the water, have these explanations complicated with another consideration, —the figure of the mercurial mass.

Observations upon the facts recently presented by Professor Olmsted, in relation to Meteors seen on the 13th of November, 1834. By A. D. BACHE, Prof. Nat. Philos. and Chem. Univ. Penn.

Before proceeding to examine the new facts recently put forth by my friend, Prof. Olmsted, in regard to meteors seen on the 12th and 13th of November, 1834, it will be well to state what is the difference of opinion between us.

Prof. Olmsted I understand to assert, that there was a recurrence of the meteoric display of November, 1833, in 1834, thus verifying a prediction made by him as a consequence of his peculiar theory. With that theory, further than as it is borne upon by facts in regard to the prediction founded upon it, I have not at present any concern. Independently of theory, it would be a very curious fact, if it were made out, that meteoric displays of an unusual kind occurred annually on the same night; and I was induced to observe on the night of the 12th–13th of November, 1834, with reference to facts rather than theory. Prof. Olmsted states his conclusions from observations made at New Haven, in these words: “On the morning of the 13th of November, 1834, there was a slight recurrence of the *meteoric shower* which presented so remarkable a spectacle on the corresponding morning of 1833.”*

My views, as resulting, first, from observations made at Philadelphia on the morning of the 13th, are, that “there occurred on the 13th of November, 1834, no remarkable display of meteors of the kind witnessed in 1833.” To sustain this, after recording the meteors seen by me on the 13th of November, 1834, I undertook to show, 1. That the meteors which I saw were neither in degree nor in their peculiarities like a portion of the meteoric phenomenon of November, 1833. 2. That they were similar, both in degree and kind,† to common meteors. The small number, and absence of a common radiant, support the first position. The nearness to the number frequently seen at a period of the night, and a period of the year when these meteors are less frequent than early in the morning and late in the autumn, together with the very different points in which their paths, if produced, would have intersected, show the second.

The new facts presented by my friend, Prof. Olmsted, and upon which I now proceed to remark, are classified by him as “foreign testimonies” and “domestic testimonies.” The first are somewhat particular, but the latter quite general. The foreign testimonies alluded to, are those of the Rev. W. B. Clark, A. M. F. G. S., &c., and W. H. White, Esq., both of England. These gentlemen saw meteors on the morning of the 13th of November, 1834.

The opinion of Mr. Clark in relation to the meteors which he saw, is to be found in the same paragraph from which Prof. Olmsted has quoted his

* Amer. Journ. Sci. vol. xxv. p. 363. Journ. Frank. Inst. vol. xvi. p. 368, in an article headed *Zodiacal Light*, between which and the meteors, Prof. Olmsted’s theory leads him to infer a connexion.

† This term, which I used to denote the peculiarity in regard to the paths of the meteors, has, I find, been misunderstood. I did not mean to express by it an opinion that the meteors of 1833 had a physical cause different from that producing ordinary “shooting stars.”

observations. It is thus expressed: "The coincidence between these and those seen in America and Europe on this day of the month, is curious, *but those which I now mention were electrical, and of no uncommon character.*"* In a subsequent paper, after reviewing the observations made by Prof. Olmsted, Mr. Twining and myself, in America, and by Mr. White and himself in England, the Rev. Mr. Clark thus concludes:† "One fact is at least established by these seeming contradictions, viz. that *common electrical*‡ meteors did appear both in America and England, on the same night, whilst there is no direct evidence to show that any others also appeared."

I have considered the opinion of Mr. Clark respecting what he saw, as the more important, because his description of the direction of the meteors is not very precise. He says they were in the direction of a line from Leo to the star Mizar. He may mean that their paths coincided with this line, or merely that they were parallel to it. Taking the former statement as most favourable to the similarity of this phenomena to that of 1833, it would still, however, be very different from that, however remarkable in itself. That fifteen meteors should fall precisely in the same line, is certainly a curious fact, but as certainly a very different one from the apparent convergence to a single point of the paths of more than 207,000 falling in very different parts of the heavens.

The Rev. Mr. Clark further states, that he saw one meteor which appeared to pass to the south of Ursa Major, and between Cor Caroli and Aucturus, the most northern of these stars being about seventeen degrees greater in north polar distance than Mizar. If this was one of the fifteen meteors before alluded to, Mr. Clark probably intended his description to apply to the general direction, and not to the precise position of their paths. This, however, is not important so far as the inference in regard to the question between Prof. Olmsted and myself is concerned.

The greatest number of meteors which Mr. Clark saw was fifteen in fifteen minutes, or else he only observed fifteen minutes; which is the correct supposition his account leaves doubtful. The portion of the heavens his view embraced is also doubtful: he merely states that he observed from a window. To make the hypothesis as favourable as possible to the number of meteors, we may suppose that he observed but for fifteen minutes, and saw fifteen meteors; that his range of vision embraced not more than one-tenth of the visible heavens, and that meteors fell in equal numbers over an equal space in other quarters. All these assumptions, and they are for the most part gratuitous, would make the number over the whole sky six hundred in one hour, while during the display in 1833, six hundred and fifty meteors§ were counted in about one-fourth part of the sky in fifteen minutes, making upwards of 36,000 in one hour, and this only one hour and a quarter before sunrise.

The observations of Mr. White do not seem to me, any more than they do to Mr. Clark, to support the idea of a recurrence of the meteoric phenomenon of 1833. The number of meteors which he saw was ten in half an hour, being less than the number seen in fifteen minutes by Mr. Clark. The observations were made from windows which commanded a view of the north and east, and supposing that they commanded but one-sixth part of the heavens, and that the meteors were of the same frequency in every part,

* London's Mag. Nat. Hist, vol. vii. p. 655.

† Ibid. vol. viii. pp. 420, 421.

