Chart 2, showing the rise of temperature produced in rabbit No. 20 in which part of the corpus striatum was destroyed, first on the one side and then on the other.

Lesions of the Optic Thalamus.—In nine experiments it was found that this was the part of the brain that was injured. In all of them the temperature rose after the operation. In one it reached 105.6°, in another 105.5°. In all but one it was over 104°, and in that one the lesion was so severe that the fact that the temperature did not rise was sufficiently explained by the shock which the experiment must have caused. The number of degrees that the temperature rose was not so great as after lesions of the corpus striatum. In three experiments it was over 3°, and in six it was over 2°. It usually attained its highest point in six or seven hours, and the average duration of the rise was forty-two hours. Figs 2 and 3 show lesions in the optic thalamus.

Difference in the Temperature of the Two Sides of the Body.—Forty observations were taken of the temperature on the two sides of the body. The average temperature on the side opposite to the lesion was the same as that on the side of the lesion, so that it would appear that in rabbits the nerve fibres which modify the temperature do not cross, while in man probably they do, for it is usual in the human subject to find that when a cerebral lesion causes a rise of temperature it is greatest on the side opposite the lesion.

MICROBIC LIFE IN SEWER AIR.¹

By ALFRED CARPENTER, M.D.LOND., D.P.H.CAMB.

My attention was first attracted to sewer air in the years 1853-55. We had a ventilator fixed to the sewer at the Friends School in 1854, which was then in Park Lane, Croydon. One of the teachers, who was of an inquisitive turn of mind, got on the roof, and smelt at the opening, with the sequence of a severe attack of sickness. It was the first case in which I was able to draw a distinct inference as to cause and effect with which I came into contact, though I had been for some time satisfied that sewer-gas did assist to cause much illness in the town. It was not long before that event that I had ventilated the soil pipes of my house, then in the Dingwall Road, the first ventilation of that kind which was put up in Croydon; and by that means, I think, saved my household from the invasion of typhoid fever, which affected my neighbours in every house in that road, right and left of me. From experiments carried out at that time in various houses in Croydon, I was satisfied as to the dangerous character of sewer air when coming from unflushed, unventilated sewers, and I determined to do my best to get the Croydon system of sewers both flushed and ventilated. It was not, however, until after the year 1865, with its distressing events, that the local authorities would agree to adopt the principle that every individual house should have its own protector from the invasion of obnoxious gases. About that time the experiments of the German scientist, Professor Keber, of Dantzig, who followed up Ehrenberg's discoveries, had made out the connection between living organisms

and disease, such as that which produced splenic fever in cattle, and relapsing fever in human beings. I began my own microscopic experiments on sewer air about this time, and tried to get some facts from personal observation which should be worthy of a place in the literature of this Society. I had proved to my own satisfaction that potato blight was caused by a mould fungus (the *peronospora infestans*), though I did not for one moment claim to be the discoverer, but only verified that which was suggested by others. I had learnt that dry rot resulted from another fungus, the "*meruleus lachrymans*." I detailed my observations upon *peronospora infestans*, in the *Times* newspaper, with the result of drawing upon me the anger of those who were working in the same field, perhaps in a more conclusive manner than I did, but of whose work in that particular field I was, like most other people, at that time quite unaware. I followed out my observations upon sewer air, by suspending microscopic slides in those positions in which sewer air was distinctly found to make its exit. It was whilst I was so engaged that I made out that a number of Mr. Latham's charcoal baskets were inserted into openings into which air sometimes entered; these baskets had been provided to obviate the mischief coming from sewers by purifying the air by means of charcoal. Some of these were openings for the admission, not for the exit of air. This was especially the case with two or three, at or near to the Zion Nursery, which had been complained of as nuisances, but which were proved to my own satisfaction to be completely innocent of offence, for air went in, instead of coming out; though it is quite possible that there was a reverse action occasionally. It was evident to me that the smell then complained of came from some other source than the sewer grating. The examination of the slides that I had placed in the exit gratings showed a variety of organisms, such as had been found in the wards of a large hospital, but I could not recognise any that I could accuse of being typhoid or other disease germs, which were the organisms I was more especially searching for. The arrested organisms were vibrios, micrococci, and vegetable germs, innocent of malignant action on man, as far as our knowledge then extended. I was not at that time aware of the plan of cultivation by means of gelatine solutions, such as are now so successfully used in similar investigations; some of which I exhibited on a former occasion to the members of this Society. I exhibited also some specimens and diagrams prepared by Dr. Heron, showing these developments when I last addressed the Society upon the subject of disease germs.

