Comments and Communications

On the Price of Books: A Publisher's Reply to Mr. Lowry

In your issue of the 22nd April, John R. Lowry protests against the present high prices of scientific books and suggests that books might be issued "in both unbound and bound form."

It has frequently been suggested that the publication of books in paper bindings would result in a considerable saving, but this is in fact not the case. The saving in most instances would amount to only a few cents, since the greater part of the binding cost is in the folding and collating of the sheets and the sewing of the signatures; this operation has to be performed by the binder whether the casing is paper or boards.

The *manufacturing cost* of many books has doubled in recent years, as your correspondent rightly points out. The list price charged by publishers has been increased by a much smaller proportion. I believe that books show a smaller increase in price over the prices of ten years ago than almost any other commodity on the market.

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Precipitation Cycles

Recalling my own papers (Smithsonian Misc. Coll. Vol. 104, Nos. 3, 5, 1944; Vol. 111, No. 4, 1949) a letter from E. Fraselle, translated from the French, is of much interest:

I have much pleasure in informing you that I am verifying the influence of the cycle of 27 days on the precipitation registered at Shangugu (Costermansville) in Ruanda (Afrique Orientale).

The graph enclosed [Fig. 1] is computed from rainfall data of this station for 41 cycles from 4–1–1946 to 14–1–1949, as tabulated below. [The table is here omitted.]

I fixed the zero of the first cycle at 4–1–1946, because it represents the phase of maximum rainfall for the cycle as indicated by the mean of the 41 cycles. This day would therefore correspond to the twelfth day of your cycle for Washington, Smithsonian Misc. Coll., Vol. 104, No. 3.

In spite of the restricted number of cycles (41) used to establish my mean curve, the general correspondence of my results with yours is striking, and I cannot hide from you my satisfaction therein. This seems to me to have a great importance when one considers that Washington is situated in the Temperate Zone and Shangugu in the tropics.

I am about to publish a paper on the subject in which I give the ratio of expected average rainfall on preferred days to that on all others as 1.60. This follows from the graph enclosed.

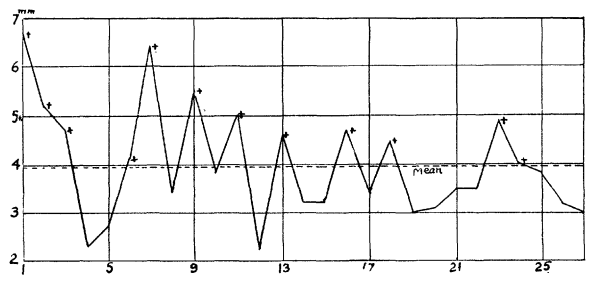

FIG. 1. The 27-day cycle in precipitation at Shangugu, lat. 2°30'S.: long. 28°54'E.; Alt. 1476 m. Ordinates, mean rainfall per day (mm) on cycle dates (abscissas) from 41 cycles. "Preferred" cycle dates +.

The matter was further referred to in my paper before the National Academy of Sciences (*Science*, 1949, 109, 436).

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Anode-Cathode Labeling in Electrochemistry

There has been much controversy over the use of the terms "anode" and "cathode" in the labeling of the electrodes in electrolytic and galvanic cells. From the standpoint of first year college students, as well as workers in the field, this has been an everlasting problem, always giving rise to doubt and uncertainty.

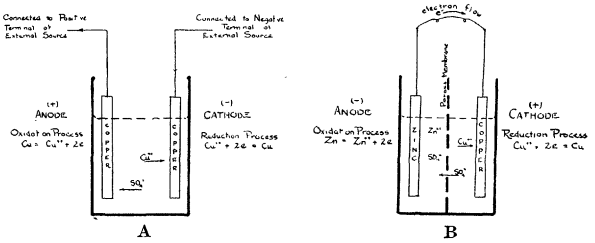

FIG. 1. A—Electrolytic cell. B—Galvanic cell (the Daniell cell).

The use of the terms with respect to an electrolytic cell, Fig. 1A, is not controversial, since it follows directly from Faraday's work on electrolysis. During electrolysis the electrode to which the anions migrate is termed the anode and that to which the cations migrate is termed the cathode. The electrode connected to the positive pole of the external circuit is the anode and that which is connected to the negative pole is the cathode.

On carrying over the use of these two terms to the galvanic cell, either one of two definitions must be followed: (1) the anode is always positive and the cathode always negative, or (2) the anions migrate to the anode and the cations migrate to the cathode. Both of these statements hold true for the electrolytic cell.

