

MADRAS RECORD OFFICE.

Government of Madras.

Public DEPARTMENT.

G.O. No.	<i>284</i>	Press ~~Mis.~~
Dated	<i>16-3-1867</i>	

Not to be folded or roughly handled

*Proceedings of the Madras Government, Public Department,
16th March 1867.*

No. 110. Read the following letter from the Chief Secretary to the Government of Bombay, to the Secretary to Government, Fort Saint George; dated Bombay Castle, 25th February 1867, No. 396.

General Department.

I am directed by His Excellency the Governor in Council to forward to you the accompanying Extract from the Proceedings of this Government, No. 395, dated this day, together with five copies of the printed Report on the Registration of Ozone in the Bombay Presidency for the year 1864-65, therein referred to.

No. 111. ORDER THEREON, 16th March 1867, No. 284.

Forwarded, together with copies of the Report referred to, to the Principal Inspector General, Medical Department.

(True Extract).

Chief Secretary.

To the Principal Inspector General, Medical Department,
with four copies of the Report.

Exd. J. H. Burns.

No. 395.

*EXTRACT from the Proceedings of the Government of Bombay, in the
General Department, dated 25th February 1867.*

Read the following letter from Dr. M. Stovell, M. D., Principal Inspector General, Medical Department, to the Chief Secretary to Government, General Department, No. 2834, dated 10th December 1866, with its accompaniment.

I had the honor, last year, of submitting to Government a very elaborate and very able Report by Dr. Cook, Superintendent of Mahableshwur, on the first year's registration of Ozone, which had been sanctioned by Government in 1863.

2. Since then Dr. Cook has been pursuing his scientific investigations with unabated interest and zeal, and I have now the honor of laying before His Excellency the Governor in Council his report on the second year's registration, extending from 1st August 1864 to 31st July 1865.

3. I beg to suggest that this report may be treated in the same manner as the last, viz., that it may be printed by Government, and copies forwarded to the several Governments in India, and to the Medical Departments of the three Presidencies, as well as to the Secretary of State for India, for distribution to the learned Societies and Medical Corporations in Great Britain, and to each of the scientific men named in different parts of the first and second Reports.

REPORT

ON THE

REGISTRATION OF OZONE IN THE BOMBAY PRESIDENCY FOR THE YEAR 1864-65.

THE number of Stations in which observations have been made during this the second year of registration has been reduced to ten, as follows :—

- | | |
|------------------|-------------|
| 1. Ahmedabad. | 6. Mhow. |
| 2. Ahmednuggur. | 7. Poona. |
| 3. Belgaum. | 8. Rajcote. |
| 4. Deesa. | 9. Sattara. |
| 5. Mahableshwur. | 10. Surat. |

2. The returns for Bombay, Kolapore, Tanna, and Sind were either omitted altogether, or were so imperfect as to be useless for the purpose of report.

3. This decrease in the number of points of observation is to be regretted, inasmuch as the chief interest and value of the present experiments lie in the extended field of observation available in this country, as well as, unfortunately, the frequency of occurrence of epidemic disease.

4. The period of observation under report extended from the 1st August 1864 to 31st July 1865.

5. As in the previous report, I propose to give a brief summary of the data yielded by each set of returns, and then arrange them with regard to the geographical position of the points of observation, pointing out—

1st.—The general presence or absence of ozone at each station during the year.

2ndly.—The connection that may appear to exist between the meteorological and physical conditions registered, and the evolution of ozone.

3rdly.—The prevalence of epidemic disease with regard to the amount of ozone registered; and in conclusion briefly to advert to anything of interest that may have occurred with reference to the subject since my last report.

6. In considering the several sets of returns in detail, I shall use the same headings as in my previous report, and for brevity quote only the indicial letters, thus:—

- A.**—Mean amount of Ozone for the year.
- B.**—Months during which the amount of Ozone was in excess of the average.
 - b.*—Prevailing winds during these months.
- C.**—Months during which Ozone was deficient (of the average).
 - c.*—Prevailing winds.
- D.**—Months during which Cholera, Diarrhœa, Dysentery, and Fevers were prevalent.
- E.**—Months during which the amount of Ozone by day was in excess of that of the night.
- F.**—Ditto during which it was in excess at night over the day.
- G.**—Noticeable facts deducible from the registrations of particular months.

No. 1.

7. AHMEDABAD. *Jail Hospital*.—Latitude $22^{\circ} 58' N.$; long. $72^{\circ} 37' E.$; distance from sea-coast 46 miles; height above the sea unknown; position of hospital: in the centre of the city.

- A.**—Day 1.5; night 0.8 = 2.1.
- B.**—August, September, and July.
 - b.*—Westerly and South-westerly.
- C.**—October, November, December, January, March, April, May, and June.
 - c.*—Easterly for the first five, and Westerly for the last three months.
- D.**—*Cholera*: from 17th May to 7th July 1865.—*Dysentery*: August and part of September.—*Diarrhœa*: September, October, November, and latter part of April.—*Fevers*: January to July, especially in the last three months of this period.
- E.**—August, September, December, and January; remaining months equal or slightly in excess.
- G.**—The highest monthly means of ozone numbers occurred in August and September, averaging for the former months 4.0 by day and 1.6 by night, and for the latter 2.8 by day and 1.3 by night. At the close of this month it suddenly fell to 0.0, was entirely absent in October, and remained at very low numbers until the commencement of July, for the first ten days of which the average rose to 2.4 by day and 2.3 by night (=4.7 for the twenty-four hours). During the months of August and September 1864 it occasionally rose to 10.0 for the twenty-four hours—the highest maxima for the year. During this time a sporadic case of cholera occurred and a few cases of dysentery. The number of cases of diarrhœa was above the average of the year, but there were fewer cases of fever than at any other time. The winds were westerly; nearly 5 inches of rain fell in August.

In October the wind changed to the eastward, and continued to blow from that direction until April. During this period the numbers registered continued very low. The entire absence of ozone in the month of October was not marked by any decided increase in the number of cases in hospital.

Epidemic cholera commenced in the latter part of May and continued until the beginning of July. The ozone numbers registered for this period were below those of the annual mean, and very much less than those of the corresponding months of the previous year. On the 1st of July they suddenly rose and continued high for ten days (as mentioned above), coincident with a steady fall of rain. The number of cholera cases in hospital suddenly decreased, and the disease had disappeared by the 6th from the jail, though it lingered later in the city.*

No. 2.

8. AHMEDNUGGUR. *Civil Hospital*.—Lat. $19^{\circ} 10'$; long. $75^{\circ} 4'$; distance from sea-coast 162 miles; height above the sea-level 2,100 feet; situated in the centre of a walled city.

- A.**—Day 0.6; night 0.6 = 1.2.
- B.**—August, September, October, November, April, and July.
 - b.*—Westerly.
- C.**—January, February, March, and May.
 - c.*—North-easterly and occasionally North-westerly.
- D.**—*Cholera*: none in the jail.—*Dysentery*: August, May, and July.—*Diarrhœa*: May and June.—*Fevers*: during the dry-weather months, or from November to April.
- E.**—August, September, October, June, and July.
- F.**—December, March, April, and May.
- G.**—The annual mean was less than that of the previous year.

The highest monthly means occurred in August, September, October, November 1864, and April, June, and July 1865, or as a rule in those months in which rain fell. The greatest maxima took place in August, when from the 6th to 11th the mean diurnal number registered was 3.0. At no time throughout the year did it exceed this very moderate amount. During these periods the wind was W. and S.W. A monthly mean higher than that usually recorded for the dry months at this station was obtained in April, viz. 0.5 by day and 0.9 by-night = 1.4. This is explained by the unusual occurrence of thunderstorms at the latter part of the month, during which three inches of rain fell.

The lowest monthly means were recorded in January, February, and March. During this time ozone was frequently absent altogether, and never exceeded 2.0 for the twenty-four hours. The winds were very variable, but when more settled,

* The disease was apparently imported from Surat. Dr. Wyllie thus reports, "Between the 14th and 19th of that month (May), however, several seizures occurred in the train between Surat and this, and on the latter date two Europeans so seized died on arrival at this station. The next day (20th) the disease laid hold of the city in severe epidemic form, and only finally disappeared on the 10th September."

generally from the N. or N.E. and occasionally N.W. The weather close and heavy or hot and dry. Although no cholera cases occurred amongst the prisoners in the jail, the disease made its appearance as an epidemic in the city and its neighbourhood on three occasions:—1st, at the latter part of December and beginning of January; 2nd, for a short time in April; and 3rd, from the 13th May to 28th June. On the first occasion ozone was at its lowest development of any time throughout the year; on the second, although the monthly mean was higher than usual, ozone was frequently absent from the registrations; and on the third, the highest diurnal number registered until the close of June was 1.0, and ozone was always absent either by night or by day, and occasionally throughout the twenty-four hours. Towards the close of the month (coincident with the disappearance of cholera) it reappeared, and continued steady throughout August.

No. 3

9. BELGAUM. *Hospital of Her Majesty's 44th Regiment*.—Lat. $15^{\circ} 52'$; long $74^{\circ} 42'$; distance from sea-coast 56 miles; height above sea-level 2,260 feet.

A.—Day 2.7; night 2.6 = 5.3.

B.—August, October, November (slightly), May, June, and July.

b.—Variable in November; Westerly and South-westerly for the remaining months.

C.—September, December, January, February, March, and April.

c.—Westerly in September; Easterly for December and January, and variable for the remaining months.

D.—*Cholera*: no epidemic in the Regiment.—*Dysentery*: chiefly in the months of August, October, November, December, May, and July.—*Diarrhœa*: chiefly in December, April, May, and June.—*Fevers*: November, May, June, and July.

