MEMOIR

ON THE

Analyſis of the Black Vomit,

EJECTED IN THE LAST STAGE OF THE

YELLOW FEVER.

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THE inveſtigation of the properties of ſecreted fluids, has long engaged the attention of the Phyſiologiſt and Chemiſt: But, their enquiries have generally been directed to a knowledge of thoſe fluids in a healthy ſtate, while little notice has been taken of the ſecretions of ſome of the moſt important viſcera after a ſtate of diſeaſe. The cauſe of this deficiency, in the examination of morbid ſecretions, and particularly in that denominated the black vomit, muſt be aſcribed to the danger ſuppoſed to attend ſuch an undertaking; though moſt obſervers muſt have been ſtruck with the ſingular appearance of this diſcharge, and much aſtoniſhed with the ſpeedy diſſolution that enſued; yet, none that I have had an opportunity of conſulting, have attempted an analyſis of this fluid. When I firſt contemplated an examination of the black vomit, in 1793 and 1794, I conſidered it as an hazardous undertaking, and limited my views

merely to diſtinguiſh that fluid from putrid bile: But, after ſubjecting it to many experiments, and finding that it had no effect on my health, I have been enabled to advance one ſtep farther in the enquiry; and I have now the ſatisfaction of ſubmitting to the Philoſophical Society, an analyſis of that fluid, together with its effects, when applied to the healthy ſyſtem.

Deſcription of the Black Vomit.

THE black matter, or vomit, ſo called, appears to be of two kinds. One, conſiſting of a number of black flaky particles, reſembling the grounds of coffee. The other, of a dark-coloured inſpiſſated mucus: of each of theſe, I ſhall give a ſeparate deſcription.

This flaky diſcharge was always preceded by violent ſickneſs and vomiting; and, as a precurſor to the ejection of this matter, in ſome caſes, the patients vomited a fluid, like whey, or muddy water, or one conſiſting of a brown flaky ſubſtance, reſembling chocolate or ſpoiled porter, mixed with browniſh-coloured mucus.* Theſe ſubſtances were ſometimes of a lighter colour, and were ſuſpended

* The chocolate, or coffee ſickneſs, or the black ſickneſs, ſays Dr. de Monchy, is not taken from the blackiſh hue or ſhade of the ſkin, but it is derived from the fœted, blackiſh matter diſcharged from the firſt paſſages. *See diseases in voyages to the West-Indies.*

in a glarey yellow-coloured fluid, which became nearly tranſparent when at reſt, by the ſubſiding of a ſmall number of brown particles. This coloured matter was generally vomited in ſmall quantities, and with conſiderable difficulty; but, when the black flaky diſcharge commenced, it was frequently ejected in large quantities, and with ſimilar force to a fluid from the action of an emetic. As the diſeaſe advances, this matter aſſumes a darker colour, and its quantity, ſometimes, becomes ſo much augmented, that I have known one gallon vomited in 48 hours, beſides a conſiderable quantity, which was of a much thicker conſiſtence, that was diſcharged by the bowels. This black vomit, after ſtanding ſome hours, depoſits a black flaky ſubſtance, from a glarey yellow-coloured fluid, ſimilar, in appearance, to an infuſion of green tea. Theſe depoſitions were ſometimes in diſtinct particles, but frequently in a kind of dark powder. The above particles were various in ſize, and of a very irregular figure, not unfrequently mixed with pieces of the villous coat of the ſtomach. Theſe may be diſtinguiſhed by their being longer in ſubſiding to the bottom of the veſſel than the flaky ſubſtance. There were ſome diſproportions between the yellow-coloured fluid, and the quantity of flaky ſubſtance, as in the other appearance of the vomit. The flaky matter was very readily re-incorporated with the

yellow-coloured fluid, by the leaſt agitation of the veſſel; and, when kept in a phial, corked for eight or ten days, aſſumed rather an agreeable, ſaccharine odour, and was extremely briſk, like fermenting beer. This laſt property is not peculiar to this fluid, but common to ſome other animal ſecretions. When the black vomit was kept for two years in a ſtate of reſt, the flaky particles became perfectly ſeparated. On agitating the veſſel, the former was immediately incorporated with the latter; and, after remaining at reſt ſix months, ſhowed ſcarce any diſpoſition to ſeparate. This was the appearance, if I recollect accurately, of the black vomit, exhibited by Dr. Monro, of Edinburgh, to his claſs, in 1792, and which had been ſent him from the Weſt-Indies: Though, as the profeſſor did not permit it to go out of his hand, I cannot ſpeak correctly as to the fact; but believe it was not ſeparated, and conſiſted of a turbid black-coloured fluid.

