines, and the gardener may say that azaleas "prefer" an acid soil. Such informal and private views may be excused if not condoned. It is harder to excuse, much less condone, the publication of animistic interpretations in the press.

A notable instance of such publication is in the article "Revolution Rocks the Plant Kingdom!" which appeared in the 26 June issue of *This Week* magazine. Here is animism at its worst. Plants are said to be "a good deal more sensitive than anyone ever suspected," and when "injured they try to get revenge by spreading their own brand of poison." L. Ron Hubbard, the promoter of "dianetics," who is described as an American scientist, is quoted as saying that plants can feel pain and worry. According to the article, Hubbard has been applying a skin galvanometer to tomatoes, "like the one used on humans to detect emotional changes such as fear and guilt. When a nail is stuck into a tomato, the indicator on the galvanometer dial quivers and begins to fall." The reports of others, some of them scientists of good repute, are twisted to fit into the animistic framework: plants can be "confused" by being grown upside down or "bamboozled into believing" that winter is approaching if they are shaded for part of the day. Putting citrus plants "to sleep" with tranquilizers is said to help them resist frost.

This is irresponsible journalism. It presents a false view of nature and a false view of science. It fails to distinguish the work of genuine scientists from that of quacks. The remedy is obvious. No editor would assign a tone-deaf writer to review a concert or a person with no special knowledge of the theater to review plays. Science demands no less. Several hundred professional science writers with high standards, a sharp eye for chicanery, and a professional organization—the National Association of Science Writers—are available. Why not make more use of them?—G.DuS.

Letters

(Continued from page 110)

not the case here, one must conclude that "unnecessary" errors were made.

The "unpublished" sources Steward mentions did not concern the errors but concerned cultural materials for which some form of publication existed in, or before, 1957, except for my Yaruro materials (Steward did indeed suggest investigating this interesting group, and I have not forgotten this). Some sources appear to me, despite the authors' belief that South American interpretations "will not be greatly affected by current research" (p. vi), to be changing current views. Thus, Moore [thesis, Columbia University (1957); *Dissertation Abstr.* **17** (Apr. 1957); Columbia Univ. Press, (1958)] and Murra [thesis, University of Chicago (1956); *Dissertation Abstr.* **16**, 90 (1956)] have modified our conception of the Inca's state and economy and hence, perhaps, of their evolutionary status. Similarly, Wilbert's comment and Le Besnerais' material further confirm Hohenthal's exclusion of northern South American "marginals" from the "Marginal" category [thesis, University of California, Berkeley (1951), abstracted in *Kroeber Anthropol. Soc. Papers* **16** (1957)], a category the authors largely retain (chaps. 13 and 14, especially pp. 374, 454). The authors, by their own use of still unpublished Warrau data, confirm the importance of such material, since they sharply modify previous treatments [for example, *Handbook* (1948), vol. 3, pp. 869–881; Steward and Faron, *Native Peoples of South America* (1959), p. 245], creating still unsolved classificatory problems requiring speculation (p. 443).

ANTHONY LEEDS
City College, New York

Food Additives

In a recent issue of *Science* [131, 979 (1 Apr. 1960)], William J. Darby made comment about my recent book, *The Poisons in Your Food.* His remarks went far beyond the accepted bounds of a review.

I understand that it usually takes several months before a book is reviewed in *Science.* In this case, however, Darby's attack appeared only one month after my book was published by Simon and Schuster. The timing was especially fortunate for those who favor the wholesale addition of chemicals to foods. Only a few days after Darby's "review" appeared, the Manufacturing Chemists' Association was able to send reprints of it to newspaper editors

throughout the country. It is also being sent to librarians throughout the country.

Darby, unfortunately, dodged the real problem by carefully avoiding the documented facts in the book, concentrating instead on character assassination and diatribe. This was hardly the treatment one would expect from a top scientist who was assigned to review a book obviously considered worthy of his talents. It was also extraordinary that the book was assigned to the chairman of a group that has enthusiastically supported the use of chemicals in foods, and that has not been divorced from the fortunes of the food and chemicals industries.

Darby charged that "most of the 'authorities' named in the book are the [organic] cult leaders, their gods, or a few true scientists whose work or expressions have been taken either out of context or out of time. . . ." Again, he gave no bill of particulars.

Would he classify as "cult" leaders such men as Malcolm Hargraves of the Mayo Clinic; Arnold J. Lehman, chief pharmacologist of the Food and Drug Administration; David E. Price, assistant surgeon general of the U.S. Public Health Service; Arthur A. Nelson of the Food and Drug Administration; the late Anton J. Carlson of the University of Chicago; David Rutstein, head of the department of preventive medicine, Harvard University; Francis E. Ray, head of the Cancer Research Laboratory, University of Florida; H. M. Sinclair, director of the Laboratory of Human Nutrition, University of Oxford; W. C. Hueper, head of environmental cancer research, National Health Institute—and many others of their caliber?

All of these scientists have warned against various aspects of the food-chemicals problem and are quoted in my book. Could they be accused of "blood-thirsty pen-pushing" and "muck-raking"?

The nature of Darby's "review" becomes apparent when he accuses me of taking "scientific facts" from certain publications which he implies are worthy of contempt. Does he think that merely because a scientific fact is reported in a lay publication such as *Time* (one of the magazines he named) it should be discredited? Readers of the review will note that the publications Darby listed are not cited for scientific content but primarily because of their colorful reactions to various substances used in foods.

In the same vein, Darby charges that the book "is an irresponsible bid for wide sales through sensationalism." This would indicate that he thinks anyone who doesn't agree with him is an opportunist and a scoundrel, and that those who don't share his convictions are incapable of acting in good faith.

For the record, I would like to point out that this book was written a year before it was published. At that time the cranberry and stilbestrol incidents hadn't yet exploded, and there seemed little likelihood of a large sale. I wrote the book without expectation of making money, but out of conviction about the harmful effects of these chemicals after a 3-year study of the problem, and Simon and Schuster made it clear that they were publishing it in the spirit of public service. (Every newspaperman is entitled to be bitten by one cause in his professional career; this was mine.)

In passing, I note that Christian Hamburger, whom Darby derides by innuendo, was only one of many physicians who warned against the dangers of the carcinogen stilbestrol in meat. Among the others are Hueper; Robert K. Enders, chairman of the department of zoology at Swarthmore College and an adviser to the Department of Agriculture and the Department of the Interior; and Carl G. Hartman, director of physiology and pharmacology for Ortho Research Foundation, a branch of Johnson and Johnson.

Could Darby be considered on the side of the consumer when he supports the use of a chemical like stilbestrol that, apart from its biological effects, fattens cattle by making the flesh absorb water?

Darby, of course, completely ignores the central theme of the book—the chronic effect of continued small doses of poison. From his so-called review no one would suspect that this problem exists. But even if he has convinced himself that it does not exist, the Food and Drug Administration still recognizes it and its threat to human beings.

Paul L. Day, scientific director of the Food and Drug Administration, recently stated that there are approximately 1500 chemicals used in foods and that some could be injurious to human beings. "The danger, where it exists, is usually not one of acute toxicity . . . but long-term toxicity, far more subtle and therefore more to be feared," he stated. "DDT, for example, causes no obvious symptoms when ingested in small amounts, but may collect in the liver and do irreversible damage."

Nor is it possible to discount the warning of Hueper that "it is . . . a well established fact that an appreciable and growing number of chemicals, of which a few are known to enter the human food supply, are capable of causing and do cause cancers in man under proper conditions of exposure."

That is what *The Poisons in Your*