E.—February, March (slightly), April, May, June, and July.

F.—From August to December (1865) inclusive.

G.—The annual mean was 0.5 higher than that of last year. The highest monthly means were registered in August, October 1864, and May, June, and July 1865. The highest daily maxima occurred in the early part of July during continuous light rain and S.W. winds, when the numbers reached 10.0 by day and 10.0 by night on two occasions, and more frequently 9.0 by day and 8.0 by night. In June the numbers were frequently very high under the same conditions of climate; again in August, and more rarely in October 1864. In November, on the occurrence of light rain on three occasions, the amount reached 9.0 for the twenty-four hours; as well as in April and May on the occasion of thunderstorms and rain.

The lowest monthly means occurred in December, January, February, March, and the first half of April, during which months the numbers frequently sank to 2.0 for the twenty-four hours and more rarely to 1.0.

In April a few cases of epidemic cholera were seen in the city and neighbourhood, and having once commenced it did not again disappear until the following September, reaching its height in June and July.

No. 4.

10. DEESA. *Hospital of Her Majesty's 56th Regiment*.—Lat. $24^{\circ} 12'$; long. $72^{\circ} 17'$; distance from the sea-coast 140 miles; height above sea-level 408 feet.

A.—Day 1.4; night 1.3 = 2.7.

B.—August, December, January, February, and June.

b.—South-west in August and June; variable for the remaining months.

C.—September, October, November, March, May, and July.

c.—South-west in September, May, and July; Northerly and Easterly for the remaining months.

D.—*Cholera*: no epidemic occurred in the Regiment, but some sporadic cases were admitted to hospital in December and July.—*Dysentery*: a few cases in August, September, October, May, and June.—*Diarrhœa*: chiefly in December, January, and July.—*Fevers*: principally in October, November, December, and January.

E.—Slightly in August, October, and November.

F.—May, June, and July.

G.—The average annual mean was 1.0 below that of the previous twelve months.

The greatest monthly means were registered in August, December, January, February, and June. The cold weather means, however, were but slightly in excess, and this excess was apparently due to the comparative absence of easterly, and the prevalence of winds having a westerly tendency.

The highest diurnal numbers were registered in August and in the middle of June following.

Ozone was never entirely absent throughout the year.

No rain fell in the month of June, and the numbers, which were moderately high during the middle of this month—though on the whole lower than might have been expected at this season—fell very low at its close, and continued remarkably so throughout the greater part of July. On the 30th of June epidemic cholera commenced in the bazaar and continued until the 31st of July. Diarrhœa was prevalent during this time amongst the men of the Regiment. The returns for April are wanting.

No. 5.

11. MAHABLESHWUR.—Lat. $17^{\circ} 56'$; long. $73^{\circ} 30'$; distance from sea-coast 40 miles; height above sea-level 4,700 feet; position in centre of the station.

A.—Day 3.6; night 3.7 = 7.3.

B.—October, November, December, January, February, April, and May.

b.—Northerly and North-easterly in October, November, and December, with Westerly breeze at night in January and February; Westerly in April and May.

C.—August, September, March, June, and July.

c.—North-easterly and Westerly in March; Westerly and South-westerly for the remaining months.

D.—*Cholera*: never epidemic on the hills. Some cases were received into hospital from the low country in April, May, and June.—*Dysentery*: not prevalent.—*Diarrhœa*: chiefly in April, May, and June.—*Fevers*: chiefly in April, May, and July.

E.—June, and slightly in July; equal in August and September.

F.—More or less throughout the year with these exceptions.

G.—The annual mean was somewhat in excess of that of the previous year—apparently due to the moister character of the climate resulting from the frequent occurrence of rain.

The highest monthly average obtained in November, February, and May giving a mean of 4.8 by day and 5.2 by night = 10.0 for the twenty-four hours.

The lowest monthly averages were those of the monsoon months of August and September, which gave a mean of 3.2 only, when the atmosphere was saturated with moisture, and the sun's rays almost entirely obscured by clouds and fogs. Towards the middle of the latter month the fogs began to break up, the occurrence of "sunshine" was recorded in the meteorological register, and the ozone numbers immediately rose from 1.5, or 2.0, to 7.5. In the following month, which was comparatively dry, the maxima of 12.0 and 13.0 for the twenty-four hours were reached during the prevalence of high winds, and the occurrence of cirrhi in the heavens. In November 9.0, 10.0, and 11.0 were frequently recorded, and on two occasions the diurnal numbers reached, 17.0 on the occurrence of, much electrical disturbance. In December the numbers were frequently high, with clear cold weather.

During the first ten days of February the average daily amount registered was 14.4, with cold weather, strong northerly and north-westerly breezes and cirrhi, the atmosphere being moist. This is the highest *average* on record. A second period of excess, giving nearly similar results, took place from the 21st to 30th of April inclusive, on the occurrence of successive showers of rain with strong N. and N.W. winds and cirrhi and cumuli clouds. The numbers continued high until the middle of June, when the monsoon having set in, the air again became saturated with moisture, and the quantity of ozone diminished.

No. 6.

12. **MHOW.** *Hospital Royal Artillery.*—Lat. $75^{\circ} 48'$; long. $20^{\circ} 33'$; distance from sea-coast 203 miles; height above the sea-level 1,893 feet.

A.—Day 0.5; night 0.7 = 1.2.

B.—March, June, and July.

b.—North-west and South-west.

C.—September, October, November, December, January, February, April, and May.

c.—South-westerly in September, February, and May; Easterly during the remaining months.

D.—*Cholera*: a case at the end of April and beginning of May.—*Dysentery*: January and February.—*Diarrhœa*: August, September, and October.—*Fevers*: from August to March.

E.—Slightly in September.

F.—Generally throughout the year.

G.—The mean amount of ozone for the year was very small compared with that of the previous twelve months. The returns for the month of August and greater part of September were wanting, as no ozone test-paper was apparently procurable. After the close of September, with the exception of a few days in the latter part of November and beginning of December, hardly any indications of ozone were registered until January. The numbers in this month were very variable and uncertain, occasionally moderately high and again entirely wanting, the mean daily average for the month being 0.7. The average for the following month was still less, but in March there was a decided reappearance, and high numbers were occasionally registered, the mean for the month reaching 1.9. 1.88 inches of rain fell; and thunderstorms were prevalent. The following month was hot and dry. N.E. winds prevailing, no ozone was again registered. In the month of May notwithstanding a change of wind to N.W. and a slight fall of rain, no indications of ozone were apparent. On the 7th of this month epidemic cholera commenced in the station and continued until the first week of June. On its disappearance ozone again appeared in the registrations and continued steadily to increase, reaching high numbers in the month of July.

No. 7.

13. **POONA.** *Hospital of Her Majesty's 33rd Regiment.*—Lat. $18^{\circ} 28'$; long. $74^{\circ} 10'$; distance from sea-coast 62 miles; height above sea-level 1,850 feet.

A.—Day 2.1; night 2.2 = 4.3.

B.—August, October, November, and July.

b.—South-westerly in August and July, variable in October, and Easterly in November.

C.—December, January, March, April, May, and June.

c.—South-easterly in December and January, North-westerly and South-westerly during the remaining months.

D.—*Cholera*: a few cases occurred amongst the men of the Regiment in May and June.—*Dysentery*: from March to July.—*Diarrhœa*: March, May, and June.—*Fevers*: chiefly in August, September, December April, June, and July.

E.—July.

F.—More or less throughout the year, with this exception.

G.—The annual mean was less than that of the previous year by a difference of 1·2. The highest monthly means occurred in August, April, October, and November of 1864. Then followed the series of low numerical means usually observed in the dry season, when N.E. winds are prevalent, reaching their minimum in March. During this month the numbers were very low (compared with the annual mean), and frequently absent altogether. This deficiency continued until the latter part of the following month, when, during a succession of thunderstorms, the numbers rose higher than they had been observed for some time. During May they were occasionally high. On the 19th 10·0 by day and 8·0 by night were registered on the occasion of a heavy thunderstorm, during which 1·54 inches of rain fell. The mean average for the month was however low, viz. 1·8 by day and 1·7 by night, and during the succeeding two months of the monsoon the numbers were very much lower than during the corresponding period of last year. On glancing over the returns for the year it will be seen that the period of deficiency as compared with the returns of last year (*vide* Table No. 1) commenced in December and continued for the remainder of the period under review. Epidemic cholera commenced in the city of Poona on the 1st of December and lasted until the 27th idem. The month of January was free, but the epidemic recommenced in February both in the city and neighbouring villages, and did not subside in the former until September and in the latter till the end of July.

No. 8.

14. RAJCOTE. *Civil Hospital*.—Lat. $22^{\circ} 15'$; long. $70^{\circ} 50'$; distance from sea-coast 41 miles; height above sea-level 500 feet.

A.—Day 0·8; night 0·8 = 1·6.

B.—August, April, and May.

b.—Westerly and South-westerly]

C.—September to March inclusive.

c.—Westerly in September, October, and November; Northerly and North-easterly during the remaining months.

D.—*Cholera*: none in hospital; July and August 1865 in the town and neighbourhood.—*Dysentery*: slightly from October to January.—*Diarrhœa*: not prevalent.—*Fevers*: October, November, December, and January.

E.— }
F.— } Daily and nightly numbers remarkably even throughout the year.

G.—No returns were made in June and July on account of the want of test-papers. This is more to be regretted from the prevalence of epidemic disease during these months. The annual mean ozone number (deduced from the ten months registrations) was higher than that of the previous year.

The highest monthly means were those of August, April, and May, giving an average of 2·3. The character of the weather was stormy, with high winds from the S.W. The ozone numbers never exceeded 4·0 for the twenty-four hours, which formed the highest maxima for the year. During the remaining months ozone was occasionally registered as absent, but the numbers were usually low and equal.