The mucus-matter which was ſometimes vomited in the yellow fever, and particularly in that which appeared in 1797, was very ropy, and of a black colour. This matter floated on a fluid of a dark colour, which appeared to receive its tinge from the colouring-matter of the mucus. When this matter was agitated in a phial, the mucus ſhowed no diſpoſition to mix with the fluid-part of the vomit, and when it was repeatedly waſhed in clear

water, became nearly of the colour of the mucus ſecreted in the alimentary canal. This black matter was diſcharged in large quantities in the caſes which proved mortal in 1797, and was a very inactive fluid when applied to the moſt ſenſible parts of the healthy body, and was eſſentially different from the coffee-ground vomit.

Analyſis of fluids, ejected a few hours before the commencement of black vomiting.

THE fluids, on which the ſubſequent experiments were made, were obtained from three patients, from one to ſixteen hours previous to the vomiting of the brown-coloured matter, which has been deſcribed as generally preceding the black diſcharge. In all of theſe caſes, the ſick refuſed every other drink but plain water; notwithſtanding the ſimplicity of drink, the fluids, which are the ſubject of inveſtigation, were of the following colours: The firſt had nearly the appearance of whey. The ſecond was of a yellowiſh colour, occaſioned by the mucus it contained. The third appeared like muddy water, or reſembled water that had been coloured by aſhes. Theſe fluids had a diſagreeable, ſaccharine taſte, and emitted an odour analogous to that ariſing from fluids which had been ejected from debilitated ſtomachs after paroxyſms of indigeſtion. They underwent but

little change after remaining at reſt for twenty-four hours, except that ſome part of the mucus-matter aſſumed a white aſpect, and ſubſided to the bottom of the veſſel.

(*a*) Theſe fluids changed the infuſion of turnſole to a red colour; paper ſtained yellow with turmerick remained unaltered, but when previouſly changed by an alkali, was reſtored to its priſtine colour.

(*b*) Caloric, or diluted acids, would not coagulate this fluid;

(*c*) Lime-water produced no clouds or turbidneſs;

(*d*) Solution of ſulphate of iron, or nitrated mercury, cauſed no precipitation;

(*e*) Muriated barytes occaſioned no alteration;

(*f*) Nitrated ſilver produced a copious white precipitate;

(*g*) Sulphate of copper did not ſhow the preſence of ammoniac;

(*h*) Fixed alkalies occaſioned no alteration;

(*i*) Oxalic acid produced no change;

(*k*) Alcohol of galls, or pruſſiate of pot-aſh, did not produce any precipitation;

(*l*) Theſe fluids, when expoſed to cold, were congealed in the temperature in which water freezes; the ice was nearly tranſparent, and, when rendered fluid, had the appearance of water, and taſted like that fluid after being boiled.

The above fluid, therefore, appears to contain an acid in a free ſtate (*a*); but no coagulable matter (*b*), nor carbonic acid, in a diſengaged ſtate, or combined with alkalies or earths (*c* & *d*); the acid (*a*) is proved not to be the ſulphuric (*e*). The preſence of the muriatic acid is ſuppoſed, from (*f*) no ammoniac is contained in this fluid (*g*), nor earths (*h*), nor lime, or the ſalts formed of lime and acids (*i*); no reaſon to ſuſpect metallic matter (*k*); but a conſiderable proportion of water (*l*).

Analyſis of black vomit.

We have already obſerved, in the deſcription of the black vomit, that it ſpontaneouſly ſeparated into yellow-coloured fluid, and black flaky ſubſtance (No. 1.). The yellow-coloured fluid and flaky ſubſtance being thrown on a filter of two-folds of paper, four ounces of a fluid paſſed through, which was ſimilar, in appearance, to an infuſion of green-tea. It was moderately viſcid, and had a faint ſweetiſh animal odour, and a ſaccharine taſte, perceptibly acrid to the lips. The matter which remained on the filter, was ſimilar, in colour and conſiſtence, to Venice treackle. It was weakly glutinous, and had the ſame odour as the

yellow-coloured fluid. When this ſubſtance was dry, it weighed 30 grains. It was friable, and not of ſo black a colour as immediately after being removed from the filter. When this matter was obtained by evaporating the black vomit over a moderate heat, it was brittle and ſhining, but had no peculiar taſte or ſmell; and when expoſed to a moiſt atmoſphere, became ſoft and glutinous.

