vated area than was originally present above sea-level in it. Of course, as soon as any area appears above tidal water erosion begins so that there is no such thing as having a mass uplifted to a given height in the mountain-building process without any erosion having occurred in that time. But let us assume that there has been an uplift of two miles on the average. Then, during the erosion, there will have been an upward movement of the crust below to restore the balance of from five to ten miles, perhaps more, before base leveling will have been accomplished. This upward movement occurs in a most irregular manner, in time and in place. The movements would necessarily be along lines of least resistance. These would be vertical in some cases while they would be inclined in others and again near the surface the moving material would at times follow a direction that is practically horizontal. These movements, tending to maintain the isostatic equilibrium, would cause much distortion, fracturing and tilting of strata. It is believed that much of this distortion, due to the maintenance of the isostatic equilibrium, has been erroneously attributed to horizontal movements of crustal material at the time the area was originally uplifted.

If there are zones of weakness in the earth's crust needed for the formation of mountain systems, I should advocate that the zones be placed where there has previously been great erosion, but having the zones in those locations does not fit into the plan of having the mountain systems formed where just previously there had been very heavy sedimentation. It would really appear as if there are no zones of weakness in the sense required by the advocates of the contraction hypothesis. It would seem, therefore, that the causes which change the configuration of the earth's surface are quite local. What affects one area to cause the uplift of a mountain or plateau has nothing to do, in my judgment, with the uplifting of the earth's surface at some other place far removed.

PERIODICALS FOR MATHEMATICIANS

By Professor EDWARD S. ALLEN

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IN 1927 there was published in SCIENCE[1] the result of an investigation of the references, in the volume of the *Journal* of the American Chemical Society for 1926, to other periodicals. This year a number of colleagues have cooperated with me in making a similar study in the field of mathematics. It is unnecessary to repeat what was said in the former article about the importance of an adequate department library even in a small institution, and about the value of such studies in helping librarians to choose the most useful periodicals.

We decided, at the outset, that it would be unfair to base any judgment on work quoted in one mathematical journal alone. The *Transactions* of the American Mathematical Society most nearly correspond to the *Journal* of the American Chemical Society, yet the number of citations and the range of subjects treated in any one year are an inadequate basis for reliable conclusions. We therefore at once took into consideration the volumes of the *Annals of Mathematics* and of the *American Journal of Mathematics* for 1928. Then, feeling that even these three would be unrepresentative of the needs of working mathematicians, we added the 1928 issues of six of the seven foreign journals which they most frequently mentioned. Crelle's *Journal* would also have been included but for the decision to restrict the representation of each European nation to one periodical. The following table gives the journals used and the number of references taken from each.

TABLE I

		No. of references
Trans. Am. Math. Soc.	vol. 30	249
Annals of Math.	vol. 29, no. 2–4	
	vol. 30, no. 1	309
Amer. Journ. of Math.	vol. 50	211
Proc. London Math. Soc.	vol. 27, parts 5, 6, 7	
	vol. 28	252
	vol. 29, part 1	
Math. Annalen	vol. 99, 100	454
Journ. de Math. (Liouville)	vol. 7	110
Rend. Circ. Mat. Palermo	vol. 52	151
Acta Math.	vol. 51, no. 3–4	
	vol. 52, no. 1–2	65
Fund. Math.	vol. 11, 12	364
Total		2,165

Of these nine journals, three are American, three predominantly British, German and French, respectively, and three international.

Thus, it will be seen, we have information with something of an American bias, yet probably no more than there should be in a list intended primarily to be helpful to American librarians.

[1] P. L. K. Gross and E. M. Gross, "College Libraries and Chemical Education," SCIENCE, 66: 385, 1927.

For each citation there were noted the periodical in which the reference was found, that to which it referred, the year of publication of the latter and the language of the article cited. No count was taken of references to the encyclopedias, the Cambridge Tracts, the Mémorial, reports of congresses and similar series published at irregular intervals; certainly libraries should own as nearly complete sets of these as possible. Neither do the tables which follow take note of the five citations of articles over a hundred years old, for libraries could not, in general, hope to possess such collections as *Acta Eruditorum*.

The following table gives the total number of references to the thirty journals which were mentioned as many as fifteen times, distributed according to the last two decades and the preceding eighty years.

TABLE II

	1829–1908	1909–18	1919–	Total
Math. Annalen	75	51	124	250
Fund. Math.			201	201
Trans. Am. Math. Soc.	18	31	82	131
Proc. Lond. Math. Soc.	30	27	59	116
Comptes Rendus	31	24	56	111
Math. Zeitschrift			79	79
Bull. Am. Math. Soc.	11	9	58	78
Acta Math.	22	10	37	69
Journ. f. Math. (Crelle)	42	11	10	63
Annals of Math.	8	12	42	62
Am. Journ. of Math.	11	14	33	58
Proc. Nat. Acad.		4	53	57
Rend. Circ. Mat. Palermo	14	23	10	47
Rend. Accad. Lincei (*sci. fis.*)	8	11	23	42
Proc. Amst. (and Verslag)	2	14	24	40
Ann. sci. école normale	13	3	22	38
Journ. d. math. (Liouville)	19	9	5	33
Bull. d. scien. math. (Darboux)	5	2	24	31
Gött. Nach.	8	8	13	29
Bull. Soc. Math. France	17	3	9	29
Annali di mat.	24		2	26
Quart. Journ.	15	5	4	24
Jahresbericht, D. M. V.	7		15	22
Monatshefte Math. Phys.	2	4	14	20
Vienna Sitzung. (IIa)	6	7	7	20
Phil. Trans. Roy. Soc. (A)	15	2	2	19
Proc. Roy. Soc. (A)	8	3	7	18
Phil. Mag.	7	2	7	16
Journ. Lond. Math. Soc.			15	15
Mess. of Math.	2	5	8	15

We considered what would be the effect of rejecting references in one article to another article in the same journal. This was suggested by the procedure in the case of the chemical survey; it would counteract the tendency, very marked in some journals, to refer to previous articles in the same series so much as to misrepresent the needs of the general worker. However, these self-references had a strong influence on the ranks of only two periodicals—the *Proceedings* of the London Mathematical Society and *Fundamenta Mathematicae*. And even there the modified record still shows them to be among the most desirable serials; and, furthermore, their relative rank is scarcely disturbed at all if we merely reject an author's reference to his own previous work—perhaps a more reasonable method.

