ing of the congress will take place on Monday evening, Sept. 17, at 8 P.M., when the council will be appointed, and the general order of business for the session will be determined. The ordinary meetings of the congress will be held on the mornings of Tuesday, the 18th, and succeeding days, beginning at 10 A.M. In the afternoons there will be visits to museums, or to places of interest in the neighborhood of London. Arrangements for the evenings will be made at a later date. The ordinary business of the congress will include the discussion of questions not considered at Berlin, or adjourned thence for fuller discussion at the London meeting. Among these are the geological map of Europe, the classification of the Cambrian and Silurian rocks and of the Tertiary strata, and some points of nomenclature, etc., referred to the congress by the International Commission. Miscellaneous business will also be considered. In addition to these questions, the organizing committee proposes to devote a special sitting to a discussion on the crystalline schists. An exhibition will be held during the week of the congress, to which geologists are invited to send maps, recent memoirs, rocks, fossils, etc. Foreign members of the congress are invited by the council of the British Association to attend the meeting of that association at Bath. During the week when the association meets, there will be short excursions in the neighborhood of Bath, and longer excursions will be made after the meeting. At these excursions excellent sections of the lower secondary and upper paleozoic rocks will be visited. Excursions will take place in the week after the meeting of the congress (Sept. 24 to 30). The number of these will depend upon the number of members desirous of attending, and upon the districts which they most wish to visit. The excursions at present suggested are: (1) The Isle of Wight (visiting the Ordnance Survey Office at Southampton on the way), cretaceous, eocene, oligocene. (2) North Wales, Pre-Cambrian and the older paleozoic rocks; West Yorkshire (Ingleborough, etc.), Silurian and carboniferous limestone. (3) East Yorkshire (Scarborough, Whitby, etc.), Jurassic and cretaceous. Should the number of members be so large as to make additional excursions necessary, they will probably be: (4) Norfolk and Suffolk, pliocene (crag) and glacial beds. (5) To the Jurassic rocks of central England. The short excursions during the week of the congress will probably be to Windsor and Eton, to St. Albans, to Watford, to Brighton, to the Royal Gardens at Kew, and to other places of interest. Brief descriptions of the districts to be visited in these excursions will be prepared (with illustrative sections, etc.), and will, if possible, be sent to members before the meeting. The full report of the London meeting will be issued soon after the close of the session. It will contain, in addition to reports of the ordinary business of the congress, the report of the American committee on nomenclature (about 230 pages); the memoirs on the crystalline schists (about 150 pages), and reports of discussion on the same; and probably a reprint, with additions, of the report of the English committee on nomenclature (about 150 pages).

— An international horticultural exhibition, we learn from *Nature*, is to be held at Cologne from Aug. 4 to Sept. 19.

— On the 4th of June, according to *Nature*, Dr. Maxwell T. Masters was elected a corresponding member of the Institute of France, in the Botanical Section, in place of the late Prof. Asa Gray. Besides Dr. Masters, the following names appeared on the list of presentation: M. Treub of Batavia, Mr. Triana of Paris, M. Warming of Lund, M. Wiesener of Vienna. Dr. Masters obtained 39 votes; M. Triana, 5; M. Treub, 1.

— We are glad to learn (from *Nature*) that a pension of £50 has been granted to Mrs. Balfour Stewart from the civil list.

— Messrs. Thomas Whittaker & Sons, New York, have published an admirable 'Planisphere showing the Principal Stars visible for Every Hour in the Year.' It is substantially made, and convenient for use in our latitude. —— *Outing* for July opens with 'An Irish Outing Awheel,' from the pen of 'Faed' Wilson. The illustrations of Irish scenery by Harry Fenn are handsomely reproduced. The number contains plenty of summer matter. Samuel M. Baylis is the author of 'After Trout in Canadian Waters.' Other articles are 'Richfield Springs,' by Mrs. M. B. Hedges; 'The Angling Tournament,' by Francis Endicott; etc. —— The July volumes of Ticknor's Paper Series will be as follows: 'Two College Girls,' by Helen Dawes Brown, ready July 7; and 'The Rise of Silas Lapham,' by William D. Howells, ready July 21. —— Macmillan & Co. are about to publish in two volumes a second series of Carlyle's letters, extending from 1826 to 1835, edited by Professor Norton. —— The J. B. Lippincott Company have in press 'Stanley to the Rescue: the Relief of Emin Pacha,' by A. Wauters, president of the Royal Geographical Society of Belgium. It will contain a map and thirty-four illustrations. —— G. P. Putnam's Sons publish this week 'The Story of Turkey,' by Stanley Lane-Poole, which forms the nineteenth volume of the story of the Nations Series.

— Mr. Joseph Jastrow has been elected professor of experimental and comparative psychology at the University of Wisconsin. This is very gratifying, as it shows an interest in this country in the scientific aspect of mind.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

The Rainfall at Fort Leavenworth, Kan.