(*a*) Eight drachms of the filtered fluid (No. 1.) was evaporated in a ſhallow veſſel, by a gentle heat: the vapour being condenſed, was found to conſiſt of water, which taſted neither acid nor alkaline; but emitted a ſtrong odour of the vomit. The evaporation being continued, until an adheſive reſiduum remained of a dark colour, reſembling melted ſugar. This ſubſtance affected the lips in a more obviouſly acrid manner than the fluid did previous to the evaporation. It was highly inflammable when dried, but not entirely ſoluble in water.

(*b*) Six drachms of the filtered fluid (No. 1.) and as many of water, were expoſed in ſeparate phials, cloſely corked, to an atmoſphere, when the mercury, in the thermometer, was as low as 25. The filtered fluid congealed as ſoon as the water. The two different fluids were examined, after ſtanding a whole night; when the phial, containing the coloured-fluid, was found entire, and

its contents not quite frozen; as, a part of the fluid, on placing the phial on its ſide, flowed among the ice. The water, in the other phial, was completely frozen, and the veſſel broken in pieces. The ice, in the former phial, was of a yellow-colour: The colouring-matter of which could be ſo much diſengaged, by waſhing it with water, as to give it the uſual tranſparency of ice. The aqueous part of the vomit, obtained in this manner, diſſolved ſoap, with facility, but had not the odour of the vomit. This fluid was neither acid nor alkaline, Pruſſiate of potaſh, or oxalic acid, did not cauſe any precipitation.

(*c*) Some alcohol was poured on the adheſive reſiduum (*a*), and a conſiderable portion of it was diſſolved, which tinged the menſtruum of a yellowiſh-colour, and gave to it the perceptible taſte of the yellow-coloured fluid. A part of the reſiduum remained inſoluble, which appeared to be of a mucilaginous nature. The menſtruum was poured off, and, by the affuſion of diſtilled water, the fluid became milky, and a reſinous ſubſtance, of a yellowiſh-colour, was precipitated, that had an odour ſimilar to the yellow-coloured fluid.

(*d*) The filtered fluid (No. 1.) betrayed the preſence of an acid to the infuſion of turnſole, as the mixture became manifeſtly reddened.

2. Lime-water, when added to a portion of this fluid, occaſioned no change: 3. Solution of ſulphate of iron cauſed no precipitation, nor did nitrated mercury, or muriated barytes.

(*e*) To ſome of the filtered fluid, I added nitrated ſilver; and, a copious white-coloured precipitate was formed. Four drachms of the above fluid was evaporated over a moderate fire, until it was reduced to about one drachm; when ſuffered to remain at reſt, in a cool place, cryſtals, of a cubic figure, were formed. Theſe decripitated upon coals, and had all the characters of muriate of ſoda, or common ſalt.

(*f*) To ſeparate portions of the filtered fluid, (No. 1.) was added oxalic acid, pruſſiate of potaſh, infuſion of galls, and a ſolution of ſulphate of copper; but neither of them produced any precipitation.

(*g*) Some diſtilled water being digeſted on ten grains of black flaky ſubſtance (No. 1.) for twelve days, after which it was gently heated, and committed to the filter. 1. This liquor immediately changed the vegetable blue to a red colour. 2. Lime-water cauſed no precipitation. 3. Muriated barytes effected no change; but, on the addition of nitrated ſilver, a white-coloured precipitate was produced. Some of the above fluid, being cautiouſly evaporated to a certain quantity, on

cooling, cryſtals, of a cubic figure, were formed. Theſe had the properties of muriate of ſoda, or common ſalt.

(*b*) Some marine acid, a little diluted, was poured on ten grains of the black flaky ſubſtance, (No. 1.) a ſlight coagulation was produced, after ſtanding twelve days, the mixture was filtered, and divided into four portions.

