screw F (Fig. 3) so as to shorten the path A E that the bands at the side move in toward the centre, the opposite being the case on lengthening the path A E. Therefore heating the air (*i.e.* rendering it less dense) has the same effect as shortening the path (*i.e.* it accelerates the motion of the light passing along it), whilst

FIG. 5.—Photograph of interference bands showing effect of introducing glowing end of match.

cooling the air (rendering it denser) has the opposite effect; which demonstrates very simply the truth of the undulatory as opposed to the emission theory of light; for on the latter theory the exact reverse would be the case.

EDWIN EDSER.

THE AUGUST METEORS, 1893.

THE Perseid shower, though it cannot rival periodical displays such as the November Leonids and Andromedes when at their best, is certainly of equal interest, for it forms a tolerably rich display every year, and continues active during several weeks from a radiant which has a comet-like motion of about 1° R.A. per day eastwards. A vast number of observations have been made during the last half-century, but it must be confessed that we have by no means completed our investigation of this remarkable stream. Nor have we gained a thorough knowledge of the numerous and fairly prominent minor showers which contribute to render this epoch the most significant and the most interesting period of the year to the meteoric observer.

Either moonlight, or cloudy wet weather, prevented my obtaining any observations at the latter part of July this year, and it was not until August 4 that I commenced work. Moonlight was, however, pretty strong, and in a watch of about half an hour I only saw four meteors, including one typical Perseid from a radiant at about 36° + 56°.

On the following night, August 5, the sky was much clouded, but between 10h. 15m. and 11h. 45m. I saw, in clear spaces, twelve meteors, of which four were Perseids, indicating a radiant at 39° + 55°. The brightest meteor seen was at 11h. 3m., but it appeared behind thin cloud in the northern sky. It was fully equal to a 1st mag. star, and left a bright streak along its path from 17½° + 76° to 219° + 78°. This was not a Perseid, the direction of flight being from near γ Andromedæ.

The nights of August 6 and 7 were cloudy and no observations could be secured.

On August 8 the sky cleared and I counted 36 meteors in the two hours from 10h. 50m. to 12h. 50m. There were 12 Perseids amongst them and the radiant was well defined at 41° + 56°. At 11h. 25m. a fine Perseid about equal to Jupiter flashed out in the region of Polaris and left a streak of nearly 20 degrees along its course.

August 9 proved fine, but lightning was extremely frequent and vivid during the whole night, and considerably interfered with the observations. It proceeded from clouds low in the east and north quarters, but apart from that the firmament was very clear. The day had been one of excessive heat, the maximum shade temperature being 84°; the lightning which followed it may be said to have been in constant play during the night, one flash succeeding another with little intermission. The effect as it burst through the broken clouds and lit up their borders was very beautiful and so striking as to distract attention from the far less imposing features of the meteor shower then in progress. In the 2½ hours' interval between 11h. 30m. and 14h. I managed, however, to observe 45 meteors, including 20 Perseids from a radiant which I determined as follows:—

h. m.	h. m.			
11 30	to 12 0	...	42 + 56	... 4 meteors.
12 0	to 13 0	...	43 + 57	... 9 ,,
13 0	to 14 0	...	43 + 57	... 7 ,,

Adopting the mean centre as at 43° + 57°, I think the position may be considered a very accurate one for the date. I saw no exceptionally brilliant meteors during the night, though several of the 1st mag. were recorded, and the Perseids struck me as being fainter than usual. Most of them traversed swift short paths not very far from the radiant, so that the position of it could be determined very satisfactorily. Mr. Booth of Leeds informs me that he found the Perseid radiant at 43° + 57° from 15 meteors of this shower observed on August 9. This position is identical with that found at Bristol on the same night.

