

* O N T H E
N O X I O U S V A P O U R S
O F
C H A R C O A L.

— *Sævamque exhalat mephitin.*
Virgil. Æneid. lib. 7. 34.

THE accurate and ingenious Doctor Hales, has proved by a great variety of experiments, that air enters in a very considerable proportion into the composition of all bodies. That air thus combined, is in a fixed state, and contributes to form the union and firm connection of the constituent parts of bodies; and

* Communicated by Dr. Dobson of Liverpool.

and that on their destruction or decomposition, this fixed air is again restored to its state of elasticity.

FIXED AIR, whether procured by fire, fermentation, or chemical resolution, has been supposed to be a body *sui generis*; and to possess properties, by which it is always distinctly characterised. It is more conformable however to the simplicity which is constantly observed in the operations of nature, to conclude, that as it is common atmospheric air which enters into the composition of bodies, it is likewise the same air which is again detached, on their decomposition or destruction; that its varieties depend on adventitious matter; and that it has different degrees of mixture and composition, according as it is obtained from different substances, or by a different process.

THAT by degrees however, it is decomposed; returns to its original simplicity;

plicity; is restored to the common magazine from which it was taken; and that the atmosphere is thus constantly gaining by one process, what it loses by another.

FACTITIOUS or FIXED AIR is the general term, by which this subject is distinguished; and when it produces any noxious effects, either in consequence of the process by which it is procured, or the manner in which it is applied, it may then be properly called MEPHITIC AIR.

MUCH has been done by some very ingenious modern writers, to illustrate this subject; and much still remains to be done, to compleat the chemical and medical history of fixed air. The present commentary, chiefly respects the factitious air of charcoal; or the mephitic vapours which arise from this substance, in the state of ignition. And the following history points out both the noxious qualities of these vapours, and their mode of action on the animal œconomy.

October

October 5th, 1769. A servant to a gentleman's family in Liverpool, shut himself up in a small room to clean plate. In this room there was a chafing-dish of burning charcoal, and the door and window were closed. He soon felt himself *very ill*, as he expressed it; was chilly, sickish, and had shooting pains in the head. He continued to be affected in this manner for upwards of an hour and a half, during which time he had been twice called out, but returned again to the same situation in a few minutes. The chills, sickness, and pain in the head became more severe, and were increased by fits; he retched, but could not vomit. These were the only sensations he could recollect; and on my asking him, whether he did not feel an oppression at his breast; or a sense of suffocation, he answered in the negative.

HE remembered that he heard the clock strike eleven, which was an hour and

and a half from his first going into the room; and still finding himself very ill, but having no suspicion of the cause, he leaned forwards, rested his head upon his hands, and from that time had no further knowledge of what passed.

ABOUT half an hour after this, some of the family going near the door, were alarmed by his groans. The door was forced open, and he was found extended on the ground; his eyes fixed and staring; his hands clenched; his arms, legs, and whole body rigid; and his countenance, which was naturally pale, had now a death-like appearance.

HE was immediately carried into the open air; but it was with difficulty that his limbs were so bent that he could be seated in a chair. He continued to groan, and on the application of hartshorn drops to his nose, exerted a kind of motion, as if offended. Cold water thrown upon his
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face, had a more powerful effect to rouse him. After ten minutes, he came to himself; and in about twenty minutes, he was able to walk.

AT this time I first saw him; he complained of pain in his head, coldness and sickness; was hot to the touch; his pulse, small and frequent, 120 in a minute. While I was examining him, I observed his voice faltered; his eyes became fixed; he staggered forwards, and would have fallen, had he not been supported. He was placed in a chair, and remained in a state of insensibility near a minute; there was no rigidity, the colour of the countenance did not change, but the pulse was extremely small, frequent, and irregular. On coming to himself, he complained much of pain in his head, was sick, retched, trembled, and was cold and hot by fits; a considerable degree of fever remained for two days, and then gradually left him.

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servations tend, however, to establish a different doctrine.

WE learn from the experiments of the celebrated Greenwood, that the air of a well, in which the men who went down perished, and in which a lighted torch was instantly extinguished, did not differ from common air, either in gravity, humidity, or elasticity. (*e*)

THE same is found to be true of the Grotto di Cani. In this, the height of the mercury in the barometer was not altered by the deadly vapours. (*f*) And we have the same proof of the state of the air in the cavern of Pyrmont. (*g*) It appears likewise from the experiments of the learned Leonardo Capuano, that those animals which do *not breathe*, are destroyed in the Grotto di Cani, though slowly and with more difficulty.*

DOCTOR

(*e*) Saggio delle Tranfar. tom. 5. p. 2.

(*f*) Mead. de Venenis, tent. 6.

(*g*) Commerc. litter. A. 1737. Heb. 8.

* Delle Mofette, Lez. 1.

DOCTOR HALES indeed proves, that the fumes of burning sulphur, and the exhalations from the lungs of animals, bring into a fixed state part of the air through which they are dispersed, and consequently diminish its elasticity. That this circumstance however is not the cause of death, is hence evident; in high winds and storms, and on ascending very high mountains, a greater diminution of elasticity takes place, without such fatal effects. †

ALL these noxious vapours, whether arising from burning charcoal, the fermenting grape, the Grotti di Cani, or the cavern of Pyrmont, operate nearly in the same manner. When accumulated and confined, their effects are often instantaneous; they immediately destroy the action of the brain and nerves, and in a moment arrest the vital motions. When

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† Veratti Com. Acad. Bonon. tom. ii. Pt. II. p. 271. 276,
And Element. Physiolog. Haller. vol. 3. p. 208.

more diffused, their effects are slower, but still evidently mark out a direct affection of the nervous system.