The firſt portion was ſaturated with lixivium of mild pot-aſh, but no precipitation enſued; yet, in a few hours, a ſaline ſubſtance appeared at the bottom of the veſſel.

To the ſecond portion was added ſulphuric acid. This threw down a copious flocculated precipitate, of a white colour, which I ſuppoſed to be lime; but, on pouring off the fluid, a thin layer, of a white-fatty ſubſtance, was ſpread over the bottom of the veſſel. This had an unctuous feel, and ſtained paper like oil; and emitted an animal odour, when thrown on coals. This matter, when kept in a phial, corked for two weeks, aſſumed a yellow colour, and had an odour like rancid ſpermaceti.

To the third portion, pruſſiate of pot-aſh was added, and Pruſſian blue produced.

To the fourth portion, alcohol of galls was added, and the mixture ſaturated with lixivium of mild pot-aſh, which immediately ſtruck a black colour.

(*i*) One hundred and twenty grains of the nitric, and as many of ſulphuric acids, were digeſted

on ten grains of dry black flaky-ſubſtance (No. 1.) placed in different veſſels, for twelve days. At the expiration of that time, the black ſubſtance was entirely converted, without the application of heat, into the fatty matter before-mentioned. That on which the nitric acid was uſed, was of a yellowiſh colour, the acid appearing to have undergone no perceptible change. But the ſulphuric had aſſumed a black colour, and the matter which had precipitated, was as white as ſnow. This, in both acids, roſe to the ſurface, and aſſumed the appearance already deſcribed.

(*k*) Some diſtilled water was boiled on the unctuous matter (*i*). This liquor was filtered; but, on the addition of oxalic acid, no precipitation enſued.

(*l*) Two ounces and an half of black vomit was put into a retort, adapted to a receiver. This was placed in a water bath. Soon after, the fluid began to boil. Two drachms, of a browniſh white-coloured fluid, having a ſmall quantity of oil on its ſurface, paſſed into the receiver. This had a ſtrong odour of ammoniac, and an oily, diſagreeable taſte. Finding that no more fluid would come over, the retort was placed in a ſand-bath, and a conſiderable quantity, of a ſimilar coloured fluid was obtained. The reſiduum, in the retort, conſiſted of a dark-coloured ſpongy

coal. This, when expoſed, a ſhort time, in a red-hot crucible, gradually aſſumed a grey colour, and, at length, was reduced to aſhes*.

(*m*) Some diſtilled water was ſuffered to ſtand ten days on fifteen grains of aſhes (*l*), after which it was gently heated and filtered. This liquor did not change the colour of paper ſtained yellow with turmerick. Muriated barytes produced no alteration; but nitrated ſilver cauſed a copious white precipitate. On the aſhes, which remained undiſſolved, two drachms of nitric acid, a little diluted, were digeſted. This mixture, being filtered, was divided into two equal parts. To the firſt portion, pruſſiate of pot-aſh was added, which immediately ſtruck a blue colour, and Pruſſian-blue was produced. To the ſecond portion, lixivium of mild pot-aſh was added, and a copious precipitate was formed. This, when collected and dried, had the appearance of lime, and was almoſt entirely ſoluble in diſtilled water. This fluid, when filtered, and oxalic acid added to it, cauſed a copious white ſediment. That this precipitate was lime, was, in ſome meaſure, con-

* Many of the preceding experiments were made in the preſence of a medical gentleman of reſpectability, viz. Dr. Samuel Duffield, conſulting phyſician to the port of Philadelphia.

firmed, by adding diluted ſulphuric acid to it, with which it formed a ſubſtance like ſelenite, or ſulphate of lime. I found, that, by re-diſſolving this precipitate in ſulphuric acid, and precipitating it again with an alkali, and treating it in the manner mentioned, it gave ſtronger proofs with oxalic acid of the preſence of lime. On the remaining aſhes, which was not diſſolved by the nitric acid, I digeſted ſulphuric acid a little diluted; after which it was boiled on them, notwithſtanding there remained a fixed reſidue. This mixture, when filtered, ſhowed the preſence of lime and iron, to chemical teſts.

