ing. In the case of plants it is well known that a long night either stimulates or inhibits reproduction when applied to short-day or long-day species, respectively (*4*).

The comments of Mr. Hammond are interesting and in our opinion serve to emphasize even further that the experiments in our report are the first to indicate *clearly* that the night or dark period exerts a discrete and specific influence in the photoperiodic responses of higher animals.

C. M. KIRKPATRICK
A. C. LEOPOLD

Purdue University
Agricultural Experiment Station
Lafayette, Indiana

References

1. KIRKPATRICK, C. M., and LEOPOLD, A. C. *Science*, **116**, 280 (1952).
2. SHULL, A. F. *Wilhelm Roux' Arch. Entwicklungsmech. Organ.*, **115**, 825 (1929).
3. WELLS, L. J., and ZALESKY, M. *Am. J. Anat.*, **66**, 429 (1940).
4. LEOPOLD, A. C. *Quart. Rev. Biol.*, **26**, 247 (1951).

The Languages of the Language of Science

THERE has been some discussion among mathematicians as to the Ph.D. requirements with respect to languages. One faction maintains that the rate of increase of papers published in the Russian language requires a revision of the usual French and German requirement to one that would admit Russian as an alternative at least. Some graduate schools have adopted this modification, and others are considering it. The other faction has said that, since there are still more papers published each year in each of the languages now required than are published in Russian, there is no point in making a change. Their other well-taken point is that in the past the Russian language did not come close to either French or German in quantity of publication. The literature of the past is, of course, of great importance.

We present herewith the results of a survey of mathematics papers, the abstracts of which appeared in *Mathematical Reviews*. Our data represent the classification by language of 34,733 papers. Of this number, 33,769 papers were written in one of seven languages. The other 964 papers were distributed among 23 languages as varied as Chinese, Esperanto, Serbian, and Gaelic.

TABLE 3

	USSR (1946–49)		Worldwide (1940–50)	
	No. of papers	Percentage of total	No. of papers	Percentage of total
Algebra	50	7.1	3,934	11.3
Analysis	425	60.9	14,251	41.1
Applied	51	7.3	9,208	26.5
Geometry	72	10.3	5,040	14.5
Group	54	7.7	1,039	3.0
Topology	47	6.7	1,261	3.6
Total	699	100.0	34,733	100.0

Table 1 is a summary of the languages in which these 34,733 papers were written. It is immediately apparent that English was used for almost half the papers, being over twice as prevalent as French, which ranks second. One reason for the extremely high position of English and the relatively high position of French is that prior to 1947 Russian scientists were given the choice of one language other than Russian into which their papers might be translated for publication. That choice usually went to French or English. It should be noted that, although Spanish and Dutch are included in the table, almost 95% of the papers were written in one of five languages.

Table 2 shows the number of papers written in the several languages in 1940 and in 1950. It also includes the ratio of increase from 1940 to 1950. The total number of papers written during the year has increased by a ratio of 2.38 : 1, but this does not necessarily mean that there has been that great an increase in papers in the field of mathematics. The number of journals abstracted by *Mathematical Reviews* has also increased since 1940. There is no easy way to determine the validity of Table 2 in view of this circumstance. It is interesting, nevertheless, to note that, with the exception of Dutch, in which the number of papers

TABLE 1

Language	English	German	French	Russian	Italian	Spanish	Dutch	Others	Total
No. of papers	15,789	4450	6722	3043	2652	859	254	964	34,733
Percentage of total	45.5	12.8	19.4	8.8	7.6	2.5	0 7	2.7	100 0

TABLE 2

	English	German	French	Russian	Italian	Spanish	Dutch	Total
1940	1052	365	349	92	145	33	9	2045
1950	2099	729	882	610	423	59	63	4865
Ratio $\frac{1950}{1940}$	1.99	2.00	2.51	6.63	2.92	1.79	7.00	2.38

is not large enough to be significant, the ratio of increase of the number of Russian papers abstracted is considerably higher than those of the other major languages.