On August 10 the sky proved variable, but it was pretty clear at times before midnight and overcast afterwards. Between 11h. and 12h. I noticed 21 meteors, of which 14, or two-thirds of the whole, were Perseids, but clouds interrupted work during a part of the time. After 12h. it was not found possible to continue the work with any further prospect of success, as clouds had obliterated all but a few 1st mag. stars. The Perseid radiant was now found at 45° + 57°, which agrees with the usual position on the date of maximum. As to the character of the radiation on this and previous nights, it was fairly definite and exact, and limited to an area of 2° or 3°. In point of activity I regarded the shower as disappointing on the 5th, 8th, and 9th, but from what I saw on the 10th, and considering the unfavourable circumstances prevailing at the time, the display was a tolerably conspicuous one. I recorded several bright meteors on the 10th, and, as they may possibly have been seen elsewhere, the times of apparition and observed paths are given below:—

	Mag.	From α	From δ	To α	To δ	Radiant.	Notes.
h. m.		°	°	°	°		
11 0	1	1+11		26+19		304−14	Slow.
11 21	1	331+38½		317+23½		Perseid	Swift, streak.
11 24	1	325+29		314+15		Perseid	Swift, streak.
11 43	♀	42+53		40+53½		Perseid	Slow, b. streak.
11 56	♃	140+84½		200+70		Perseid	Swift, streak.

On August 11 the sky was overcast.

On August 12 it was partly fine before 13h., but by no means favourable for this class of work. I counted 24 meteors, including 7 Perseids with radiant at 48°+57°.

On August 13 the conditions had greatly improved, and after midnight there was not a cloud in the sky. Watching for 3¼ hours I recorded 43 meteors and found the Perseid shower still visible from a radiant at 48°+57° (8 meteors). No exceptionally bright meteors were seen, but at 13h. 5m. one about equal to Jupiter fell from

338½°+27° to 347°+19½°, its radiant being very probably at 271°+48° near the head of Draco.

On August 14 the atmosphere was unusually clear, and during the four hours from about 10h. 15m. to 14h. 15m. I observed fifty-six meteors. The Perseid shower was still distinctly visible, and the meteors pretty bright. From seven accurately observed paths a very good radiant was obtained at 49° + 57°. There was also a well-defined shower of streak-leaving meteors from Camelopardus at 61° + 59°, and these, if confused with the Perseids, would have given the latter radiant a very diffused appearance. On this and the preceding nights I saw many Cygnids and Cepheids from radiants at 292° + 53° (sixteen meteors) and 311° + 62° (fourteen meteors), and this pair of showers formed by far the most important of the minor displays of the epoch. I had in previous years detected the Cygnids, but never remember to have seen the shower of Cepheids on such activity.

On comparison of my Perseid radiants deduced, on August 5, 8, 9, 10, 12, 13 and 14 it will be seen that they exhibit an easterly movement in satisfactory agreement with my observations in preceding years. This remarkable displacement of the radiant may now almost be regarded as "an old story" but it will always remain a very significant and interesting feature of the shower both from an observational and theoretical standpoint. The motion of the radiant amongst the stars may be nearly as easily and certainly observed by an experienced and precise observer as the motion of a comet. The circumstances are different of course, for a radiant is simply an apparent position and not a visible object, but trustworthy observations define this position with considerable exactness, though it is impossible to eliminate all the sources of error.

Mr. Corder, at Bridgwater, informs me that on August 10, before 14h. he counted 129 meteors, but he regarded the display as rather a poor one. The mean position of the radiant was at 44°+57½°, but he considers that it shifted from 40°+56⅓° to 47°+58½° during his observation.

Mr. Corder, watching until 15h. on August 13, counted 77 meteors, but he says the Perseids had almost ceased, and gave an uncertain radiant, but such as it was could be located near the stars B and C Camelopardi. He found a very active and well-defined shower of Cygnids from the point 293° + 50°. W. F. DENNING.

CHOLERA AND ARTICLES OF DIET.