(*n*) Three ounces of black vomit were put into a retort, and the pneumatic apparatus being affixed, the retort was placed in a ſand-bath, which was gently heated, after exhauſting the air in the neck of the retort. The firſt meaſure of air that was obtained, did not appear to burn when a lighted taper was preſented to it. The ſecond meaſure of air was incorporated with water, and ſome iron-filings inſerted in the phial, which was ſuffered to remain twenty-four hours. This mixture was found to precipitate lime from lime-water. Alcohol of galls produced a violet tinge. The vomit which remained in the retort, after the air had been extracted, from being of a very black

colour, was changed, by the application of heat, to a light-brown.

From reviewing the preceding analyſis, the black vomit appears to be compoſed of the following ingredients:

(*a* & *b*) Prove it to contain a conſiderable proportion of water;

(*c*) A reſinous and mucilaginous ſubſtance;

(*d*) Proves a predominant acid, which is not the carbonic, phoſphoric or ſulphuric acids; but, in all probability, an acid analogous to the one, contained in the fluids, ejected previous to the commencement of black vomiting. In repeating this experiment, on the ſame coloured fluid, taken from twenty different patients, during ſeveral ſeaſons of the prevailing Yellow-Fever, I always found a ſimilar acid to predominate. May not the inceſſant vomiting, and the ejection of black matter, itſelf, which has been ſaid to be ſtopped by the exhibition of lixivium of mild potaſh, or lime-water, accompliſh that end, by combining with this acid, and forming a ſubſtance leſs irritating to the ſtomach, than the acid in an uncombined ſtate?

(*e*) That it contains muriate of ſoda or common ſalt;

(*f*) Proves it to contain neither lime, metallic matter, nor ammoniac.

(*g*) Proves the black flaky ſubſtance (No. 1.) to contain an acid, in a diſengaged ſtate, probably analogous to the one predominant in the filtered fluid. This experiment, likewiſe, ſhows it to contain muriate of ſoda, or common ſalt.

(*h* & *i*) Prove an unctuous animal ſubſtance, and a conſiderable quantity of iron. The former reſembled, in ſome reſpect, ſpermaceti. How far this ſubſtance is analogous to that analyſed by the maſterly talents of Fourcroy, I cannot determine; as I had not a ſufficient quantity of it, to enable me to endeavour to imitate his analyſis. From the black flaky ſubſtance being entirely converted into the fatty matter (*i*), it is probable that it reſembles the fatty ſubſtance, deſcribed by Dr. Gibbs*:

(*k*) Shows the unctuous ſubſtance to contain no lime:

(*l*) The black vomit yielded, on diſtillation, a browniſh white-coloured fluid, and a quantity of dark-coloured oily matter:

(*m*) The carbonaceous matter (*l*) appeared to contain muriatic acid in a combined ſtate; likewiſe, lime and iron:

(*n*) Proves carbonic acid gas†.

* See Tranſactions of the Royal Society of London, for 1794.

† When the foregoing experiments were committed to paper, and during the period of the late yellow-fever, I ſubmitted them to the peruſal of Dr. Adam Seybert, whoſe chemical accuracy is well-known to this ſociety. This gentle-

The proportion of the different ſubſtances, which conſtitute the black vomit, I had not an opportunity of eſtimating, as I could not obtain a ſufficient number of grains, of the black flaky matter, to ſubject it to a more regular analyſis.

Experiments to aſcertain the effects of black vomit on the living ſyſtem.

From the internal ſurface of the ſtomach and inteſtinal canal appearing, on diſſection, inflamed and ſphacelated, particularly in ſome patients who had vomited black, it has been believed that the black vomit was corroſive, and had a power of acting on parts it came in contact with*. This power has likewiſe been inferred from ſome patients complaining of a foreneſs in their throats, immediately after the ejection of this black matter.

To determine how far it was capable of acting on the healthy body, it was ſubmitted to the following experiments:

1ſt. In October, 1794, immediately after a quantity of black vomit was taken out of the ſto-

man obligingly favoured me with his company; on the 22d of November; when moſt of the experiments were ſhown to him, made on the black vomit, reſerved for that purpoſe, and the reſult nearly correſponded with what has been already deſcribed.

* See Deſportes on diſeaſes of St. Domingo, p. 203, vol. 1.

mach, after death, I applied ſome of it to my tongue and lips; to the latter it gave, a ſhort time after application, the ſenſation of a fluid perceptibly acrid. This experiment was, the next day, ſeveral times repeated, with the ſame reſult.