My last attempt at investigation in this direction was made upon a ventilating opening at the side of my garden upon Duppas Hill Terrace. The results of that investigation have been published in *St. Thomas's Hospital Reports* for the year 1883; they involved a medical question which I was anxious to submit to the medical profession, and I did not detail them to this Society. The substance of my observations which were carried on in the winter of 1880-81 was that certain smells came from that ventilator, which varied in nature as well as in intensity. Sometimes the smell was excessively offensive from the presence of sulphide of ammonium, at others there was an ordinary sewer-air smell, and at others a sweet hay-like odour, which could not be called dis-

¹ Extracts from an Address to the Croydon Microscopical Club.

tinctly offensive. I never smelt that particular smell at that sewer without getting a relaxed throat, and a cough in the next day or two, and on two occasions a distinct feverish attack lasting for forty-eight hours. There was one point of importance in the microscopical examination of the slides which I suspended in the ventilator—namely, that whenever the sweet hay-like smell existed, some very minute highly refractive organisms, smaller than the ordinary micrococci, were seen, which were always absent when the sulphuretted hydrogen was present in quantity. I never suffered from relaxed throat after inhaling the sulphuretted hydrogen, and I came to the conclusion that the highly refractive particles were the germs which gave me the relaxed throat, and that they were non-existent when putrefaction was thoroughly established.

Some experiments have been made by Mr. J. S. Haldane in the Westminster Palace sewer which go to prove that micro-organisms were few whenever there was a regular current of air; that with little or no draught there was an increase of carbonic acid, and with that increase an increase of micro-organisms, but they were moulds rather than bacteria. But another very curious thing was found to exist—namely, that when the ventilation within the sewer was much improved, so that CO₂ was materially diminished, there was a considerable increase in the number of bacterial organisms, as if a diminution of oxidation allowed of the increase of germs.

Mr. Haldane examined the air in the Bristol sewers, which are not ventilated. He found that in those sewers the moulds exceeded the bacteria, whilst in the air of the streets the bacteria exceeded the moulds.

Hesse has shown us that, although the spores of the moulds are much larger than those of the bacteria, they remain suspended in the air much longer than do the bacteria. Mr. Haldane concludes that it is to the presence of air from without that we owe the more prolific existence of bacteria in sewers, and not *vice versa*. His experiments led him to conclude that true sewer-air contained fewer micro-organisms than the air of a street, or even the air of an ordinary living room. Our experimenter did find, however, that when the sewage was splashed about there was a large increase in the number of organisms observed, which is a great argument against the formation of large sewers.

It is said that there is much doubt as to the power of sewer-air to disseminate typhoid germs independent of water-supply. My own experience, arrived at by passing through three serious epidemics of that disease in Croydon, fully convinced me that when sewers, such as some of ours were in 1875, are loaded with typhoid excreta, the germs, which are capable of reproducing the disease, do get conveyed from sewers into human beings by aerial means, either directly through the air, or indirectly through the water-supply. In those epidemics, the very large number of domestic servants, especially kitchen-maids and cooks, who became victims to the disease, was one of their marked characteristics, the reason being that those persons went downstairs into the basements in the early morning, before the house was thoroughly ventilated, and inhaled the sewer-air that had collected in the kitchen during the night.

Then there was Dr. Buchanan's demonstration as to the reasons why fever existed on one side of two or three streets which he specified, in which the water-supply being the same, and the sewer the same, in one set of cases the air was admitted into the houses from the sewer, in the other it was not. It is clear, however, that ordinary sewer-air cannot produce mischief unless the organisms from particular forms of disease exist in the sewer. It becomes the bounden duty of the authority to take care that no such organisms continue to live and multiply there, and that, when cases of any infectious disease exist in a given locality, they shall pay particular attention to the sewers in that locality, and prevent them from discharging disease-germs into the streets from the open grids which are left for ventilating purposes. The grids will do this if the sewers are only partially ventilated, and are sewers of deposit.