‡ This term, electrical, is in allusion to his theory.

§ Amer. Journ. Sci. vol. xxvi. p. 367

we should have one hundred and twenty meteors for the whole sky in one hour; one-three-hundredth part of the probable number visible in 1833, at Boston, in one hour. During the display of 1833, ninety-eight meteors were seen in fifteen minutes, the rate being three hundred and ninety-two per hour, within three-quarters of an hour of sunrise.

Neither does it appear that the meteors seen by Mr. White had an apparent radiant. One of the meteors of which he speaks, "glided almost perpendicularly towards the earth: this was succeeded by another of a most brilliant appearance, which took a westerly direction."

The ten meteors to which I have before referred, are said to have appeared between Leo, Virgo and Ursa Major. This place, as assigned in a general description, is a matter of course, since these were the principal constellations within view from the north and east windows from which Mr. White observed. Nothing is said about a radiant, too remarkable a fact to have been overlooked, had it existed.

But the number of these meteors has frequently been equalled, and even exceeded, in cases, between which and the meteors of 1833, no connexion has been claimed. I need only quote a few cases. On August 8th, 1823, Professor Brandes noticed sixty-five in two hours. On August 10th, "one hundred and fifty were noticed in less than two hours, and Professor Brandes remarks that they were obliged to leave many unrecorded."* During August, 1833, Mr. Espy and myself noted, over one-fifth of the visible heavens, thirty-seven meteors in one hour. We have noted eight in fifteen minutes, six in nine and a half minutes, five in ten minutes; and this at a time of the evening, and at a season when meteors are comparatively infrequent. At other times one meteor only would be seen in half an hour, showing the variable nature of the occurrence, even on the commonest occasions. Prof. Olmsted himself refers to *showers* of meteors seen in *April*, 1833 in Virginia, in England on the *nineteenth* of *November*, in France in *April*, 1833, in August, 1833 in England, &c.

There is no connexion in point of time, between the English observations and those made in America. The meteors seen by both Mr. White and the Rev. Mr. Clark, occurred at a time when meteors were not frequent, even at New Haven.

The "American testimonies" given by Prof. Olmsted would determine the question if it were *did meteors occur on November 13th*, 1834; but upon the one really at issue they do not bear. The authorities, consisting of a member of the Theological Seminary at Andover, an anonymous writer in the St. Louis Observer, and a female servant at Zanesville, give no particulars on which to found an opinion as to the nature of the meteors which they saw. The St. Louis Observer merely states, loosely, that he saw, at five, A. M., in fifteen or twenty minutes, thirty or forty meteors. The accounts want the precision necessary to form any opinion in the case.

In regard to the remarks which my friend, Prof. Olmsted, appended to his facts, it is necessary to observe, first, that in addition to the indirect evidence of no meteoric displays having been seen at eleven military posts from Maine to Florida, six western posts, and five on the northern frontier, and which he notices, I presented other *indirect evidence*, not noticed by him, derived from scientific friends at Wilmington, Baltimore, the University of Virginia, and the University of North Carolina; and *direct evidence*, also unnoticed by him, from observations at New York, Philadelphia, and Nash-

* On shooting stars, by E. Loomis. Amer. Journ. Sci. vol. xxviii. p. 96.

ville. Further, that a sentinel at Mackinac, where meteors *did* fall in considerable numbers, saw and remembered the fact. My friend states his preference for the testimony of nautical men, and yet of all those who navigated between this and England, on the night in question, not one has recorded observations of any extraordinary meteoric occurrence like that of the 13th of November, 1833.

In the second remark, allusion is made to a record on the minutes of the American Philosophical Society. This record* is there entered as a "verbal communication in relation to the result of observations on the recurrence of the remarkable meteoric display of November 13th, 1833." This record rests, not on the responsibility of that learned body, but on my own, and I believe I have shown full warrant for it. Records are made of all verbal communications presented to the Society, and among them will be found a reference to the new facts presented by my friend, Prof. Olmsted, as the substance of another verbal communication made by me.

In conclusion, I think the examination of those of the new facts which are susceptible of such a course, has conclusively shown that the meteors referred to in them were of ordinary character. And a comparison of this result with the inferences which I have elsewhere drawn from my own observations, and those of others, leads to the conclusion, that no satisfactory evidence has yet been presented of the occurrence, in 1834, of a meteoric display, which, in numbers, in peculiarities, or in connexion (as parts of the same phenomenon) and extent combined, was such as to connect it with the meteoric display of November 13th, 1833.

Bibliographical Notices.

The Book of Science. A familiar Introduction to the principles of Natural Philosophy, adapted to the comprehension of Young People. PART III. CHEMISTRY. [Philadelphia, Carey, Lea & Blanchard.]

The little work now before us is one of a series on Natural Philosophy. It has a merit which is rare in books of its class, that of accuracy. The preparation of elementary works is too often undertaken by the half learned in the subject of which they treat. Hence erroneous, partial, or inaccurate, views are sometimes instilled. It is a high distinction of our time, that men the most eminent in the different branches of science, have applied themselves to the preparation of popular works. The difficulty in such cases seems to be that few are able to come down sufficiently to the comprehension of the general reader. And few stand so high that their reputation may not be touched by treating a subject superficially. The class of works now referred to is however, a different one from that to which the subject of the present notice belongs.

Chemistry is a difficult subject to bring down to the comprehension of the young in a book: it requires experiments to illustrate, and frequent verbal explanations to relieve difficulties. A teacher who would take in hand the Chemistry of the Book of Science, and follow it in his experiments, and accompany it by his explanations, would do a good service to the youth under his charge, for the information is exact and such as he may rely on himself. It is besides generally brought up to the Chemistry of the day.

* This quotation from the minutes, which are not published, is made by permission of the Society.