In the months of April and May, when the amount of ozone was greatest (considerably in excess of the quantities registered in the previous twelve months), the number of cases in hospital was reduced to a minimum. There were no patients suffering from *dysentery* or *diarrhœa*, and the average number of fever cases was very small. The largest number of admissions into hospital took place in September, October, November, and December, during which months the presence of atmospheric ozone was the least marked. *Cholera* was prevalent during the month of July in the town and neighbourhood, but the ozone return is wanting for this month, as stated above, and the relative amount of atmospheric ozone therefore cannot be noted.

No. 9.

15. SATTARA. *Civil Hospital*.—Lat. $17^{\circ} 40'$; long. $74^{\circ} 2'$; distance from sea-coast 56 miles; height above the sea-level 2,320 feet; position: suburb of the city.

A.—Day 2·0; night 2·3 = 4·3.

B.—August, September, October, November, and July.

b.—Westerly and South-westerly in August, September, October, and July; variable in November.

C.—December (1864) to June (1865) inclusive.

c.—Easterly, occasionally Westerly at night, from December to April inclusive; Westerly and South-westerly in May and June.

D.—*Cholera*: May, June, and July in the city.—*Dysentery*: June.—*Diarrhœa*: August and September slightly.—*Fevers*: October, November, December, and January.

F.—Slightly throughout the year.

G.—The annual mean was less than that of the previous year, the deficiency, on comparison of returns, being chiefly marked in the months of June and July. The highest monthly means were obtained in the first four months of the period under review which gave a daily average of 5.7.

The highest daily maxima occurred in August, November, and portion of July. In August there was a period of excess from the 5th to 17th which gave a daily mean of 7.7, the highest numbers being 4.5 by day and 4.5 by night. The latter ten days of November gave a diurnal mean of 8.3 and a maximum of 5.0 by day and 6.0 by night = 11.0 for the twenty-four hours. There was an unusually heavy fall of rain for that period of the year accompanied by high but variable winds. The third period of excess in July was coincident with a steady fall of rain and south-west winds. It gave a daily mean from the 3rd to 10th of 8.3, and a maximum number of 9.0 for the twenty-four hours.

The lowest monthly means occurred in March when 1.0 by day and 1.3 by night were registered. The weather was very dry, the daily difference between the dry and wet bulb thermometers being 18° 8.

After the deficiency in March the numbers continued low, and the usual access of high numbers, as noted above, was not observed. The latter half of the month of June gave a mean of 1.4 by day and 1.9 by night, the corresponding mean of last year being 2.4 by day and 2.9 by night. In the commencement of July occurred the period of excess noted above.

Cholera commenced in the city in May and continued until the middle of July when it subsided. It began somewhat earlier and continued rather later in the villages of the neighbourhood.

No. 10.

16. SURAT. *Civil Hospital*.—Lat. 21° 11'; long. 73° 3'; distance from sea-coast 10 miles; height above sea-level 30 feet.

A.—Day 1.0; night 1.0 = 2.0.

B.— }
C.— } Ozone equal in amount throughout the year.

D.—*Cholera*: commenced in February and continued till the following August.—*Dysentery*: December, April, and July.—*Diarrhæa*: November, December, March, April, and May.—*Fevers*: October, November, December, and January.

E.— }
F.— } Equal throughout the year.

G.—The returns from this station are, I regret to say, unsatisfactory.

It is very improbable that the amount of atmospheric ozone as given by the test-papers should have been absolutely uniform throughout the year, despite all atmospheric changes attending the variations of the seasons. The daily and nightly numbers throughout the year are set down as 1.0, never either more or less.

This uniformity I presume could only result from the ozonometer being placed in some confined position where it was shut off from the influence of the external air, or from the inferiority of the test-papers used.

The variations shown in the registrations of a great portion of the previous year are too marked (from 2.0 to 8.0 for the twenty-four hours) to allow of the supposition that one regular number represents fairly the normal state of things throughout the year.

PART II.

17. The annexed table (No. 1) gives the tabulated monthly means for each station.

18. It would thus appear that the mean daily amount for the districts through which the various stations are scattered has been 3.2 for the year under report, or 20 per cent. less than that of the previous year (4.0).

19. The period of deficiency, as compared with the previous year, extended from September to July, and was more especially marked from December to June inclusive.

20. By arranging the stations with regard to their daily mean quantities they take the following order:—

Classification of stations with regard to mean daily average.

Mahableshwur..	7.3	Ahmedabad.....	2.1
Belgaum	5.3	Surat	2.0
Poona	4.3	Rajcote	1.6
Sattara	4.3	Ahmednuggur	1.2
Deesa	2.7	Mhow.....	1.2

21. And if classed together and arranged geographically the divisions take the following order:—

Classification of Divisions.

Hills (Mahableshwur)	7.3
Southern Maratha Country	5.3
Deccan Division.....	3.2
Coast Division	2.0
Northern Division.....	1.9

TABLE No. 1,
Showing the monthly means of the quantities of Ozone registered at the various Stations for the year 1864-65.

Months.	Ahmedabad.		Ahmednuggur.		Belgaum.		Deesa.		Mahabaleshwar.		Mhow.		Poona.		Rajkote.		Satara.		Surat.		Means.
	1		2		3		4		5		6		7		8		9		10		
	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.	Day.	Night.	
August	4.0	1.6	1.1	0.7	3.4	4.5	1.8	1.5	1.7	1.6	..	..	3.6	3.9	0.9	0.9	3.1	3.2	1.0	1.0	4.4
September	2.8	1.3	1.0	0.9	1.5	2.0	1.0	1.1	1.6	1.6	0.7	0.2	2.0	2.3	0.8	0.6	2.9	3.0	1.0	1.0	2.9
October	0.0	0.0	1.0	0.4	3.1	3.4	1.3	1.1	3.8	3.8	0.0	0.0	2.8	3.0	0.5	0.6	2.2	2.3	1.0	1.0	3.1
November	0.8	0.3	0.9	1.0	2.5	3.0	1.4	1.1	4.9	5.3	0.1	0.1	2.8	3.0	0.6	0.7	2.9	3.4	1.0	1.0	3.6
December	1.0	0.9	0.0	1.0	1.7	2.2	1.5	1.5	3.9	4.1	0.1	0.2	1.4	1.5	0.6	0.6	1.8	2.0	1.0	1.0	2.8
January	1.0	0.7	0.3	0.2	1.3	1.3	1.5	1.5	4.0	4.2	0.3	0.4	1.3	1.6	0.6	0.7	2.0	1.9	1.0	1.0	2.6
February	1.1	0.9	0.4	0.5	2.1	1.6	1.6	1.5	4.7	5.3	0.2	0.2	2.2	2.1	0.6	0.9	1.7	2.0	1.0	1.0	3.1
March	0.9	0.9	0.2	0.6	1.7	1.2	1.3	1.2	3.2	3.3	0.4	1.5	0.7	0.8	0.8	0.7	1.0	1.3	1.0	1.0	2.3
April	0.6	0.5	0.5	0.9	2.6	1.9	..	..	4.4	4.8	0.0	0.0	1.7	1.8	1.3	1.3	1.7	1.7	1.0	1.0	3.0
May	1.0	0.9	0.3	0.6	3.3	2.6	1.2	1.3	4.8	5.2	0.0	0.0	1.8	1.7	1.4	1.1	1.5	2.1	1.0	1.0	3.2
June	1.0	1.0	1.1	0.0	4.7	3.7	1.7	1.8	3.6	2.7	0.7	0.8	2.0	2.0	..	..	1.7	2.1	1.0	1.0	3.6
July	1.4	1.3	1.0	0.9	5.2	4.5	1.2	1.3	2.8	2.5	2.8	4.0	3.0	2.8	..	..	2.0	2.7	1.0	1.0	4.6

22. In my last report I pointed out the probability of the arrangement of the various Stations in the list given in paragraph 20 being hereafter altered as the relative healthiness of the Stations varied, by the prevalence or otherwise of epidemic disease, and in a minor degree by the variations of meteorological phenomena, but stated that I believed the Divisions would retain their relative positions. This alteration of position on the list of the Stations has taken place, more especially in the case of Mhow, Deesa, and Poona, in all of which epidemic disease has shown itself. Mhow, which had a central position in the list of last year, has sunk to the bottom of the present one.

23. The geographical divisions rank much the same as before. The hills retaining their pre-eminence even more decidedly are succeeded in the list by the Southern Maratha Country, next ranks the Deccan division, then the Coast, and lastly the Northern division, which, further removed from the sea-coast than others (the mean distance of the three stations it includes being 194 miles), and of which the climate is for the most part dry and hot, with a long continuance of easterly and northerly or non-ozone winds, will always be marked by a deficiency of atmospheric ozone.

The Coast division is but very poorly represented in the present case by the station of Surat, where the ozonometer was exposed in the Civil Hospital situated in the city, in which cholera was epidemic for six months of the year.

24. In the following table I have grouped the returns, with reference to the geographical position of the stations, in order to show the effect of prevalent winds from particular quarters on the development of ozone. The results correspond with those obtained the previous year, and show that the higher ozone numbers are always as a rule obtained when westerly and south-westerly winds prevail. A glance at the column of means, especially of the 1st and 2nd divisions, will make it apparent that the numbers arrange themselves in a sliding scale, the lower corresponding with the dry season of the year and northerly and easterly winds, and the higher numbers at each end of the scale with the period of the year when the rainfall takes place, and westerly and south-westerly winds are the prevailing ones :—

TABLE No. 2,

Showing the monthly means of particular Districts in connection with the prevalence of certain winds.

I.—NORTHERN DIVISION.