Do microbes exist in sewer-air? No doubt they may do. If sewers are properly laid, and there is no sewage deposit, no impediment to discharge allowed to take place, and no part of a given length have stagnant air in any part of it, there will be no active disease germs.

But if the sewers are sewers of deposit, some germs may settle on the pipes above the line of sewage, they may fructify there, and their living, growing spores be carried away by the currents of air, and then discharged to the possible danger of the people.

They are not, however, the necessary parts of a sewer system, but are the accidents of defect. I have not the least doubt myself that a stinking grating is not dangerous from the circumstances I have mentioned. It is an undoubted fact that the year which produced a panic in the House of Commons, and by which the Metropolitan Board of Works was brought into being, was produced by the stinks from the London sewers and the bed of the Thames. It was the healthiest year that London had experienced for a long time as far as enthetic disease is concerned.

We may take it as true that disease germs from sewer ventilators are possible factors, but they are rarely provided. If the sewers are only partially ventilated, with tendency to the formation of carbonic acid in excess, there is a mould formation rather than bacterial life, and moulds are not yet proved to be zymotic disease germs to human beings. They are comparatively benign, like to benign bacteria; they help to purify both air and water, and return the albuminoid or nitrogenous matters to their simple elements, ready for use by the vegetable world.

I cannot conceive benign organisms becoming malignant in the processes which take place in sewers, unless the temperature be raised much beyond that which is ordinarily found in pipes and sewers with an abundant water-supply. So it would have nearly to reach blood heat. I mentioned, when speaking of sewer flushing, that this process must be frequent at certain times when temperature is higher than usual. If at any time the temperature in this country should be continuously high for a month or six weeks together, so that the temperature of the London water-supply should be kept above 65° F. for a month, London may prepare for a tremendous outbreak of typhoid in the succeeding autumn if they continue to take their water-supply from the Thames. It requires a continuous temperature for probably a month to develop typhoid spores in the drinking water as at present manipulated at the filter works of the water companies. That season will come some day with the usual result, "panic," and consequent loss. Here, for the same reasons, unless sewers have their temperature permanently raised for some time, there is no danger from benign germs becoming malignant, but I believe that it is possible for the continuous discharge of hot water so to raise the temperature of a drain pipe, that it may be a hidden source of danger, and that such continuous discharges of hot water from manufactories may be dangerous in badly constructed sewers, though an excessive heat destroys bacteria, such as is experienced on a hot sunny day; but if sewers are well and truly laid, if the pipes are smooth inside and have been properly jointed, if they flush clean, and are properly flushed at intervals, depending upon the temperature of the sewage, then there is no real danger from the admission of hot water into sewers.

THERAPEUTIC MEMORANDA.

COMBINATION OF BROMIDE OF POTASSIUM WITH BELLADONNA FOR ENURESIS.

Two cases of nocturnal incontinence of urine of long duration in boys of 12 years of age, coming under treatment at the same time, have yielded in a striking manner to a combination of bromide of potassium with belladonna, after belladonna alone and other drugs had failed to produce effect. In the first case the boy had been discharged, on account of the incontinence, from an orphan institution, where he had been admitted with a view to emigration. He had been an in-patient at this hospital four years previously for three months, according to the record of patients, with "scrofulous cystitis, cured by accidentally induced acute cystitis from injections." At this time he was circumcised. The enuresis had lasted from infancy. When readmitted last February the usual precautions were taken to ensure regular emptying of the bladder at night. An enema was given before sleep, and was successful on the first night or two that it was tried but not afterwards. Belladonna, iron, saccharin, nux vomica (up to $\text{m}\times$ of the tincture thrice daily), and codeine were given successively, without even temporary effect. On April 15th he was ordered pot. brom. gr.x, tincture of belladonna $\text{m}\times$, every night, and this was at once effectual. From the time that he took the first dose until May 11th, when he went home, and for a fortnight afterwards, when he was last heard of, no wetting of the bed occurred, excepting once, on the 20th of April, when he had not been attended to as usual. At this time the dose of tinct. belladon. was in-