In a previous paper (*1*) reference was made to the classification of Russian papers by general field during the years 1946–49. The authors received several communications suggesting that the data would have more significance if compared with the same classification on a worldwide basis. Table 3 presents these data. The differences in percentage need no particular comment except to note that security classification may account for the large differences in the field of applied mathematics.

The inevitable conclusion from the data presented is that the Russian language is gaining more and more significance in the field of mathematics. Whether it is now time for a shift in the Ph.D. requirement is a point for argument, but it appears that some adjustment will have to be made before long.

Even more significant is that the Russian scientist is making tremendous strides, whether we like it or not. Since our survival depends on a correct estimate of the situation, it is time for American scientists to draw their conclusions about the quality of Russian work from other sources than the editorial columns of their newspapers.

ROBERT J. HOWERTON
CHARLES E. DISS

Regis College, Denver

Reference

1. HOWERTON, R. J., and HOWERTON, P. W. *Science*, **113**, 307 (1951).

Baule-Mitscherlich Limiting Factor Equation

RECENTLY, in a brief communication to SCIENCE (**115**, 23 [1952]), the author pointed out that Blackman's concept of limiting factors, which is based on Liebig's law, is not valid. Since that communication was submitted, a paper written on the subject by Baule (*Landwirtsch. Jahrb.*, **51**, 363 [1918]) has been studied. In it Baule argues that Liebig's law is invalid, and he presents a general limiting factor equation derived from that of Mitscherlich (*Landwirtsch. Jahrb.*, **38**, 537 [1909]). Baule's paper has apparently been ignored by most English-writing biologists. The most conspicuous case of such omission is that of Van den Hohnert (*Rec. trav. botan. Néerl.*, **27**, 149 [1930]), who carried out experiments designed specifically to elucidate the limiting factor problem but failed to include any consideration of Baule's equation.

The general equation is:

$$E = E_{max}(1 - e^{-0.7x/h_1})\ (1 - e^{-0.7y/h_2})\ (1 - e^{-0.7z/h_3})\ (\ldots)\ (\ldots),$$

where E is the rate of a process influenced by several factors; E_{max} is the maximal rate obtained when all factors are present at optimal intensity; and the x, y, z, etc., are intensities of the separate factors influencing the process. The 0.7 and the h's are constants introduced to facilitate fitting the equation to experimental data.

An inspection of the equation shows that the "slowest" factor does not limit the rate of the process exclusively, but all factors are influential at all times in varying degree, depending on their intensity. This is true except in the special case where a factor has zero intensity. Then the rate is zero, regardless of the intensity of other factors; thus Liebig's law is valid in this special case. The equation predicts, as has frequently been demonstrated experimentally, that when one factor is at a suboptimal intensity, the manipulation of other factors will still produce changes in the rate of the process. An examination of the individual terms of the equation reveals that the manipulation of a single factor, other factors being constant, should yield a logarithmic curve, not a Blackman-type curve. This prediction is also abundantly confirmed by the experimental results obtained by a host of researchers. The equation, therefore, seems to constitute an acceptable expression of limiting factor theory, and deserves more recognition than biologists have accorded it during the 35 years since it was published.

JACOB VERDUIN

The Franz Theodore Stone Institute of Hydrobiology
Put-in-Bay, Ohio

Fluoridation of Water

WITH reference to page 199 of the Feb. 20, 1953, issue of SCIENCE, stating a resolution was passed by the Subsection on Dentistry (N2) endorsing fluoridation of city water supplies, can you give me any further information as to the disposition of the resolution?

VICTOR E. CARUSO

Wyckoff, New Jersey

On Saturday, December 27, Section Nd adopted the following resolution and directed that it be conveyed to the AAAS for approval and publication:

Be it resolved, That Section Nd (dentistry) convened in annual session in St. Louis December 27 strongly endorsed the fluoridation of city water supplies as a partial preventive of decay of the teeth of children and recommends that all cities and communities having a central water supply adopt this health measure.