Months.	Ahmedabad.		Deesa.		Mhow.		Means.	Winds.
August.....	4.0	1.6	1.3	1.5	..	..	4.4	Westerly and S.W.
September	2.8	1.3	1.0	1.1	0.7	0.2	2.3	Ditto.
October	0.0	0.0	1.3	1.1	0.0	0.0	0.8	Variable.
November	0.8	0.3	1.4	1.1	0.1	0.1	1.2	} Northerly and Easterly.
December	1.0	0.9	1.5	1.5	0.1	0.2	1.7	
January	1.0	0.7	1.5	1.5	0.3	0.4	1.8	
February	1.1	0.9	1.6	1.5	0.2	0.2	1.8	
March	0.9	0.9	1.3	1.2	0.4	1.5	2.0	} Variable.
April	0.6	0.5	..	..	0.0	0.0	0.5	
May	1.0	0.9	1.2	1.3	0.0	0.0	1.4	Westerly and S.W.
June.....	1.0	1.0	1.7	1.8	0.7	0.8	2.3	Ditto.
July	1.4	1.3	1.2	1.3	2.8	4.0	4.0	Ditto.

II.—DECCAN.

Months.	Ahmednuggur.		Poona.		Sattara.		Means.	Winds.
August.....	1.1	0.7	3.6	3.9	3.1	3.2	5.2	Westerly and S.W.
September	1.0	0.9	2.0	2.3	2.9	3.0	4.0	Ditto.
October	1.0	0.4	2.8	3.0	2.2	2.3	3.9	Ditto.
November	0.9	1.0	2.8	3.0	2.9	3.4	4.6	Variable.
December	0.0	1.0	1.4	1.5	1.8	2.0	2.5	} Northerly and Easterly.
January	0.3	0.2	1.3	1.6	2.0	1.9	2.4	
February	0.4	0.5	2.2	2.1	1.7	2.0	2.9	
March	0.2	0.6	0.7	0.8	1.0	1.3	1.5	
April	0.5	0.9	1.7	1.8	1.7	1.7	2.7	Westerly.
May	0.3	0.6	1.8	1.7	1.5	2.1	2.6	Ditto and S.W.
June.....	1.1	0.0	2.0	2.0	1.7	2.1	2.9	Ditto.
July	1.0	0.9	3.0	2.8	2.0	2.7	4.1	Ditto.

In the 3rd division the low numbers recorded in August and September at Mahableshwur have interfered with the regularity of the series. The excessive rainfall which then takes place in the monsoon saturates the atmosphere with watery vapour, many of the trees lose their leaves, the sun's rays are for weeks obscured, large quantities of decaying vegetable matter accumulate, and atmospheric ozone is less easily detected than at any period of the year beside. This season is the unhealthy season of the Hills, and intermittent and remittent fevers are prevalent amongst the scanty population that remains.

III.—SOUTHERN MARATHA COUNTRY.

Months.	Belgaum.		Hills.		Means.	Winds.
August.....	3.4	4.5	1.7	1.6	5.6	Westerly and S.W.
September	1.5	2.0	1.6	1.6	3.3	Ditto.
October	3.1	3.4	3.8	3.8	7.0	Ditto and variable.
November	2.5	3.0	4.9	5.3	7.8	} Northerly and Easterly.
December	1.7	2.2	3.9	4.1	5.9	
January	1.3	1.3	4.0	4.2	5.4	
February.....	2.1	1.6	4.7	5.3	6.8	
March	1.7	1.2	3.2	3.3	4.7	Northerly and Westerly.
April	2.6	1.9	4.4	4.8	6.8	Westerly.
May	3.3	2.6	4.8	5.2	7.9	Westerly and S.W.
June.....	4.7	3.7	3.6	2.7	7.3	Ditto.
July	5.2	4.5	2.8	2.5	7.5	Ditto.

25. In my last report I pointed out that "the quantity of ozone registered by day at the various stations is found to be in excess of that of the night more generally than the converse."*

The relative quantities in the returns for the present year vary with the various stations, but on massing them together and taking the sums of the monthly means for the Presidency, it is found that the mean quantity is equal for both night and day. On a critical examination, however, the returns show, with sufficient regularity to form a rule, that the excess by day or by night varies with the seasons. During the monsoon or rainy months, when high numbers prevail, there is a slight excess by day over that of the night, and in the cold and dry weather the reverse is the case, a slight preponderance being observable in the numbers registered for the night.

* The Registrations made in England give a maximum quantity for the night.

26. Of the twelve months under review, extending from August 1864 to July 1865 inclusive, epidemic cholera has been prevalent in the Bombay Presidency for the latter two-thirds, or from December to July.

The development of Ozone in connection with the prevalence of disease.

We have seen that the amount of atmospheric ozone has been throughout the year less than that of the previous year, and in paragraph 19 I have pointed out that the deficiency has been more particularly marked from December to June inclusive—for that portion of the year in fact during which epidemic cholera has prevailed.*

27. The diminution of atmospheric ozone is thus seen to have been coincident *generally* with the prevalence of epidemic cholera. If now we review the series of returns, the connection between the two in the light of cause and effect will, I think, be made apparent.

Thus in the Ahmedabad Jail epidemic cholera made its appearance amongst the prisoners in May and continued until July, during which period the ozone numbers registered were below those of the annual mean (at this season of the year they should have been in excess), and they were very much less than those of the corresponding months of the previous year. On the first of July the ozone numbers suddenly rose and continued high for some days during which time cholera ceased in the Jail.

At Ahmednuggur and its neighbourhood cholera thrice made its appearance as an epidemic. On the first occasion ozone was at its lowest development of any time throughout the year; on the second it was frequently absent from the registrations; and on the third it was never present continuously for twenty-four hours, and very frequently absent altogether, the highest number registered being 1.0. Its appearance in increased quantity was coincident with the disappearance of the epidemic.

At Belgaum the appearance of the epidemic in April was preceded by several months of remarkably low ozone numbers.

At Deesa there was a significant decrease of ozone towards the close of June, and the deficiency continued throughout July. Epidemic cholera commenced in the bazaar on the 30th June and continued till the end of July.

At Mhow the quantity of ozone registered had been scanty for some months, when in April and May it disappeared entirely. On the 7th of the latter month epidemic cholera broke out in the station and continued until the first week in June. On its subsidence ozone was again registered, and the amount continued steadily to increase, reaching high numbers in the month of July.

* I may here state that the knowledge of the occurrence of the epidemic in the various Collectories has not been alone gleaned from the Hospital ozone returns, which would of course speak only of its occurrence in the Regiments or Jails, or of the incidental cases that might be admitted to a Civil Hospital, but by the kindness of the several Collectors and other officials of the districts in which ozone registrations have been made, I have been furnished with statements of the presence or absence of cholera during the period under review.

In the city of Poona cholera made its appearance on the 1st December and lasted till the close. It passed over the month of January, and recommencing in February continued till the end of July. Throughout this period, with occasional and incidental exceptions, the mean average amount of ozone was less than that of the same months of the previous year, and occasionally the deficiency was very marked.

At Sattara the lowest monthly mean occurred in March, and the numbers continued low without any of the comparatively high quantities which usually mark the setting in of the monsoon. The latter half of the month of June gave a mean only one-half as high as that of the corresponding month of the previous year. Cholera commenced in the city in May and continued until the middle of July, when it subsided. At the commencement of this month ozone reappeared in full quantity, and attained a maximum amount between the 3rd and 10th.

On every occasion when epidemic cholera has been prevalent there has been a coincident deficit more or less distinctly marked of atmospheric ozone.

28. The converse indeed cannot be asserted so explicitly. On many occasions ozone has been deficient, or even altogether wanting, when no epidemic has prevailed. It is more than probable that other atmospheric conditions must also exist before cholera can establish itself as an epidemic. There is generally on these occasions a want of proper circulation of the air, a state of unusual calm or stagnancy, and a deficient quantity of negative electricity in the atmosphere, though this may perhaps be but another way of stating that the amount of ozone is deficient.

A certain amount of moisture in the atmosphere is also, I believe, essential ere the epidemic condition can be established. Even as the germs of plants cannot come into a state of activity in absolute dryness, so it is very probable that the *materies morbi* of cholera require a certain amount of atmospheric moisture to assume a state of activity. The evidence that is being gradually accumulated on this point would apparently go far to prove that the germs of this disease contained in the *excreta* of cholera victims is capable of lying dormant for long periods until exposed to suitable conditions of atmospheric heat and moisture.

It has frequently been noticed that a peculiar haze is observable during the prevalence of the epidemic. Mr. Glaisher states that this was observed during the cholera epidemic of 1832, 1848-49, and 1854, and that he has again detected it during the present (1866) epidemic in London.

The comparative freedom of the troops from epidemic and malarious diseases during the dry months of the cold season is notable.

At Ahmednuggur the months of December and January, when cholera prevailed, were remarkable for their moisture. The Civil Surgeon appends a note to his returns for these months to the effect that the weather was more like that of the rains than of the cold season. At Poona there was a slight fall of rain in

November and December, and the air was moister than usual ; and again in February, when cholera, as above stated, recommenced, the same conditions were observable, while later in the season, when the rains became more general as the monsoon approached, cholera made its advent in almost all the districts included in our lists.

The seasonable and heavy downpours of rain of the monsoon have doubtless quite an opposite effect, especially when they are accompanied by the storms of thunder and lightning which usually usher in this season ; and it is a noteworthy fact bearing on this point, that when the monsoon season has been strikingly deficient in rain-fall it has usually been marked by the prevalence of epidemic cholera.

29. Almost as remarkable as the fact of the deficiency of ozone during the prevalence of cholera is that of the reappearance of ozone in considerable amount on the subsidence of the epidemic.

