thyst of Fujiya, Hoki Province, must be noted, and rose quartz is found at Gota. Maki Province (pp. 46, 47). Inclusions of quartz come chiefly from Mukaiyama and Takemori, the green fibrous inclusions being epidote and the brown fibrous ones tourmaline; included sulphur of a beautiful yellow is limited to quartz of Takemori. Fluid inclusions are quite common, being usually distributed irregularly throughout the crystal, though sometimes in definite layers parallel to the faces of the rhombohedron (p. 44). Felspar, tourmaline and garnet are here found in association with quartz. Localities well known since ancient times for beautiful quartz crystals are the granitic regions around Kimpû-zan, Kai Province. Here colorless and transparent crystals for ornamental work have been obtained for centuries (p. 38). It is well known that the manufacture of beautiful crystal balls has long been carried on in Japan.

A small crystal of crysoberyl has been found in stanniferous sand of Takayama, Mino Province; it was of a pale greenish-yellow color (p. 82). Beautiful crystals of vivianite were at one time met with at Ashio, Shimotsuke Province. At first they were light blue, but became darker on exposure to the air (p. 86). Some blue, transparent crystals of tourmaline have been found at Takayama, Mino Province, and beryl found here resembles the tourmaline in color and form, one end of the crystal being of a lighter hue, while the other end is decidedly darker and only semi-transparent. The topaz, however, is the most conspicuous of the gems found in Japan and Dr. Wada gives a very full account both of the occurrences and of the crystallographic forms (pp. 89–113). It occurs in pegmatite veins in granite as in Takayama and Hosokute, Mino Province, Ishigure, Ise Province, and Tanokamiyama, Omi Province. Japanese topazes were first exhibited in the National Exposition of Tokio in 1877. Six different hues have been observed, as follows: (1) Colorless; (2) wine-yellow, or bluish-yellow; (3) pale blue; (4) pale brown and pale blue in sectors; (5) pale green; (6) brown. On exposure to daylight the brown and brownish-yellow shade into blue, and the blue tends to become colorless. The brown hue is confined to a few freshly-quarried specimens, and is never observable in those which have been kept long in daylight. In some specimens the structure is shown by inclusions arranged parallel to the outline of the crystals, producing the strange effect observable in the so-called "phantom quartz."

The most beautiful of the topaz crystals illustrated by Dr. Wada (Plate XXIV., Fig. *a*) was found between 1870 and 1880. It came later into the possession of Count K. Inowe who presented it to Dr. Wada. It measures 84 mm. in length, 64 mm. in the longer diameter and 51 mm. in the shorter. It is based on a piece of felspar, and on the side is black quartz crystal, the topaz standing nearly perpendicular to its prismatic faces.

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SPECIAL ARTICLES

THE GEOMETRICAL MEAN AS A B. COLI INDEX

Several reasonable objections have dissatisfied bacteriologists with the present methods of estimating the average number of *B. coli* in water.[1] The following method is proposed as a simple, convenient, and theoretically desirable means of arriving at a numerical index representing such a series of results. It was suggested in 1912 by data obtained at the Washington Filter Plant,[2] and has since been practically applied with much success.

Data—*B. coli* are determined to be present or absent in a series of fermentation tubes containing portions of the sample in multiples of ten, *i. e.,* 10 c.c., 1 c.c., .1 c.c., .01 c.c., .001c.c., etc.

Example: Suppose twenty samples or series of tubes gave the following results, where + or positive means *B. coli* were found present,

1 Report of the Committee on Standard Methods, American Public Health Association, 1916.

2 Wells, W. F., "Some Notes on the Use of Alum in Connection with Slow Sand Filtration at Washington, D. C.," Proceedings of American Water Works Association, 1913.

and conversely — or negative means *B. coli* were not found.

10 C.c.	1 C.c.	.1 C.c.	.01 C.c.	.001 C.c.
20+ 0−	18+ 2−	8+ 12−	1+ 19−	0+ 20−

Problem.—The problem is to derive from a number of such determinations a numerical index of the most probable result to be obtained by repetition.

Definition.—Call the quantities used "Dilutions," since the dilution method is the one used for measuring those quantities. Specifically grade the dilutions as follows:

Quantity..	10 c.c.	1 c.c.	.1 c.c.	.01 c.c.	.001 c.c., etc.
Dilution ...	0	1	2	3	4, etc.

Call the "Dilution Positive" that "Dilution" at which higher "Dilutions" were negative and lower positive, after reverting skips where such occur.

Example continued:

"Dilution	0	1	2	3	4
Positive" ...	2	10	7	1	0

Average Dilution Positive.—Add the "Dilutions Positive," and divide by the number of samples to find the "Average Dilution Positive."

Example continued:

"Dilution Positive"

$$\begin{array}{rl} 0 \times 2 = & 0 \\ 1 \times 10 = & 10 \\ 2 \times 7 = & 14 \\ 3 \times 1 = & 3 \\ 4 \times 0 = & 0 \\ \text{Total } 20\ ) & 27 \\ \text{Average} & 1.35 \end{array}$$

Score.—The decimal part of the "Average Dilution Positive" gives the "Score," and the integral part tells how many figures to point off. The reason for calling it a "Score" is that it is directly comparable to the bacteriological score of oysters.[1] In the above example, the "Score" would be 3.5. For all ordinary purposes, the "Score" is a very good index and can be used directly.

