Letters

Earth's Cores

In the interests of historical accuracy I would like to suggest a clarification of the following statement by Charles L. Drake and John C. Maxwell (3 July, p. 15) about the discovery of the earth's internal structure: "The fluid core was found through the seismological studies of Wiechert, Oldham, and Gutenberg, and the solid inner core by Lehmann in 1936."

Examination of the original publications shows that Wiechert, Oldham, and Gutenberg did not claim that the "core" they discovered is fluid. It was generally believed that the entire earth is solid until 1926, when Harold Jeffreys presented convincing evidence that the core is fluid (*1*). Contrary to the usual statement in modern textbooks, failure to observe transverse waves through the core was *not* sufficient to establish its fluidity. Conversely, Lehmann did not state that the inner core is solid in her 1936 paper; that was first suggested by Francis Birch in 1940, and was not established until much later (*2*).

Omission of first names in the sentence quoted above unintentionally conceals the fact (apparently known only to specialists) that one of the most interesting features of the earth's structure—its inner core—was discovered by a woman. Danish seismologist Inge Lehmann.

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References and Notes

1. H. Jeffreys, *Mon. Not. R. Astron. Soc. Geophys. Suppl.* **1**, 371 (1926).
2. For further details on the history of this subject, see S. G. Brush, *Am. J. Phys.* **48**, 705 (1980).

Publication Credit

Derek de S. Price (Letters, 29 May, p. 986) proposes a mechanism for dividing credit on research papers in order to discourage putting many authors on a single paper. He suggests that each author be given equal "credit" (in whatever terms) so that in a paper with ten authors, each would receive 1/10 credit for the work. The scheme does not, however, take into account the relative contributions of the different authors. Our experience is that, at least in biomedical research settings, the first author has done the major portion of the work, as well as the writing of the manuscript, with subsequent authors contributing decreasing amounts.

Some time ago, for our own amusement, we attempted to quantify credit for a research paper. We felt that any formula should meet the following criteria:

1) The larger the number of authors, the less credit per author.

2) The first position should get the most credit, and in general the ith author should receive more points than the $(i + 1)$th author.

3) If the first author needed so much help, the first position should get less credit as the number of authors grows, and in general the ith author out of N should receive more points than the ith author out of $N + 1$.

4) The first author should receive significantly more points than the second. This may be controversial, but we feel it is appropriate in biomedical settings.

We propose the formula

$$\text{Points} = [(1/i)/(1 + (1/2) + \cdots + (1/N))] \times 100$$

for the ith author out of N. (The points are standardized to 100 per paper.) Table 1 shows the resultant point distribution for up to $N = 6$ authors. This formula satisfies all properties above. Note that the ratio of points allotted to the ith and jth authors is always $j:i$, regardless of N. Thus concerning criterion 4, the first author always receives twice as many points as the second.

Table 1. Point distribution for up to $N = 6$ authors.

Authors (N)	Position in list					
	1	2	3	4	5	6
1	100					
2	67	33				
3	55	27	18			
4	48	24	16	12		
5	44	22	14	11	9	
6	41	20	13	10	8	7

In contrast, the more straightforward formula

$$\text{Points} = [(N + 1 - i)/(1 + 2 + \cdots + N)] \times 100$$

does not consistently satisfy either criterion 3 or 4 above. For example, if there are five authors, the first author receives only 33 points, compared with 27 for the second. Moreover, the fourth author out of five receives more points than if he or she had been fourth out of four.

We realize there is often a "last author" effect, whereby the laboratory director or principal investigator is put last on the list of authors, and that, psychologically, that person is given more credit for the paper than the previously listed authors. The paper is then referred to as "coming out of Ptolemy's group" (even though Ptolemy may never even have laid eyes on the paper), and the name of the first author is lost to posterity. This effect becomes more pronounced as the list of authors grows. We have deliberately not included such an effect as we do not wish to encourage this pernicious habit.

There are several immediate consequences of our scheme. The person most responsible for the work will have an incentive to keep the number of authors as small as possible. There will be much scuttling around as people reevaluate curricula vitae—their own and others—in light of the fact that it takes *14* papers being sixth out of six authors (25, being eighth out of eight) to equal one SAE (Sole Authorship Equivalent).

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Price, in his letter concerning multiple authorship of scientific papers (29 May, p. 986), appears to be proposing to legitimize the assessment of a scientist on the basis of the number of times his name appears in print by applying a factor which is at best marginal in its significance. Attributing to a given author fractional credit for a paper by dividing it by the number of co-authors assumes that the value of all papers is the same, irrespective of length, content, or number of collaborators. This contention is