30. Surely these coincident phenomena are too significant to be lightly explained away or attributed to casual or fortuitous circumstances.

31. In the annexed table (No. 3) I have given the aggregate number of cases in hospital suffering from dysentery, diarrhoea, and intermittent fevers during each month of the year, with the monthly average of ozone numbers.

TABLE No. 3,

Showing the aggregate number of cases of Dysentery, Diarrhoea, and Intermittent Fever in Hospital during each month of the year.

Months.	Dysentery.	Diarrhoea.	Fevers.	Monthly average of Ozone.
August.....	214	326	685	4·8
September	135	326	1,160	3·3
October	179	322	1,426	2·8
November	134	240	1,704	3·0
December	160	228	1,499	2·2
January	139	182	1,330	2·0
February	111	67	912	2·4
March	145	161	1,091	2·0
April	124	151	1,049	2·3
May.....	217	422	1,301	2·6
June.....	287	277	1,353	3·4
July.....	380	279	1,687	4·8

NOTE.—The Hospitals included in this table are those of Ahmedabad, Ahmednuggur, Belgaum, Deesa, Mhow, Poona, Rajcote, and Sattara.

32. The most prominent deduction perhaps is the diminished number of cases admitted during the dry weather months of January, February, March, and April, and of the greater prevalence of these classes of disease during those months when the humidity of the air is greatest.

33. There is little apparent connection between the prevalence of these classes of disease and the development of atmospheric ozone. In paragraphs 53 and 54 of my previous report I have attempted to show why this result might perhaps be anticipated. If the results, as regards cholera, which have been shown in this and my former report are borne out, as I believe they will be by more extended experiments, the presumptive hypothesis would be that the poisonous emanations, or malarious products, which give rise to cholera on the one hand, and to dysentery and diarrhoea on the other, are of essentially different natures—the one directly acted on by “nature’s great disinfectant” ozone, and the others to an extent hardly appreciable ; or that the remaining climatic influences have so preponderating an effect as to render nugatory the restrictive power of atmospheric ozone.

Certain it is that the influences which the presence or absence of ozone in the air exerts over the prevalence of epidemic cholera cannot be shown in connection with the predominance or otherwise of dysentery, diarrhoea, or intermittent fever ; though, with the former two at any rate, some similarity in the nature of the exciting causes with that of cholera might have been anticipated, and has, I believe, generally been accepted.

34. In contrasting the returns of this with those of the previous year, it will be evident that all the more important deductions and results previously obtained have been strengthened and verified.

The ozone months, or those months in which the development of ozone is greatest, are May, June, July, August, September, and October, and the non-ozone months November, December, January, February, March, and April. The ozone winds are those from the west and south-west ; the non-ozone winds those blowing from east and north-east. During seasons of drought the development of ozone is in abeyance. At those stations where the monsoon fall is seasonable and in fair quantity ozone is in full development, while in others—as on the western ghats, where it is excessive, and the atmosphere is thoroughly saturated with moisture—the amount of ozone is greatly reduced. Storms of rain, especially when accompanied with much electrical disturbance, always increase the quantity of atmospheric ozone. The highest maxima are recorded when thunderstorms, with heavy or continued rain, accompanied with strong winds from the west or south-west, occur ; the lowest readings take place when there has been a long continuance of dry weather, with prevalence of light easterly or north-easterly winds ; and the difference between the dry and wet bulb thermometers is very marked. Elevation above the sea-level (other things being equal), and nearness to the sea-coast predispose very decidedly to high ozone numbers, while inferior position, distance from the sea, closeness of situation, contiguity of closely-

packed houses, narrow streets, and thickly-inhabited quarters, and generally all causes which militate against fresh air and the free circulation of the atmosphere—as in Jails and Civil Hospitals when situated in cities or walled towns—produce low ozone readings.

The connection between ozone periods and the prevalence of dysentery, diarrhoea, or intermittent fevers is too slight to be appreciable, or the results are too much obscured by other phenomena to be of any value; but on the other hand the connection between the prevalence or absence of atmospheric ozone and the occurrence of epidemic cholera would appear to be so marked that it only requires an extended series of observations to establish the fact that this disease becomes epidemic only when atmospheric ozone is in a marked degree deficient of the average amount.

On the importance of thus establishing a rule of cause and effect I need not dilate.

PART III.

35. When treating of the nature of ozone in my last report I mentioned that both Schoubein and Clausius believed oxygen to exist in two conditions. The former considers ozone to be polarized oxygen, and to exist in two forms, as positive active and as negative active oxygen, and divides their combinations into two classes, antozonides and ozonides, according as they are formed with positive active or negative active oxygen. Clausius considers that each molecule of ordinary oxygen consists of an electro-positive and an electro-negative atom, the former being antozone and the latter ozone, the combinations of the two differently electrified atoms forming ordinary oxygen.

36. The subject has received much elucidation by the researches of Meissner, who has published in his *Untersuchungen über den Sauerstoff* an elaborate history of the experiments which have occupied him many years, and which, together with the researches of the abovenamed eminent chemists, may be taken as setting at rest the conflicting theories that have been held on this subject, and putting the whole matter on a satisfactory basis.

This work has been translated and published in an abridged form by Dr. Tribe, of the Madras Medical Service, to whom I am indebted for a copy of this very interesting treatise. The space at my command will allow of my giving merely a short view of the results and conclusions arrived at. They are briefly as follows.

37. When perfectly dry air is strongly electrified in a suitable apparatus the oxygen is found to have undergone a change, and to exist in two conditions—the one as ozone, and the other as antozone.

38. In order to separate them they are passed through a solution of iodide of potassium, which entirely absorbs all the ozone and the antozone is passed on into a proper receiver in an unmixed condition.

39. As the properties of the former have already been fully studied and described, it will be sufficient to concentrate our attention on the latter.

40. The stream of antozone is conducted into a receptacle containing water which it is made to pass through. As it issues from the water a dense white mist is formed. This mist, always produced when antozone is set free in contact with moisture, is the most tangible test and proof of its existence; for, unlike ozone, antozone has none of the remarkably active and conspicuous properties which immediately make its presence felt, and no chemical test or reaction has been found to mark it, unless it be, as we shall afterwards find, the faculty of restoring to their original purity the test-papers coloured by the action of the ozone.

41. It is not essential for the production of this mist that the antozone should be passed through water; if set free in air saturated with moisture, mist is at once formed; the more saturated the moisture, and the stronger the current of electricity which is used to separate the oxygen into its component elements, the denser is the mist produced.

42. The mist is formed so long as the stream of air is electrified; immediately the electricity is interrupted the formation of mist ceases.

It is essential that the air when electrified is absolutely dry.

43. No other gas but oxygen when electrified can form mist. Mist, or fog, or cloud, or steam, wherever formed, is due to oxygen, and, as it would appear, to positively electrified oxygen or antozone.

44. When antozone is passed through water “each bubble as it rises to the surface is filled with the dense white mist which at first lies on the surface of the water, and only rises, and ultimately flows over, through being forced upwards by the following bubbles as they rise to the surface. When the air in the room is quite still, this mist flows over and slowly sinks like little clouds. This mist remains a long while in the open vessel unchanged, separating itself into little-formed masses with a rounded surface—in fact into little clouds.”

45. The mist thus formed is not permanent; in a certain time—half an hour or more—the antozone loses its power of retaining the water with which it formed mist. The mist becomes thinner, the surface of the receptacle becomes bedewed with moisture, until at last the antozone, further decreasing in strength from above downwards, lets the moisture fall as fine rain without any change of temperature, such as marks the deposition of moisture suspended in ordinary air, and the air becomes again quite clear. No further agitation of the enclosed air with water produces any mist: the antozone has disappeared.

46. The moisture of the mist can be forcibly separated from the antozone by substances possessing a strong affinity for water, as sulphuric acid or chloride of calcium; and if, when dessicated, the antozone be again passed through or agitated with water, mist is once more formed. A current of antozone has thus

the power of drying air through which it passes, absorbing to itself the moisture which may be present, and again, as it gradually loses its specific character, setting free the moisture thus condensed.

47. As the electrified condition of the oxygen dies away and becomes more faint, antozone as such disappears, the result being ordinary oxygen. "To this dying or fading away the Germans have applied the term 'abklinging,' meaning not merely the gradual disappearance of the antozone, but also the diffusion of its peculiar properties among surrounding atoms."

48. Ozone on the other hand is very permanent, and may be kept in a suitable receptacle for long periods unchanged. When therefore air is electrified, and both ozone and antozone formed, the latter will gradually disappear, and after a time nothing but ozone will be formed (plus ordinary oxygen) in the receptacle.

49. The presence of moisture and heat hasten the abklinging of antozone; and both ozone and antozone are destroyed or converted into ordinary oxygen by a heat of 230° to 240° .

50. The presence of ozone has a restraining influence on antozone, and to some extent prevents its forming mist; and further, it hastens its abklinging or disappearance, and quickly induces the resolution of the mist formed. It has a different effect on dry antozone when there is no moisture present, and instead of hastening its abklinging, its presence rather seems to retard it. The more concentrated the ozone relatively to the antozone, the greater will be its effects on the latter.

51. Antozone has a peculiar smell, somewhat resembling, but still differing from, that of ozone. It produces a very unpleasant choking and spasm of the glottis when inhaled, which effect was at one time attributed to ozone, but which Meissner states to belong to antozone only.

52. Antozone is formed by the same processes that yield ozone. It may be prepared artificially by electrifying air or oxygen in a suitable apparatus by the action of sulphuric acid on peroxide of barium, or by the oxidation of phosphorus, &c.