Geometrical Mean.—The "Score" can be converted into the "Geometrical Mean" from the following table:

TABLE FOR CONVERTING SCORE INTO GEOMETRICAL MEAN

	0	1	2	3	4	5	6	7	8	9
0	100	102	105	107	110	112	115	118	120	123
1	126	129	132	135	138	141	145	148	151	155
2	159	162	166	170	174	178	182	186	191	195
3	200	205	209	214	219	224	229	235	240	246
4	251	257	263	269	276	282	289	295	302	309
5	317	324	331	339	347	355	363	372	381	389
6	398	407	417	427	437	447	457	468	479	490
7	501	513	525	537	550	562	576	589	603	617
8	631	646	661	676	692	709	725	741	759	776
9	794	813	832	851	871	891	912	933	955	977

From the previous example, the "Score" 3.5 becomes "Geometrical Mean" 2. 24, which is not very different. Either represents an approximation sufficiently close to be considered the number of *B. coli* per c.c.

Percentage Method.—The same results are given by an alternative method, which may sometimes be more convenient. Compute the percentages that are positive in each "Dilution." The resulting figures should extend from a "Dilution" at which 100 per cent. are positive to one at which 100 per cent. are negative. The percentages are then added, and will give a number of three figures before the decimal point. The first or hundreds figure is discarded, the other figures giving the "Score" when properly pointed off by inspection.

Example continued:

Quantity		Per Cent. +
10	c.c.	100
1	c.c.	90
.1	c.c.	40
.01	c.c.	5
.001	c.c.	0
		235

Discarding the 2 gives the "Score" figures of 35. Inspection shows there are more than .35 and less than 35, and thus the same result, 3.5, is obtained as by the previous method.

Reversion Method. (*a*) *Direct.*—The principle of reversion used in figuring the oyster score[1] may also be applied in this method.

Example continued: The + .01 c.c. tube and one of the + .1 c.c. tubes revert to the 1 c.c. column, leaving seven + .1 c.c. tubes out of twenty samples. This gives 35 per cent. of the .1 c.c. tubes positive or as before the "Score" 3.5 when pointed off, (*b*) *Percentage.* The same thing may be done from the percentage column above, *i. e.*, 5 per cent. of the .01 c.c. and 5 per cent. of the .1 c.c. tubes revert to make the 90 per cent. of the 1 c.c. tubes up to 100 per cent., leaving 35 per cent. of the .1 c.c. tubes positive as before.

Single Dilution Method.—Frequently determinations are made in one dilution only. In this case the "Percentage Positive" gives the "Score" as where several are used.

Split Dilutions.—Where other "Dilutions" are used than the regular ones, the same methods can be applied by using the corresponding "Dilution" in the computation.

CONCLUSION ARGUMENT

The reason the above simple methods give the "Geometrical Mean" arises from the fact that the ordinary bacteriological dilution scale is in reality a logarithmic scale, and the average dilution is the average logarithm or the logarithm of the "Geometrical Mean." A vast amount of published bacteriological data to be considered at some other time proves that bacteriological results follow a logarithmic probability curve, from which it follows that the median value closely corresponds to the geometrical mean. It is equally probable, therefore that another sample would be greater as less than the geometrical mean. There is nothing in this principle to limit the application of the method, and by intelligent application it can be employed in interpreting all similar forms of data.

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PITTSBURGH MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The seventieth meeting of the American Association for the Advancement of Science was held in Pittsburgh, Pennsylvania, on December 28, 1917, to January 3, 1918. It seems to be a very general opinion of the members who attended that the meeting was practically an unqualified success. The total registration at the office of the permanent secretary was 692.

It is impossible to estimate the number of members who were deterred from attendance by the statement sent to the press by the Pennsylvania Railroad late in December, and by the published letter of Dr. Richards, but it is obvious that no congestion of traffic, and no clogging of trains resulted from the meeting. Of the 692 persons registered, 194 came from Pittsburgh and other parts of Pennsylvania, 122 registering from Pittsburgh alone. The remaining attendance came as usual from all points of the compass, and were distributed on the regular trains arriving at different times, so that their train presence was scarcely to be noticed.

The attendance was distributed as follows: from Pittsburgh and the rest of Pennsylvania, as just stated, 194, New York 84, Ohio 59, District of Columbia 44, Illinois 34, Massachusetts 26, West Virginia 21, Indiana 20, Michigan 18, Wisconsin 15, Maryland, Missouri and Canada 14 each, Iowa and Texas 13 each, New Jersey and Virginia 11 each, California 10, North Carolina 8, Connecticut, Tennessee and Kansas 6 each, Minnesota and Arizona 5 each, New Hampshire, Louisiana and Montana 4 each, Maine, Delaware and Kentucky 3 each, Japan, Nebraska, Utah, Oregon and Colorado 2 each, Rhode Island, Georgia, North Dakota, Arkansas and Wyoming 1 each.

The interest of the meeting was enhanced by the presence of the following foreigners, who were made honorary associates for the meeting: Lieutenant Georgia Abbetti, of the Italian Military Commission; Lieutenant G. P. Thompson, of the Royal Flying Corps of Great Britain; Captain DeGuiche, of the French Military Commission, and Dr. Shigetaro Kawasaki, chief geologist of Korea.

The impressive keynote of the whole meeting was war preparation and efficiency. This was borne out not only in a number of symposia devoted to specific war topics, but also in other discussions, and in other papers, the titles of which would not necessarily lead one to expect a development along the line of war preparation. The local press was keen in noticing this aspect of the meeting, and paid great attention to the papers of the entire session.

The opening general session of the association was held Friday night, December 28, in the lecture hall of the Carnegie Institution. The president of the Association, Professor Theodore W. Richards, of Harvard University, was absent, and Dr. George H. Perkins, of the University of Vermont, senior vice-president, presided. Mr. H. M. Irons, city at-