IN 1837 rainfall observations were instituted at Fort Leavenworth under the supervision of the post surgeon, and the record was continued, with but few breaks, until October, 1883. In the latter year, in view of the proximity of the Signal Service station in Leavenworth City, the authorities at the War Department, or the officers at the fort, suffered this magnificent record to be discontinued. The length of the series, surpassing any other record west of the Mississippi, and antedating by almost twenty years the settlement of Kansas by the white man, has made it of especial value as evidence upon the question of a secular change in rainfall over the Western plains.

The observations up to 1874 were rendered generally available by their publication in the 'Smithsonian Precipitation Tables' and in the 'Report of the Kansas Board of Agriculture for 1874;' for the years 1871 to 1880 they were published in 'Professional Paper No. IX.' of the Signal Service; and for 1881 to 1883 they have not been printed, or at least have not become generally accessible. The series subsequent to 1873 seems, moreover, to have been little used, and discussions of secular change in rainfall have generally been made by completing the Fort Leavenworth series since 1873 with the Signal Service records at Leavenworth City, the entire comparability of the two series being assumed without investigation or proof.

That this assumption is quite unscientific, and that it is liable to lead to erroneous results, does not need to be argued before the careful meteorologist. The difference in the rules and methods of observation and the spirit of the observers, as well as the difference in the locations and exposures of the gauges and in the gauges themselves, furnish abundant room for systematic discrepancy.

With the record thus constructed out of the two series of observations, an average increase of seven inches seemed to have occurred during the past twenty years, and this result has been widely used to confirm the belief in a permanent increase in the rainfall over the Western plains. For the reasons above stated, this conclusion seems to me to stand in need of a complete re-examination. In a preliminary survey of the Fort Leavenworth observations as printed, errors were discovered that showed the necessity of a thorough scrutiny of the original data (see *Science*, xi. No. 272).

In order to make the desired examination, I have visited Fort Leavenworth, and through the courtesy of Major Alfred A. Woodhull, Surgeon U.S.A., was enabled to make copies of the original records for the years not hitherto published, and for the periods needing confirmation. I am also indebted to Major Woodhull for certified copies of a portion of the records that have heretofore been incorrectly printed.

In view of the error already discovered, — namely, that the measured snowfall in January, 1871, had not been reduced to inches of

water, — I examined all of the data since 1870, to correct, so far as possible, all other errors of the same kind. The record of snow for the winters of 1870–71 and 1871–72 were found to be given in this way, and comparison with the Signal Service observations also indicated that the reduction had been neglected in a few instances in subsequent years. This critical examination of the original observations has led to the construction of the accompanying table of monthly totals: —

MONTHLY PRECIPITATION AT FORT LEAVENWORTH, KAN.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1870.....	—	—	—	—	—	—	—	—	—	—	—	1.27*	41.70
1871.....	1.12	3.37	1.70*	1.22	2.00	5.44	1.63	4.66	1.85	4.00	3.94†	0.46	31.39
1872.....	0.20	0.87†	2.30	4.50	8.15	3.64	9.99†	6.83	4.05	0.83	0.00	2.85	44.21
1873.	0.98	1.35	1.80	4.30	5.03	3 11	3.12	1.40	2.53	0.91	0.87	5.24†	30.64
1874.....	1.44	1.07	1.50	1.40	1.00	3.55	2.95	1.69	4.76	0.37	3.46†	1.02	24.21
1875.....	0.05	1.25†	1.70	2.23	4.17	2.34	6.72	3.15	0.78	0.74	0.40	1.98	25.51
1876.....	1.20	0.44	5.71	6.19	6 17	4.81	2.28	4.21	3.62	3.00	1.91	0.66	40.20
1877.....	1.65	0.58	4.14	5.16	7.61	7.59	4.36	2.15	1.88	4.36	1.71	2.82	44.01
1878.....	1.36	2.88	1.95	2.76	3.96	4.36	1 89	2 38	2.61	0.54	2 28	2 40	29.37
1879.....	0.12	0.35	0.06	3.44	2.05	7.89	3.59	0.62	2.79	3.85	6.26	1.85	32.87
1880.....	2.14	1.55	2.53	1.46	3.90	0.96	5.86	6.68	1 68	2.40	1.80	0.40†	31.36
1881	0.15	4.61	2.20	1.67	3.14	3 73	2.00	1.92	5.23	4.46	1.40	0.96	31.47
1882.....	1.07	0.88	0.76	3.84	2.61	2.82	3.00	0.65	1.18	2.28	1.92	1.06	22.07
1883.....	0.48	2.05	0.72	1.27	6.65	12 16	2.25	1.97	0.85	8.31†	2.02†	0.65†	39 38

* Observations by Mr. F. Hawn. † Observations by Signal Service.