2d. A friend of mine applied it to his lips, and it produced a ſimilar ſenſation; but would not affect his tongue.

3d. Finding the effects of this matter ſo different from what was expected, I began to believe that this diſcharge varied materially in point of activity, in different patients; but, on ſubjecting the black vomit, procured from a number of perſons, to the ſame teſt, it produced the ſame effect.

4th. Two ounces of a fluid, reſembling chocolate, was obtained, which was vomited a few hours before death. This was applied in the ſame manner; but, there could not be perceived any difference in the reſult.

5th. In the beginning of October, 1799, Mr. Joſeph Parker, an active and intrepid member of the board of health, obligingly preſented me with five ounces of black vomit, obtained from the phyſicians of the City-Hoſpital. Some of this I applied to my tongue, in his preſence, but could not perceive the leaſt corroſive effect. When this fluid was applied to the ſkin, on different parts of the body, it produced no other effect, than what water did of the ſame temperature. I have often

immerſed my hand in black vomit, immediately after it was diſcharged from the ſtomach, and whilſt it was warm, without exciting the leaſt uneaſy ſenſation in the ſkin.

(*a*) October 4th, 1799, three cats were confined in a room, and fed with beef, which had a conſiderable quantity of the flaky ſubſtance of the vomit inſerted into it. This manner of feeding was continued until they had ate one drachm and an half of the flaky ſubſtance, and had drank ſeveral ounces of the black vomit. On the 5th, the excretions by the bowels were of a dark colour; yet, there could not be diſcovered any difference in their health; but, from their being ſtrangers to each other, they had a conſtant propenſity to combat. This malicious ſpirit continued until the 20th, when they were diſmiſſed in good health.

(*b*) A large dog was confined in a room, and, by an aſſiſtant, his jaws were forced aſunder, and he was compelled to ſwallow an half-pint of black vomit. The following day, the excretions by the bowels were fluid, and of a black colour; but, there could not be obſerved the leaſt alteration in his health, from the time of making the experiment, until he was diſmiſſed; which was about three weeks after.

(*c*) Two full-grown fowls were confined, and fed with bread, ſteeped in black vomit, for twelve

days. This, Mr. Parker, as well as myſelf, obſerved, they ate with great avidity; but it had no evident bad effect upon their health; for, they continued as well after as they were before the experiment, and ſeemed to give [the preference to that kind of food] to every other which was preſented to them, and they appeared to thrive equally as well as if they had been fed upon corn.

(*d*) On the 3d of October, 1779, in a ſmall yard, adjoining the houſe in which I live, ſeveral ounces of the black vomit, recently obtained, was evaporated over a moderate heat, in order to obtain the flaky ſubſtance. During this experiment, Mr. Parker held his head over the veſſel for ſome minutes, ſo as to inhale the ſteam of black vomit; after which, we continued within two yards of the veſſel, without experiencing any unpleaſant effect.

(*e*) The following day, I cauſed the windows and doors of a room to be cloſed, and the ſame experiment was repeated on a ſand-bath, conſtructed in the middle of a room. The fluid was evaporated until the atmoſphere was ſo impregnated with the effluvia of the vomit, as to render the apartment extremely unpleaſant, not only from the odour of the vomit, but the warmth of the room. In this atmoſphere, I remained one hour; during which, I had a conſtant propenſity to cough, and had, at times, nauſea and inclination to vomit; but, after walking out in the air, theſe effects gra-

dually ſubſided. I experienced, however, a ſenſe of wearineſs at my cheſt for many hours after.

From the above experiments, it appears that the black vomit, when applied to the moſt ſenſible parts of the body, produced little or no effect.

Secondly, It appears that large quantities of this fluid may paſs through the ſtomach and bowels of quadrupeds and other animals, without apparently diſturbing digeſtion, or affecting their health. This fact inconteſtibly proves the inactivity of this fluid; and renders it probable, that the ſpeedy death which enſues, after this diſcharge in Yellow Fever, is not from the deſtructive effects of this matter on the ſtomach and bowels; but, moſt likely, from the great degree of direct, or indirect debility, which had been previouſly induced, on which the black vomit is ſometimes an attendant, and ſtrongly expreſſes the great danger to be apprehended from the enervated ſtate of the ſyſtem.