If the first statement is accepted, then in the case of the Daniell Cell (a galvanic cell), $Zn/ZnSO_4//CuSO_4/Cu$, the zinc electrode is the cathode and the copper electrode is the anode. This being the case, then the second statement cannot be true for the galvanic cell. From Fig. 1B, it can be seen that the copper ions migrate to the vicinity of the copper electrode and this we have termed anode according to statement 1. Confining ourselves strictly to Faraday's work and using these notations with respect to the galvanic cell, we would label the copper

electrode as the cathode, for it is to this electrode that the cations, the copper ions, are migrating. No mention has yet been made of positive and negative electrodes. Actually, an electrode is negative only because it is more negative than the other electrode in the system.

Using the second definition, it is immediately apparent that the terms now indicate the chemical processes occurring in the vicinity of the electrodes—namely, oxidation in the vicinity of the anode and reduction in the vicinity of the cathode. It would seem better from the chemical point of view to label the electrodes with respect to the chemical processes occurring than by any other terms. Oxidation processes will always occur in the vicinity of the anode and reduction processes will always occur in the vicinity of the cathode if this definition is followed in the labeling of both electrolytic and galvanic cells. There can be no mistaking the processes of oxidation and reduction, since they can be defined in terms of electron loss and electron gain, respectively.

Affixing the terms positive and negative to the electrodes would be a very simple matter. In the electrolytic cell, that electrode to which electrons are being admitted is termed the negative electrode (cathode), for it is more negative than the other electrode in the cell. In the galvanic cell, that electrode at which electrons are being liberated is termed the negative electrode (anode), for it is more negative than the other electrode in the cell. The chemical processes occurring at the negative and positive electrodes in the electrolytic and galvanic cells will be different, but the processes occurring at the anode and the cathode will be the same. The diagram shown of the electrolytic and galvanic cells make clear the notation and charge of each electrode.

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Corrections

In the paper "Preliminary Observations on the Biological Effects of Radiation on the Life Cycle of *Trichinella spiralis*" by Alicata and Burr (*Science*, 1949, **109**, 595) the reports of earlier observations by E. E. Tyzzer and J. A. Honeij (*J. Parasitol.*, 1916, **3**, 43), B. Schwartz (*J. Agric. Res.*, 1921, **20**, 845), and others, on the deleterious effects of radiation on the reproductive tissue of *T. spiralis* were inadvertently omitted from the list of references.

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A typographical error in Table 1 of my paper "The Validity of the Use of Tracers to Follow Chemical Reactions" (*Science*, 1949, **110**, 14), under the entries for chlorine makes the estimated maximum ratios for the tracers Cl^{36} and Cl^{38} somewhat ambiguous. The stable isotopes should be written as Cl (natural abundance). The ratios were calculated for reactions with the tracers Cl^{36} and Cl^{38} in systems containing chlorine of natural isotopic abundance. Due attention has been given to the fact that the Cl^{35} and Cl^{37} will react at different rates.

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Book Reviews

Kinematic relativity: a sequel to relativity, gravitation and world structure. E. A. Milne. New York: Oxford Univ. Press; Oxford, Engl.: Clarendon Press, 1948. Pp. vi + 238. $6.50.

This book is a presentation of the author's theory of cosmology and physics. It is a sequel to his study *Relativity, gravitation and world structure* (1935), but can well be read independently from the earlier volume. It is a fascinating treatise, centered around a brilliant idea, excellently presented and showing unusual skill in the elaboration of some of the details. Even though the reviewer could not agree with all parts of the book, his admiration never slackened for the scope of the work and the wealth of results obtained by the author with the help of only a handful of collaborators.

The central idea of Milne's theory is a restatement of Mach's principle (cf. p. 3) that the laws of nature are a consequence of the contents of the universe. Our expanding universe is, however, an ordered structure, consisting of galaxies moving as if they had originated at a certain time at a common point (the "origin of the world") and moved away from each other henceforth. There is, therefore, it can be claimed, no purpose in establishing laws of motion which would be valid in an arbitrary type of universe or in setting up laws of invariance which disregard the structure of our universe. In our universe, a definition of absolute rest, at every point of space time, can be obtained by considering the motion of the galaxies at that point. The coordinate systems in which matter, on the average, is at rest along the time axis are, according to Milne, preferred over other coordinate systems, but are mutually equivalent. The equivalent coordinate systems form a sixparametric manifold: three parameters are necessary to give the "average material point" whose world line coincides with the time axis of the coordinate system, and three parameters give the orientation of the space axes. The equivalent coordinate systems thus form a much smaller manifold than in Einstein's special theory of relativity, in which ten parameters are necessary to describe an inertial coordinate system. In Milne's theory, coordinate systems