In the latter case more antozone is evolved than ozone, whence the dense white mist which is given off by the phosphorus, a large portion of the ozone uniting at once with the phosphorus.

53. If at the instant of its production antozone is in contact with water, it unites with it chemically and produces binoxide of hydrogen. Antozone in company with ozone has also another and remarkable chemical action. It was known that nitric acid is produced in the atmosphere by electrical discharges, and those who affect to disbelieve the existence of atmospheric ozone have tried to prove that the colouration of the iodized test-papers is due to the presence of this acid in the air. Meissner distinctly shows that nitric acid is never formed

directly by the action of electricity on the air, but only as a secondary effect by the action of ozone and antozone which are produced by electricity. These agents perform distinct offices in the oxidation of the nitrogen of the air into nitric acid, the antozone first acting on the nitrogen and producing nitric oxide, which is then further oxidised into nitric acid by ozone.

54. And now as regards the theory of the nature of these gases. "From a purely chemical point of view, unconnected with the present inquiry, Lamont and Gerhardt, as well as Dumas, considered that elements in their free state might be regarded not as single atoms, but as several, or at least two atoms united to form a polyatomic or diatomic molecule.

"Thus free hydrogen might be regarded as (H.H.) free chlorine as (Cl.Cl.), and a molecule of oxygen as composed of at least two atoms. On altogether different grounds, when inquiring into the nature of the force termed heat, Clausius conceived the idea that in the simple gases several atoms unite to form a molecule; that of oxygen, for instance, consisting of at least two atoms. When he became acquainted with Schonbein's researches on ozone, Clausius applied this idea to explain its nature. Conceiving that if the two atoms of a diatomic molecule were similarly electrified (either positively or negatively) they would repel each other and thus form ozone, he thought that if this diatomic molecule were by this or any other means separated into its two atoms, these isolated atoms or ozone might act differently from the compound molecule, so that oxygen as it becomes free consists of isolated atoms, the greater number of which quickly reunite to form diatomic molecules, while a few remaining separated from ozone. By the slow combustion of phosphorus, for instance, the molecules may be decomposed into atoms with which the phosphorus unites. Should the phosphorus, however, unite with one atom, the other may be repelled by the heat or electricity and appear as ozone.

"When Clausius published his theory nothing was known of antozone; but the fact that there are two excited states of oxygen agrees with this theory. * * *

"The manner in which electricity produces the excited states of oxygen decidedly shows that both ozone and antozone are oxygen, but antagonistically electrified by distribution. In what the nature of this electric state consists is of course no more known than it is with other substances. According to this view oxygen exists in three different states, just as other substances may exist in a neutral or non-electric state, a positive state, and a negative state. If, conformably to the above view, we suppose the compound molecule of ordinary inactive oxygen to have at least two ponderable cores, two atoms of oxygen, to be diatomic, and to act like a neutral body, should a positively or negatively electrified body be brought near, it will act on the diatomic oxygen by distribution. If we now make the legitimate assumption that the property of gases as non-conductors depends solely on the arrangement and mutual conditions of their atoms, we may

conceive of one of the two atoms of a molecule as a conductor, *i. e.* we may assume that electricity can move from one atom to another inside the molecule, though not from one molecule to another. Were it not so, gases would cease to be non-conductors. From molecule to molecule distribution alone can take place.

"On this hypothesis the action of the electric distribution will take place in the molecule in such a way that one of its atoms is charged with positive and the other with negative electricity. In this state one molecule acts by distribution on the next, and so on. If now electric distribution be strong enough, the two atoms, of which one is attracted and the other repelled by the body causing the distribution, are divided into two isolated atoms, which are differently electrified, and there is, as in the theories of De la Rive and Clausius, the chemically active oxygen, the positively electrified atom being antozone in fact, and the negative ozone.

55. "Oxygen in both electric states has a great tendency to unite with and oxidise other atoms; but it depends upon the kind of electricity with what oxydisable substances it will combine. Antozone combines readily with water, but not with potassium, iodine, &c. with which ozone, which has no particular attraction for water, easily unites. Oxydisable substances are divisible into two groups of very unequal size, one of which, and by far the largest, unites with ozone and the other with antozone. * * * *

"The substances which are furthest removed from ozone, and, being highly positive, have very great attraction for ozone, are the easily oxydisable metals potassium and sodium; after a number of similar substances follow zinc, iron, lead, &c. which polarise neutral oxygen, and unite with the ozone at ordinary temperatures in the presence of water which attracts the antozone; then follow nearer to ozone platinum, gold, charcoal, &c., which being more negative have less attraction for negative electricity, and under ordinary circumstances do not polarise oxygen, and are not oxydisable, the *difference being* their attraction for positive and negative electricity being too little. At the negative end of this series are the ozonides, metallic peroxides, which can combine with no more ozone, but have a strong affinity for antozone, and being unable to unite with it, withdraw it from its base, the ozone of the peroxide uniting with it to form diatomic or ordinary oxygen." Schonbein long ago proved the negative character of ozone as regards its electricity; he found that by immersing platinum foil in the gas the metal became negative.

56. As antozone is set free in the atmosphere by the same natural processes, and to the same amount as ozone, it cannot but have an important share in meteorological phenomena. As Meissner has shown, it does in fact play a very important part in the formation of cloud, and in the conduction and dissemination of watery vapour over the earth's surface. Meteorologists have proved that aqueous vapour as it becomes water in the atmosphere is always first condensed into mist, as fog

vesicles of various sizes, with walls of varying thickness, which become aggregated as they are precipitated. "The formation of vesicles, instead of aqueous vapour being at once condensed into drops, is of great importance, as it explains the removal of water from one portion of the earth's surface to another, without which there could be little or no rain on continents, and none of the changes from a clear to a cloudy sky, on which the ordinary changes of temperature greatly depend." "The gradual formation of mist or cloud, and its transformation into drops, occupies the time between the moment when the aqueous vapour ceases to exist as gas in the atmosphere, and when it is precipitated in the form of rain."

57. When air containing aqueous vapour is cooled a certain amount of the vapour is condensed into mist. If the air in the receiver of an air-pump is suddenly cooled by rarefaction, little clouds of mist are formed, which disappear as the air again becomes warmed, and may be made to reappear at pleasure by further exhausting and rarefying the contained air.

58. These mist vesicles can only be formed when oxygen gas is present. "Oxygen alone has the power of forming the peculiar aggregation termed cloud or mist; moisture is precipitated in the form of vesicles only in or upon oxygen." If oxygen be gradually replaced by nitrogen or other gas, the clouds formed by condensation become fainter and fainter until nothing but transparent little drops can be seen in the act of being precipitated. The addition of a small proportion of antozone (or positive-active oxygen) greatly facilitates the formation of mist. If this gas is present even in very minute quantities, a slight rarefaction of the air is sufficient to form dense mist.

If antozone be added to air in the proportion of 1-400th of its volume, mist is formed without the aid of diminution of temperature.

"Antozone is the cloud-maker *κατ' ἐξοχήν*, and possesses this property of oxygen in every degree, from antozone artificially produced, in which it exists in the greatest perfection, to ordinary air, in which it exists to the smallest extent possible."

59. Antozone, contrary to ozone, whose particles lose none of their pristine energy by being diffused among those of neutral oxygen, may exist in various degrees of intensity according to the amount of positive electricity with which the atoms of oxygen are charged.

60. The observations of meteorologists "show that indications of positive electricity are obtained at all times, seasons, and places when the sky is clear and cloudless, and that this positively increases with elevation. Herschel states that out of 10,500 observations at Kew taken between 1845 and 1847 no less than 10,176 indicated positive electricity, while of the 364 instances in which there were negative indications the greater number were accompanied by heavy rain."

"That positive tension increases with the height is equally certain, since this has been proved by numerous observations made during balloon ascents.

Moreover the lower strata ordinarily examined are generally negative as regards the higher, and positive with respect to the earth."

61. The knowledge of the properties of positive oxygen is capable further of explaining other meteorological phenomena which have proved difficult of solution.

62. "Saussure says that vesicular vapour is under some especial influence, by which it can be maintained in the form of fog or cloud many degrees below freezing point without being frozen—a fact confirmed by Barral and Bixio in their balloon ascent, and this fact formed the foundation of Vogel's theory of the formation of hail. For this reason the assumption that vesicles are formed by a diminution of temperature is not a satisfactory explanation, and their existence must be ascribed rather to some peculiar state either of the contents of the vesicle or of the atmosphere surrounding it. Saussure adds that the assumption that these vesicles are formed and maintained by electricity would be in accordance with the fact of heavy rain so frequently following electric discharges from the clouds." "Hube and others also came to the conclusion that vesicles were formed and maintained by electricity by the gradual or sudden removal of which the vesicles were transformed into drops.

"Parrot supposed oxygen to be the cause of aqueous aggregations in the atmosphere, but then he thought that the water was dissolved by the oxygen. In fact from ignorance that antozone has the power of condensing moisture, all these hypotheses were more or less wide of the truth.

"Atmospheric oxygen, as it is positively electric, or possesses the property of antozone, attracts moisture and condenses it to vesicles, which, being collected in large quantities, form mist or cloud. The more positive the oxygen is, the less necessity is there for the temperature to be below, or to sink towards, the dew-point in order to condense moisture to vesicles. Strong electric tension acts hygroscopically, and may to some extent take the place of a reduction of temperature; antozone may lessen the amount of aqueous vapour in the atmosphere, so that the relative dampness is diminished without the point of saturation being lowered, while fresh moisture may be again taken up by the warm dry air. Now as positive tension increases with elevation, while the amount of moisture may diminish, here is a simple explanation of what long has been, and still is, a subject of discussion in meteorology. Many hygrometric observations have shown that the relative moisture decreases in the higher regions, and that there is often absolute dryness among the clouds; but people have tried to avoid recognising the inevitable conclusions because it appeared irreconcilable with other well-known facts.