Important changes in the values for April, May, July, and August, 1871, are corrections of serious errors existing in the published observations, the corrected values having been furnished by Major Woodhull. For those months in which the record at the fort is missing, namely, February and July, 1872, and October to December, 1883, the Signal Service observations have been inserted to complete the series.

The Signal Service record has also been substituted in November, 1871, and December, 1880, — months in which the fort record is manifestly recorded improperly, but for which the correct record cannot safely be inferred; and also in December, 1873, November, 1874, and February, 1875, for portions of which the fort record of snow is apparently measured carelessly, or recorded without reduction, but of whose error the evidence now at hand is not entirely conclusive.

Although in these several instances the fort record has been completed by the use of Signal Service observations, the series still remains essentially homogeneous and comparable from 1837 to 1883.

Combining the whole series in ten-year means, we have the material for ascertaining the existence of any secular change: —

Period.	No. of Years.	Amount.
1837-46.....	10	30.4
1847-56..... ..	10	32.3
1857-65.....	9	33.7
1867-76	10	33.2
1877-83.....	7	32.9

The increase of seven inches shown by the combined Fort Leavenworth and Signal Service records has largely disappeared. Examining, now, the average annual rainfall from 1872 to 1883 given by the Signal Service record and the record at the fort, we find that the former is 38.5 inches, and the latter 33.0 inches, showing a discrepancy between the two of five and a half inches.

To what this discrepancy is due, — whether to differences in the rules of observation or to an error of ten per cent in the Signal Service gauge (as was the case at Providence, R.I.), or to some other cause, — I do not know; but it is fairly manifest that the conclusions based on the assumed comparability of the two series are quite worthless.

GEO. E. CURTIS.

Birmingham, Conn., June 30.

Photographs of Lightning-Flashes.

POSSIBLY some of your readers may be interested in the following report: —

In the month of June, 1887, a committee of the Royal Meteorological Society, London, issued about two hundred circulars to the secretaries of photographic societies in various parts of Europe and America, and also to other likely persons, requesting them to furnish the society with photographs of lightning-flashes.

About sixty photographs of lightning-flashes were received in answer to this invitation; and these were exhibited at the meeting of the society in March, 1888, where they received much attention.

From the evidence now obtained, it is evident that lightning assumes various typical forms, under conditions which are at present unknown.

The following appear to be some of the most typical forms of lightning-flashes: —

1. Stream lightning, or a plain, broad, rather smooth streak of light. Only two or three specimens of this form have been received. The committee are disposed to consider this a distinct type of a single stream-like character, without distinct irregularities or branches, and not merely the result of bad focusing, because other objects, such as trees, are extremely sharp.

2. Sinuous lightning, when the flash keeps in some one general direction, but the line is sinuous, bending from side to side in a very irregular manner. This is by far the commonest type.

It is very noticeable that the thickness of the line varies during the course of discharge. Sometimes the thinnest part of the white streak is the highest, and the flash appears to get thicker as it approaches the earth; at other times a flash in the air begins thin, broadens out in the middle, and fines away again at the farther extremity.

The committee can offer no explanation of this at present, but they would call attention to the fact, that, in some photographs of electric sparks taken from an induction-coil, those of high tension are thinner than those of low tension.

3. Ramified lightning, in which part of the flash appears to branch off from the main streak like the fibres from the root of a tree. Of course, there is no evidence as to whether these fibres branch off from, or run into, the main flash.

4. Meandering lightning. Sometimes the flash appears to meander about in the air without any definite course, and forms small, irregular loops. The thickness of the same flash may vary considerably in different parts of the course, as mentioned above; and a flash may go pretty straight in one portion of its path, but meander considerably in another.

5. Beaded or chapleted lightning. Sometimes a series of bright beads appear in the general white streak of lightning on the photographic plate. Occasionally these brighter spots appear to coincide with bends in a meandering type, but often the beads appear without any evident looping of the flash.

But as a flash is moving in space, while two directions only can be shown on the plane of the paper, there is every reason to believe that the brighter spots on the positive picture may be points where the flash was zigzagging, either directly towards, or away from, the observer, and thereby giving a somewhat longer exposure to these spots.

6. Ribbon lightning. Nearly one-sixth of the photographs received by the society show flashes exhibiting more or less of a ribbon-like form. One edge of the ribbon is usually much whiter and firmer than the other.

Occasionally in the same picture some flashes appear normal, and others ribboned; but the flashes in a picture need not have occurred simultaneously. The committee have not yet in their possession any conclusive evidence as to whether the same flash may be normal in one portion, and ribboned in another portion, of its course.

In one picture there is a bright streak on the top of the flash; then about an eighth of an inch of ribbon-like light, the folds fol-