

in its vicinity. Long after this, however, the Fleet was not covered in. It was still permitted to diffuse its pestilential exhalations through the atmosphere of the rapidly-growing City, notwithstanding it had long ceased to bear vessels with merchandise as far as Fleet and Holborn Bridges, if no further. So late as 1746 only about 400 acres of the surface of the districts of Holborn and Finsbury were built upon; but in 1846, one hundred years later, there were about 1,790 acres covered with houses and streets. This vast step, taken in a hundred years, is a wonderful exemplification of the speed with which the English metropolis had grown; but the total surface which the Fleet drains of sewage in the Holborn and Finsbury districts is 4,444 acres, so that there is still much ground to be built upon; and, consequently, to swell the refuse-flood of this subterranean stream.

The above example of the deadly effects of sewer gases discloses that whether in an individual or a compound state, they are to be provided against as far as possible. Sewer miasms are all more or less deleterious, but the most dangerous of them all is sulphuretted hydrogen. This gas is known by the peculiarity of its odour, and is always produced during the putrefactive process going on in the decomposition of sewage. Its smell is so palpable that it may be discovered even when diluted with ten thousand times its bulk of air. Although little heavier than atmospheric air, in the proportion of 1,179 to 1,000, the diffusiveness of its nature is so great, that its increase of weight possess little or no influence in making it occupy a low level. It is exceedingly poisonous, and under all circumstances, will destroy life, whether it is inhaled, or absorbed through the skin, or injected into the cavities or tissues. This, then, is one of the principal gasses evolved by matter in a state of decomposition. It comes up reeking through the gratings from our sewers, in the streets; it is inhaled by the passers-by, some of whom we have known to have been suddenly seized with headache on happening to stand a few minutes beside a grating, inadvertently inhaling the gas. One part of it in 1,500 of air, will immediately kill small birds, and one in 290 is, in a few minutes, fatal to rabbits and dogs. This is no doubt the gas which was so deadly to the White Friars. It discolours almost all the common metals; indeed, the salts of lead and silver are so quickly blackened, and are so sensitive of its action that they indicate the presence of the gas when the atmosphere does not contain more than one part in about 100,000. These, therefore, are the tests for it.

Another dangerous gas evolved by the decaying of organic matter, is *carbonic acid*, which is found in the air of sewers to the extent of 0.5 to 2.3 per cent. The gases evolved from the sewage itself, contain of this gas about 19 per cent. Like sulphuretted hydrogen, its diffusive power is very great, although it is heavier than air in proportion of 1,525 to 1,000. It acts as a powerful narcotic, and if it be breathed in a somewhat pure condition, it will produce immediate asphyxia. "If this gas has been produced at the expense of the oxygen of the air, as happens in sewers and crowded rooms," says Dr. Letheby, "as little as 3 per cent will quickly destroy life. Expired air contains from 3 to 5 per cent. of the gas; and the tragedies of the

Black Hole at Calcutta, and the round house at St. Martin's, are examples of the terrible fatal power of such an atmosphere; even the proportion of from 1.5 to 2 per cent., will cause almost immediate distress, and a feeling of suffocation." Mr. Bence Jones found that these were the proportions in the dormitories of a metropolitan work-house, where the vitiated air proved deleterious in a more than ordinary degree; and in the atmosphere of the Wellington barracks, where the sickly troops were lodged, it was ascertained by Dr. Roscoe, that the quantity of carbonic acid at night, ranged from 0.12 to 0.14 per cent. In a crowded theatre it does not exceed 0.32 per cent. Yet are there few persons who have not felt the depressing influence of such an atmosphere. Think, then of the sewer gases which contain from 0.5 to 2.3 per cent. of it.

Ammonia is another product of putrefaction, and is one of the constituent elements of the sewer air. It is lighter than the atmosphere in the proportion of 560 to 1,000, and is known by the peculiarity of its smell and alkaline reaction. The action of this gas is peculiarly injurious to the animal economy; and, when inhaled in a concentrated state, it produces immediate asphyxia. When somewhat diluted with air, it acts principally on the lungs; and when still more diluted, and breathed for a considerable time, it produces symptoms of typhoid fever. Even if the air is charged with only a small quantity of ammonia, the continued inhalation is destructive of health. This gas, however, performs a two-fold function in the operations of this world. Than even the inhalation of ammonia in an atmosphere impregnated by it, there is another property possessed by it more dangerous still. This consists in its capacity to convey the less volatile products of putrefaction into the air. "In all probability," says Dr. Letheby, "it is the purveyor of the miasms of infected districts, as it is known to be of the fetid compounds of animal and vegetable decomposition. It was the agent which gave volatility to the putridities of the Thames, during the hot weather; and it is the medium by which the more offensive matters of coal-gas are held in suspension. Nor is it less powerful diffusing the sweet odours of plants, and the subtle constituents of many perfumes. It may therefore act for good as well as for evil."

The volatile compounds of ammonia with carbonic acid and sulphuretted hydrogen are, also, injurious; so are light carburetted hydrogen or marsh gas and coal gas, which are all present in sewers. Into these, however, we will not here enter; but we may ask, what are the dangers of the complex sewer gases themselves? From what we have already said of the properties of the individual constituents, it is evident that the complex mephitisms must be extremely injurious to the animal economy. This has been amply confirmed by experience, which has proved that they are amongst the most active poisons. One breath of the undiluted gases, will destroy life immediately, and even when they are largely mixed with atmospheric air, they quickly cause asphyxia, narcotism and death. In smaller quantities, they are less active, but not less certainly injurious; and even when further diluted with atmospheric air, they produce a general prostration of the vital powers.