"Observation shows that mists are always electric, generally strongly so, and that the electricity is without exception positive. According to the observations of Volta, &c., the denser the mist, the stronger the electricity; or in other words, the stronger the electricity, the more antozone there is present, and the denser the mist."

63. Having thus satisfactorily shown how mist and clouds are formed, the Professor goes on to explain the part played by electricity in the production of rain or hail, and how it is that the electrometer generally shows negative electricity when it begins to rain or snow, particularly at the commencement of sudden heavy downpours, but less when the rain has lasted some time.

64. "When a vesicle is formed by positively electrified oxygen, the attraction of this tension acts from the centre towards the aqueous envelope, diffusion takes place; and the exterior of the vesicle becomes positive. This free positive electricity may be given off, as the existence of the vesicle does not depend directly upon this, but upon the positive tension of the interior not at once uniting with the negative electricity attracted by the aqueous envelope: this union takes place as the positive electricity at the surface of the vesicle escapes." "Now, if we regard a cloud as a collection of such vesicles, those at the exterior of the cloud will gradually yield their positive tension to the less positive particles of air surrounding the cloud; the positive tension being weaker at the exterior than in the interior, the latter gives up its tension to the periphery only as that of the latter is diminished, and therefore becomes relatively negative. But when the amount of tension in the centre and at the periphery differs very much, the centre may act on the periphery, the positive electricity at the periphery be driven off into the atmosphere, and the periphery, *i. e.* the water of the vesicles, becomes negatively electrified. This must hasten the junction of the maintaining tensions of the vesicles, and consequently their conversion into drops. But when the centre of the cloud acts strongly on the periphery, and under its influence the cloud begins to dissolve into rain, the drops will of course be negative. In other cases where there is but little difference between the central and peripheric tension, the rain may just as well be positive; and were rain at its commencement from the above cause negative, this negative electricity might diminish as the cloud went on raining from diminution of the central tension. Therefore rain which commences suddenly, and that of thunderstorms, should be at first highly negative, but less so after some continuance; while slowly-falling rain from diffuse clouds, as well as dew, should be positive, which is in fact the case.

"Palmieri says that dense clouds, as nimbi, and thunder-clouds are positive in the centre, surrounded at the periphery by a negative girdle, which Flube attributed to the friction induced by its passing through the air.

"Dellman found the positive electricity in the centre of a cloud much stronger than the negative at its circumference. Diminution of the positive tension of a cloud promotes its conversion into water by hastening the discharge of the electricity by which its vesicles are formed and maintained.

"Thunder-clouds arise frequently in summer from strong electricity suddenly condensing all the moisture present, so that the air surrounding the cloud becomes very dry, and a bad conductor, while the isolation of the cloud is very complete from the absence of evaporation and wind."

65. The principal sources of positively electrified oxygen or antozone in the atmosphere would appear to be two—electricity evolved by evaporation from the earth's surface, or by the friction of winds blowing with more or less force over earth and sea; and the oxydation of organic matter over the world's superficies.

66. As regards the first source, every molecule of neutral oxygen electrified gives rise, by the separation of its two atoms, to both ozone and antozone. The first has its peculiar office in keeping pure and free from deleterious gases, and fit for respiration, the air we breathe; the other the formation of cloud, and the distribution of moisture in the atmosphere.

As regards the latter source, oxydation is in truth but combination with ozone or with the negatively electrified atom; neutral diatomic oxygen is thus again broken up into its two oppositely electrified atoms, and as the negative atom unites with matter in oxydation, the positive or antozone is set free.

67. Again it is proved by experiment that the green parts of plants under the action of sunlight evolve ozone. Whether this is effected by the polarisation of diatomic oxygen, when both ozone and antozone would be set free, or whether, as Meissner supposes, the ozone thus evolved "is the same oxygen that, when vegetable substance is decomposed and oxydized, unites with it, and so again makes it reducible," and represents the ozone which in oxydizing organic substances unites with them, while the antozone remains in the atmosphere, is not as yet apparent.

68. As fire or flame is but rapid oxydation, the act of burning polarises the oxygen of the air, the ozone uniting with the organic substance, while the antozone is given off.

69. Thus the air over large cities is positively electrified, and more or less dense from the products of combustion held suspended in the watery vesicles. London fogs are antozone mists filled with particles of coal and various products of combustion suspended or dissolved in the vesicular vapour.

70. If the antozone produced by combustion or otherwise cannot become saturated with moisture from other sources, it dries the lower strata of the air as it rises; and Meissner thus explains the yellow fogs of North-west Germany termed "*Hohe-rauch*," dependent on the burning of some 60,000 acres of moorland.

Brief summary. 71. To sum up as briefly as possible the chief points of the subject-matter given above—

The oxygen of the atmosphere is a *diatomic* gas, whose two atoms, contained in every molecule, are capable of separation, and when so separated, being differently electrified, possess different powers or properties; the one, being charged with negative electricity, we call ozone; and the other, with positive electricity, we denominate antozone; the two again united constitute neutral or ordinary oxygen.

Ozone readily unites with all oxydisable bodies, and its union with matter is in fact oxydation whenever or wherever it occurs. By its capability of thus uniting with and destroying putrescent or mephytic matter, it constitutes nature's great disinfectant and purifier of the atmosphere.

Antozone on the other hand has less chemical activity, its chief characteristic being its capability of union with watery vapour, and the production of fog vesicles and cloud, and thus in the economy of nature performing hardly less important functions than the former.

Ozone is persistent, and is destroyed only by uniting with oxydisable matter, or with its oppositely electrified atom—antozone, and thus forming again neutral oxygen.

Antozone is not permanent, but gradually loses by dispersion its electric charge and "abklings," and by union with other atoms constitutes diatomic or neutral oxygen.

Negative oxygen has a peculiar influence over its oppositely electrified atom; in the dry state it retards its abkling, while in the presence of moisture it hastens its disappearance.

Antozone, set free in the atmosphere by the action of electricity, and by processes of oxydation and respiration, gives rise to the positive electric condition of the atmosphere; and as the positivity increases with elevation, it enables cloud to be formed in the higher regions of the atmosphere, where, from the excessive dryness of the air, watery vapour could not otherwise exist in a vesicular condition. Antozone is the origin of all fog, steam, and smoke or cloud, wherever found.

When, through the loss of its electric charge, antozone begins to abkling, the vesicles forming the cloud commence to coalesce and form into drops which fall as rain. When this suddenly takes place the rain is charged with negative electricity, but when slowly from diffuse cloud the rain is positive.

Antozone has a remarkably drying effect on the atmosphere when it cannot obtain from other sources the requisite amount of moisture.

Antozone in a concentrated form is irrespirable and obnoxious to life.

72. Dr. Faraday states that antozone has the power of restoring to their original purity the iodised test-slips coloured by exposure to ozone.

73. I had some years since pointed out the probability that the deleterious effects of the simoom of the deserts of Kutchee, Upper Sind, and elsewhere, might be attributable to ozone existing in the atmosphere in a concentrated form. Dr. Tribe, in the appendix to his translation of Meissner's work, shows that these effects are due rather to antozone than to ozone, and, with the greater light now thrown on the subject, I entirely concur with his view of the case. He says—"As air, which is estimated to have no more than 1-400th part converted into antozone, has double the drying power of the same amount of perfectly dry non-electrified air, the drying power of this antozone air of the deserts, where all the conditions are so favourable to an intense development of positive electricity, must be enormous. In the deserts, as with an ordinary friction electric machine,

the negative extremity is the earth, the dry air of the deserts is nearly as good a dielectric as the glass by the friction of which the electricity is polarised. There may be nothing in this vast electric machine of nature exactly corresponding to the metallic conductor, but Clausius and others have shown how oxygen in its diatomic form may be a non-conductor, and when polarised a conductor of electricity. If to this friction of the winds be added that of the shifting sands against the surface of the earth, the total amount of electricity produced by the deserts must be enormous, and one would think far exceed that developed by oxydation.

"Dr. Cook has in a pamphlet collected together several instances of the effect of the simoom, * * * * and attributes it to a very concentrated form of ozone, generated in the atmosphere by some intensely marked electrical condition. As, when the above was written, the properties and effects of antozone had not been distinguished from those of ozone, he is undoubtedly correct in his surmise, and it might *a priori* be asserted that, could any intense form of antozone be by any means produced, its effects when respired must be instantaneous death."

74. The haze that so thickly overspreads the low-lying Concan, as seen from the heights of Mahableshwur, during those months in which the burning of the fields takes place in order to fit them for cultivation, is doubtless due to antozone evolved by the wide-spreading conflagration.

75. There is another phenomenon which also receives elucidation by the knowledge of the properties of this natural agent. Few of the visitors to these hills in the cold season, or at the close of the hot weather, who have seen the strange formation of vast masses of cloud in the ravines running down from the mountain scarp to the Concan but must have been puzzled at their origin. After heavy falls of rain—especially from thunderstorms, when the atmosphere is clear from vapour above—vast columns of cloud, like steam from some gigantic cauldron, rise rapidly from these ravines and tower far into the sky, there to gradually dissolve or disappear. Standing on the scarp of the mountain side, and looking down into the forest-clad depths of the ravine, the cloud is seen to originate at the bottom of its depths, and, increasing in volume as it rapidly ascends, to fill the whole ravine with dense vapour. It cannot originate by a column of cold air passing down into the moisture-laden atmosphere below, for these ravines act like huge funnels, and, as evidenced by the drifting upwards of the cloud masses, the heated air of the Concan comes sweeping up as through a chimney. It is not therefore condensation by cold that gives rise to the phenomenon, and as this is the only cause of cloud given in books on meteorology, it does not admit of explanation unless the existence of atmospheric antozone is granted. Now, however, the matter is easy of solution. Antozone, generated in the depths of the ravine from the action of oxydation or otherwise, seizes on the unusual amount of moisture present in the air of these depths, and forms clouds which are drifted up on the ascending column of air from the heated plains below. As the antozone *abklings* or is neutralised by free ozone in the higher regions, the cloud masses break up and disappear.