We also made a study of the relative ranks of periodicals when references in American journals alone were considered. Perhaps the most important alterations of standing are the lowering of the place of the *Mathematische Zeitschrift* and the advance in rank of *Biometrika* and the *American Mathematical Monthly* (which did not even gain a place in Table II). On the whole, it does not seem worth while to reproduce the results of this particular study. For one thing the data are less extensive. And if there were any one-sidedness, any excessive inbreeding in American mathematics, the use of American references only as a guide for librarians would merely tend to perpetuate them.

The following table shows the total number of periodicals cited, with the distribution of those not named in Table II according to the number of citations.

TABLE III

Periodicals included in Table II	30
" cited 10–14 times	14
" " 5– 9 "	21
" " 4 "	8
" " 3 "	10
" " 2 "	19
" " 1 time	36
Total	138

It would be convenient to be able to infer, in a mechanical way, that Table II gives an adequate guide for a librarian. Thus, one can by its use distinguish between those journals whose large (and expensive) series of volumes contain a moderate number of useful articles apiece, and those of recent origin which have at once published a number of important works; that is, between those whose files are desirable and those for which a current subscription is important. Conspicuous examples of the latter type are *Fundamenta Mathematicae*, *Mathematische Zeitschrift* and, of even more recent origin, the *Journal* of the London Mathematical Society.

Yet it would be decidedly unwise to use the results

of our tabulation uncritically. For instance, the *Proceedings* of the London Mathematical Society and *Fundamenta Mathematicae* have nearly the same rank, whatever criterion is employed. Yet a knowledge of the two journals will tell that the one is more important for a general mathematical library, the other in a department which specializes in questions of the bases of mathematics or in the theory of aggregates. Again, the mere listing of the number of references takes no account of the amount of material covered by one citation. One article in *Acta Mathematica* has many times the length, and in general many times the importance, of one in *Comptes Rendus*. An indication that these statistics may be misleading in the lower ranges is the fact that the *Sitzungsberichte* of Berlin were cited only half as many times as those of Vienna, and were therefore not included in any of our tables. It is probably fair to assume that this difference is due to the accident of the interests of mathematicians publishing in 1928.

In spite of these limitations, libraries may well be definitely helped by this investigation. Of the first thirteen serials of Table II, all except two are strictly mathematical journals, and should, in view of their importance, be on the subscription list of all mathematical libraries. To these the most important additions, in my opinion, are Liouville's *Journal, Annali di Matematica* and *Annales de l'école normale,* all of which publish memoirs of fundamental importance. American libraries will of course have the *American Mathematical Monthly,* while *Biometrika* is needed by workers in biological statistics.

Libraries should, as far as possible, have files of the American research journals and, among the longer established European periodicals, should do their best to obtain the *Annalen,* the London *Proceedings* (at least the volumes since 1890), *Acta,* Crelle's and Liouville's *Journals.*

Since the demand for non-specialized scientific serials is distributed among many departments every college library which wishes to further scientific progress should attempt to have all such periodicals listed in Table II. As has been suggested before, the Berlin *Sitzungsberichte* should certainly be added to the list. After the publications of the Paris and London academies, those from Berlin are the ones whose files are most desirable. The prominence already attained by the *Proceedings* of the National Academy deserves especial mention.

As to the languages which the mathematical worker should have at his command, the usual four are, of course, well in the lead.

TABLE IV
LANGUAGES USED IN ARTICLES CITED

	References in All journals	References in American journals
English	779	428
German	639	151
French	568	127
Italian	161	50

The high rank of English is obviously due in part to the fact that that language is almost exclusively used in four of the nine journals from which data were taken. It should be pointed out that a large number of the French citations refer to *Comptes Rendus* and *Fundamenta,* where the average number of pages in an article is small. The figures of our table, therefore, give too low an estimate of the relative importance of German and Italian.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

GENERAL LECTURES FOR THE DES MOINES MEETING

THE annual meetings of the American Association and associated organizations are now generally attended by several thousand science workers representing a large number of different fields of science, and the cities in which these meetings are held are so selected as to carry the advantages and the influence of the meetings successively into different regions of the eastern United States and Canada. Most of the thousand or more papers and addresses presented are technical in character, given by men and women of science for other workers in their respective fields, but the association aims to have on the program for each meeting a number of non-technical, semipopular or popular lectures on a variety of scientific subjects. These are given by eminent authorities in their own fields, but they are presented in such style as to be interesting to science workers in other fields and to the intelligent public generally. In some instances illustrated lectures are specially arranged for students in the schools of the city in which the meeting is held. All these general lectures are freely open to everybody and they are widely reported in the daily press throughout the United States and Canada and beyond. Recent results of research and recent trends of thought in the special sciences are thus made available to workers in all branches, and science as a whole