ALTHOUGH in by far the larger number of cases the distribution of cholera has been traced to the use of impure water, yet there are a few authentic instances on record of its dissemination by means of various articles of diet, such as milk, fruit, salad, whilst Kossel and Steyerthal quite recently report two cases (*Deutsche med. Wochenschrift*, 1892) in which its communication was traced to bread and butter. It becomes, therefore, not only of interest but importance, to ascertain what is the vitality of the cholera organism when purposely brought in contact either superficially or incorporated with various articles of food. Researches in this direction have been undertaken from time to time by various investigators, Babes, Celli and others, whilst Dunham's experiments published in the *Medical Record* for 1892 are amongst the most recent and exhaustive on this subject. This author found that cholera organisms purposely introduced on to salad leaves and placed in a covered dish and kept at the ordinary temperature of a room, retained their vitality for five days, on cooked cauliflowers for from six to ten days, and on the same vegetable uncooked for thirteen days. On a sliced strawberry they did not survive more than twenty-four hours.

Some important contributions to our knowledge of this subject have been made by Friedrich, and are brought together in an elaborate memoir, "Beiträge zum Verhalten der Cholerabakterien auf Nahrungs und Genussmitteln" published in the *Arbeiten a. d. Kaiserlichen Gesundheitsamte*, vol. viii. 1893, p. 465.

The range of materials investigated is very extensive, upwards of fifty different articles being specially studied in this respect, including numerous kinds of fruit, several vegetables, besides milk, tea, coffee and cocoa, also particular descriptions of beer and wine, whilst amongst the miscellaneous materials examined may be mentioned caviar, biscuits, bonbons, tobacco, and snuff!

In the majority of cases the bacilli were not only rubbed on to the surface of the various fruits and vegetables, but were also inoculated on to slices, so that the effect on the bacillus of the *composition* of a particular fruit or vegetable could be ascertained. When simply exposed on the exterior of a given material, the vitality of the bacillus depends chiefly on the degree of moisture which is present in its environment, this organism being specially characterised by its rapid destruction in dry surroundings, but when brought in contact with the juices it is the proportion of fruit acid and sugar present which primarily determine its behaviour. The cholera bacilli are very sensitive to acid, and hence their destruction on most slices of fruit in from one to six hours.

Thus when inoculated on to slices of bright red very juicy and sour cherries, the bacilli were annihilated in three hours, whilst when simply rubbed on the surface and kept in a moist atmosphere they were still alive at the end of five days. On the other hand, when thus treated and exposed to the ordinary air of a room, the bacilli could not be found after twenty-four hours, whilst when placed in the direct sunshine their vitality was limited to one hour and a half.

But even on slices of fruit containing a much smaller amount of acid, such as pears, the vitality of the cholera organism was not much prolonged, and the reason for this must be sought in the fact that, when grown in solutions containing sugar, this organism produces acid, and the acid thus produced impedes its further development and destroys its vitality.

On vegetables such as cucumbers, cauliflowers, cabbages, the cholera bacillus maintains its existence for several days; thus on spinach leaves preserved in a damp atmosphere, the bacilli were still present after twelve days, and even when exposed to the ordinary air of a room they did not disappear until after six days.

As regards the behaviour of the cholera organisms in tea it is interesting to note that in a 3 per cent. infusion of black Chinese tea they are destroyed within twenty-four hours, whilst in a 4 per cent. infusion no trace of them could be found at the end of sixty minutes.

Friedrich has confirmed the results of other investigators on the bactericidal properties of coffee, finding two hours' immersion in a 6 per cent. infusion of this material sufficient for the destruction of these organisms.

In various kinds of beer, Munich, Pilsener, and Lager, they could not survive more than from one to three hours, but still more rapid was their extinction in white and red wine, for five minutes after their introduction they could no longer be found in the former, whilst in the latter their vitality did not exceed twenty minutes.

From the numerous investigations recorded it is obvious that during any epidemic of cholera the consumption of uncooked fruit and vegetables should be avoided, or that at any rate precautions should be taken to ensure their sterility by careful cleansing or by the removal of the rind or skin where possible.

G. C. FRANKLAND.

NOTES.

MEN of science throughout the world will be glad to know that the honour of knighthood has been conferred upon Dr. Joseph Henry Gilbert, F.R.S., who has been associated for