76. Mr. Glaisher has lately, during the prevalence of cholera in London, drawn attention to the presence of a peculiar blue mist in the air, and states that he noted a similar mist prevalent during the cholera epidemics of 1832, 1848-49, and 1854. The mist is peculiar in continuing many days despite changes in the winds, and in occurring when there is *no excess of humidity in the air*. The mist is doubtless to be ascribed to antozone present in abnormal quantity in the atmosphere. It is not improbable that antozone is in excess when ozone is deficient—a fact which would admit of proof by experiment if, as Dr. Faraday states, the rapid bleaching of coloured ozone test-paper is diagnostic of the presence of antozone. The experiment might easily be carried out at any station where ozone registrations are kept during the prevalence of epidemic cholera.*

77. Dr. Allnath, in a letter to the *Times* dated 6th November, describes some experiments made in relation to the occurrence of antozone in the atmosphere. The alternations of periods of excess of ozone and antozone are very marked. He writes, "On the 2nd instant the test-slip exposed in the morning was acted on with considerable energy, and manifested in a few hours nearly 5 degrees of colouration. During the night, however, an antithetical period occurred, and the tests were almost totally deprived of their hue and reduced to their primitive white. On the following evening at 5 o'clock, finding the test which had been exposed since the morning still manifesting no signs of reaction, I placed side by side three other slips of various shades of colour which had been previously subjected to the full action of the atmospheric ozone. These were simultaneously exposed during the night. On the morning of the 4th I found the coloured slips were becoming completely blanched. These conditions lasted till noon, when suddenly the decolourised ozonoscopes showed symptoms of reaction, and at 6 P.M. were all recoloured of an uniform tint of about 3 degrees. On the 6th, so energetic was the generation of ozone, that the tests were blackened to an extent almost beyond the maximum of Schonbein's graduation."

78. With experiments conducted by myself no such sudden and remarkable changes have been indicated; possibly the conditions of the atmosphere of these hills are more stable than those of the atmosphere of insular Britain.

79. The registration of ozone has, I am glad to find, been commenced at the following stations in the North-West Provinces:—Nynee Tal, Roorkee, Agra, and Beawur. It is much to be desired that the area of observation should be widely extended.

80. A committee was appointed by the Academy of Sciences at Paris, consisting of its most eminent members, at the commencement of this year (1866) to examine and report on several questions relating to ozone. The results will doubtless be most valuable.

HENRY COOK, M.D.

* It is not, I presume, supposed that this mist is the *cause* of cholera, as it does not always follow that cholera becomes epidemic when ozone is not to be detected in the air. The occurrence of this mist, as an indication of antozone, should merely be looked upon as a coincidence with epidemic cholera.

ADDENDUM.

TABLE No. 1,
Showing the Monthly Means of the quantities of Ozone registered at the various Stations in the year 1863-64.

Months.	Ahmedabad.		Ahmednagar.		Belgaum.		Bombay.		Dessa.		Hydrabad.		Kolapore.		Kurrachee.		Mahauleshwar.		Mhow.		Poona.		Rajpote.		Sattara.		Surat.		Tanna.		Means.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
	1	Day Night	2	Day Night	3	Day Night	4	Day Night	5	6	7	8	9	10	Day Night	11	Day Night	12	Day Night	13	Day Night	14	Day Night	15	Day Night	16	Day Night	17	Day Night	18		Day Night	19	Day Night	20	Day Night	21	Day Night	22	Day Night	23	Day Night	24	Day Night	25	Day Night	26	Day Night	27	Day Night	28	Day Night	29	Day Night	30	Day Night	31	Day Night	32	Day Night	33	Day Night	34	Day Night	35	Day Night	36	Day Night	37	Day Night	38	Day Night	39	Day Night	40	Day Night	41	Day Night	42	Day Night	43	Day Night	44	Day Night	45	Day Night	46	Day Night	47	Day Night	48	Day Night	49	Day Night	50	Day Night	51	Day Night	52	Day Night	53	Day Night	54	Day Night	55	Day Night	56	Day Night	57	Day Night	58	Day Night	59	Day Night	60	Day Night	61	Day Night	62	Day Night	63	Day Night	64	Day Night	65	Day Night	66	Day Night	67	Day Night	68	Day Night	69	Day Night	70	Day Night	71	Day Night	72	Day Night	73	Day Night	74	Day Night	75	Day Night	76	Day Night	77	Day Night	78	Day Night	79	Day Night	80	Day Night	81	Day Night	82	Day Night	83	Day Night	84	Day Night	85	Day Night	86	Day Night	87	Day Night	88	Day Night	89	Day Night	90	Day Night	91	Day Night	92	Day Night	93	Day Night	94	Day Night	95	Day Night	96	Day Night	97	Day Night	98	Day Night	99	Day Night	100	Day Night	101	Day Night	102	Day Night	103	Day Night	104	Day Night	105	Day Night	106	Day Night	107	Day Night	108	Day Night	109	Day Night	110	Day Night	111	Day Night	112	Day Night	113	Day Night	114	Day Night	115	Day Night	116	Day Night	117	Day Night	118	Day Night	119	Day Night	120	Day Night	121	Day Night	122	Day Night	123	Day Night	124	Day Night	125	Day Night	126	Day Night	127	Day Night	128	Day Night	129	Day Night	130	Day Night	131	Day Night	132	Day Night	133	Day Night	134	Day Night	135	Day Night	136	Day Night	137	Day Night	138	Day Night	139	Day Night	140	Day Night	141	Day Night	142	Day Night	143	Day Night	144	Day Night	145	Day Night	146	Day Night	147	Day Night	148	Day Night	149	Day Night	150	Day Night	151	Day Night	152	Day Night	153	Day 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Night	296	Day Night	297	Day Night	298	Day Night	299	Day Night	300	Day Night	301	Day Night	302	Day Night	303	Day Night	304	Day Night	305	Day Night	306	Day Night	307	Day Night	308	Day Night	309	Day Night	310	Day Night	311	Day Night	312	Day Night	313	Day Night	314	Day Night	315	Day Night	316	Day Night	317	Day Night	318	Day Night	319	Day Night	320	Day Night	321	Day Night	322	Day Night	323	Day Night	324	Day Night	325	Day Night	326	Day Night	327	Day Night	328	Day Night	329	Day Night	330	Day Night	331	Day Night	332	Day Night	333	Day Night	334	Day Night	335	Day Night	336	Day Night	337	Day Night	338	Day Night	339	Day Night	340	Day Night	341	Day Night	342	Day Night	343	Day Night	344	Day Night	345	Day Night	346	Day Night	347	Day Night	348	Day Night	349	Day Night	350	Day Night	351	Day Night	352	Day Night	353	Day Night	354	Day Night	355	Day Night	356	Day Night	357	Day Night	358	Day Night	359	Day Night	360	Day Night	361	Day Night	362	Day Night	363	Day Night	364	Day Night	365	Day Night	366	Day Night	367	Day Night	368	Day Night	369	Day Night	370	Day Night	371	Day Night	372	Day Night	373	Day Night	374	Day Night	375	Day Night	376	Day Night	377	Day Night	378	Day Night	379	Day Night	380	Day Night	381	Day Night	382	Day Night	383	Day Night	384	Day Night	385	Day Night	386	Day Night	387	Day Night	388	Day Night	389	Day Night	390	Day Night	391	Day Night	392	Day Night	393	Day Night	394	Day Night	395	Day Night	396	Day Night	397	Day Night	398	Day Night	399	Day Night	400	Day Night	401	Day Night	402	Day Night	403	Day Night	404	Day Night	405	Day Night	406	Day Night	407	Day Night	408	Day Night	409	Day Night	410	Day Night	411	Day Night	412	Day Night	413	Day Night	414	Day Night	415	Day Night	416	Day Night	417	Day Night	418	Day Night	419	Day Night	420	Day Night	421	Day Night	422	Day Night	423	Day Night	424	Day Night	425	Day Night	426	Day Night	427	Day Night	428	Day Night	429	Day Night	430	Day Night	431	Day Night	432	Day Night	433	Day Night	434	Day Night	435	Day Night	436	Day Night	437	Day 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Night	580	Day Night	581	Day Night	582	Day Night	583	Day Night	584	Day Night	585	Day Night	586	Day Night	587	Day Night	588	Day Night	

RESOLUTION.—The suggestions of the Principal Inspector General, Medical Department, may be adopted, and he may be requested to convey to Dr. Cook the thanks of Government for his valuable paper.

Ordered that copies of the above be forwarded to—

The INSPECTOR GENERAL MEDICAL DEPARTMENT.

John F. Blagden

Chief Secretary to Government.

GENERAL DEPARTMENT.

Bombay Castle, 25th February 1867.

To

The Secretary to the Government of Madras

Sir,—I am directed by His Excellency the Governor in Council to forward to you the accompanying Extract from the Proceedings of this Government, No. 395, dated this day, together with five copies of the printed Report on the Registration of Ozone in the Bombay Presidency for the year 1864-65, therein referred to.

I have the honor to be,

Sir,

Your most obedient Servant,

F. P. Chapman

Chief Secretary to Government.

In Pub No 294/67

*Recd. Secy to Govt. 16th March 1867
A. H. H.*

22 March 1865

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