THOSE who are exposed to the vapours of the fermenting grape, are as instantly destroyed, as they would be by the strongest electrical shock. A state of insensibility is the immediate effect upon those animals which are thrust into the Grotti di Cani, or the cavern of Pymont; the animal is deprived of motion, lies as if dead, and if not quickly returned into the fresh air, is irrecoverable. And if we attend to the histories of those who have suffered from the vapours of burning charcoal, we shall in like manner find, that the brain and moving powers, are the parts primarily affected.

A COOK who had been accustomed to make use of lighted charcoal more than his business required, and to stand with his head over these fires, complained
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for a year of very acute pain in the head; and after this, was seized with a paralytic affection of the lower limbs, and a slow fever. (*b*)

A PERSON was left reading in bed with a pan of charcoal in a corner of the room. On being visited early the next morning, he was found with his eyes shut, his book open and laid on one side, his candle extinguished, and to appearance like one in a deep sleep. Stimulants and cupping glasses gave no relief; but he was soon recovered by the free access of fresh air. (*i*)

FOUR prisoners, in order to make their escape, attempted to destroy the iron work of their windows, by the means of burning charcoal. As soon as they commenced their operations, the fumes of the charcoal being confined by the closeness of the prison, one of them was struck dead;

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(*b*) Morgagni. Epist. 64. §. 15. (*i*) Chesney, 696.

another was found pale, speechless, and without motion; afterwards he spoke incoherently, was seized with a fever and died. The other two were with great difficulty recovered. (*k*)

Two boys went to warm themselves in a stove heated with charcoal. In the morning they were found destitute of sense and motion, with countenances as composed as in a placid sleep. There were some remains of pulse, but they died in a short time. (*l*)

A FISHERMAN deposited a large quantity of charcoal in a deep cellar. Some time afterwards, his son, a healthy strong man, went down into the cellar with a pan of burning charcoal and a light in his hand. He had scarcely descended to the bottom, when his candle went out. He returned, lighted his candle, and again descended. Soon

(*k*) Donatus Epist. 694. (*l*) Ib. 695.

Soon after he called aloud for assistance. His mother, brother, and a servant hastened to give him relief, but none of them returned. Two others of the village shared the same fate. It was then determined to throw large quantities of water into the cellar; and after two or three days, they had access to the dead bodies.*

CÆLIUS AURELIANUS says, that those who are injured by the fumes of charcoal, become cataleptic. (*m*) And Hoffman himself, in another part of his works, enumerates a train of symptoms which in no respect correspond with his idea of suffocation. Those who suffer from the fumes of burning charcoal, says he, have severe pains in the head, great debility, faintness, stupor and lethargy. (*n*)

It appears from the above histories and observations, that these vapours exert their

* Histoire de l'Académie de science, Ann. 1710.

(*m*) De morbis acutis, lib. ii. c. x.

(*n*) Tom. 1. p. 229. § 5.

their noxious effects on the brain and nerves. Sometimes they occasion sudden death; at other times, the various symptoms of a debilitated nervous system, according as the poison is more or less concentrated. The olfactory nerves are first and principally affected, and the brain and nervous system by sympathy or consent of parts. It is well known, that there is a strong and ready consent between the olfactory nerves and many other parts of the nervous system. The effluvia of flowers and perfumes, in delicate or irritable habits, produce a train of symptoms, which though transient, are analogous to those which are produced by the vapours of charcoal; viz. vertigo, sickness, faintness, and sometimes a total insensibility. The female malefactor, whom Doctor Mead inoculated by putting into the nostrils dossils of cotton impregnated with variolous matter, was immediately on the introduction, afflicted with a most excruciating head ach, and had a constant fever till after the eruption.

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THE vapours of burning charcoal, and other poisonous effluvia, frequently produce their prejudicial and even fatal effects, without being either offensive to the smell, or oppressive to the lungs. It is a matter of importance therefore, that the common opinion should be more agreeable to truth; for where suffocation is supposed to be the effect, there will be little apprehension of danger, so long as the breast keeps free from pain or oppression.

It may be well to remember, that the poison itself is distinct from that gross matter which is offensive to the smell; and that this is frequently in its most active state, when undistinguished by the sense. Were the following cautions generally attended to, they might in some instances be the happy means of preserving life. Never to be confined with burning charcoal in a small room, or where there is not a free draught of air by

by a chimney or some other way. Never to venture into any place in which air has been long pent up, or which from other circumstances ought to be suspected; unless such suspected place be either previously well ventilated, or put to the test of the lighted candle. For it is a singular and well known fact, that the life of flame, is in some circumstances sooner affected and more expeditiously extinguished by noxious vapours, than animal life. A proof of which I remember to have received from a very intelligent Clergyman, who was present at a musical entertainment in the theatre at Oxford. The theatre was crowded; and during the entertainment, the candles were observed to burn dim, and some of them went out. The audience complained only of faintness and languor; but had the animal effluvia been still further accumulated or longer confined, they would have been extinguished as well as the candles.

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THE most obvious, effectual, and expeditious means of relief to those who have unhappily suffered from this cause, are such as will dislodge and wash away the poison, restore the energy of the brain and nerves, and renew the vital motions. Let the patient therefore be immediately carried into the open air, and let the air be fanned backwards and forwards to assist its action; let cold water be thrown on the face, and let the face, mouth and nostrils be repeatedly washed; and as soon as practicable get the patient to drink some cold water. But if the case is too far gone to be thus relieved, let a healthy person breathe into the mouth of the patient; and gently force air into the mouth, throat and nostrils. Frictions, cupping, bleeding, and blisters are likewise indicated. And if after the instant danger is removed, a fever be excited, the method of cure must be adapted to the nature and prevailing symptoms of the fever.

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