Laſtly, The experiments (*d* & *e*) tend, in ſome meaſure, to prove, that an atmoſphere highly impregnated with the odour of black vomit, recently obtained, would not produce fever, apparently under the moſt favourable circumſtances.

Of the opinions of authors concerning the black vomit.

The opinions of authors concerning the properties of the black vomit, from the days of Hip-

pocrates until the preſent period, may be reduced to four heads. Firſt, that it conſiſted of putrid bile: Secondly, that it was putrid blood, or, according to ſome writers, a mixture of blood and bile: Thirdly, that it was the villous coat of the ſtomach, in a ſtate of diſſolution, produced by inflammation, terminating in mortification. Fourthly, it is ſuppoſed to be bile changed to a black colour, in conſequence of meeting with the nitric acid, which is ſuppoſed, by profeſſor Mitchell, of New-York, to be generated in the ſtomach and inteſtinal canal. The firſt of theſe opinions, viz. that the black vomit is putrid bile, I believe has been adopted merely from its being found, on diſſection, in the gall-bladder; for, their properties are very diſſimilar. The black flaky ſubſtance, which is the only part of the vomit bearing the leaſt analogy to bile, is generally of a darker colour, of a thicker conſiſtence, and is compoſed of a number of flaky particles. This fluid gives a black or brown tinge to linen; whereas, bile, even after becoming highly putrid, and after being retained in veſſels for months, and even years, imparts a yellow colour to water and linen, and has an intenſely bitter taſte. This property and colour of bile is not deſtroyed by a high degree of putrefaction. The experiments made on theſe ſecreted

matters, render the diſſimilarity of properties ſtill more obvious. The black flaky ſubſtance, by digeſtion with ſulphuric acid, may be entirely converted into the fatty matter before-mentioned: But, ſulphuric acid, when digeſted on putrid bile, ſoon diſſolved it into a blackiſh green liquor. This colour was rendered more apparent by the addition of water; and the mixture had an extremely bitter taſte. When diluted acids were added to putrid bile, they afforded a much larger quantity of coagulable matter, than when mixed with the flaky ſubſtance of the vomit. Moreover, theſe fluids differ, in their ſpecific gravity; for, that of the black vomit, compared with diſtilled water, is as 1 is to 1-025, whereas, that of putrid bile is as 1 is to 0125.

Theſe eſſential differences make it evident, that the black flaky ſubſtance is not bile of any deſcription, or it ſhould poſſeſs ſome of the diſtinguiſhing properties of that fluid.

The ſecond opinion is, that the black vomit conſiſts of putrid blood. With reſpect to this opinion, ſimilar objections may be made, to what we have already advanced, againſt its being putrid bile. Blood, after becoming highly putrid, and kept for ſix months, will impart a red colour to water. This property, like that in bile, is not deſtroyed by an high degree of putrefaction. Blood farther differs from black vomit, in not conſiſting

of flaky particles, likewiſe by ſhowing no proof of containing an acid in a diſengaged ſtate. It farther differs from black flaky ſubſtance, in not being converted into the fatty matter, by digeſtion with the mineral acids. And, likewiſe, in its ſpecific gravity; for, that of the black vomit, compared with diſtilled water, is as 1 is to 1-025, whereas, that of putrid blood is as 1 is to 0417. Viewing putrid blood in its ſimple ſtate, it certainly bears but little analogy to the flaky matter of the vomit, either in colour, odour or taſte; but, when it is combined with the muriatic, nitric, or ſulphuric acids, and the mixture diluted with an infuſion of green tea, it reſembles, in many reſpects, the black vomit. The odour, ariſing from this combination, ſo much reſembles that ariſing from black vomit, which had been kept for ſeveral years, that I could hardly diſtinguiſh one from the other.

The cloſe analogy of this compound to black vomit, would incline one to believe, that the latter was nothing more than blood combined with a diluted mineral acid; but, as the preſence of theſe acids, in the black vomit, in a diſengaged ſtate, could not be detected by the beſt teſts that we are acquainted with, and, as it is not probable that they are ſecreted by the liver, which we ſhall ſhortly endeavour to prove is the viſcus that ſecretes the colouring-matter of the vomit, this idea of its formation, muſt, of courſe, fall to the ground.

The black vomit has been ſaid to conſiſt of a

mixture of putrid blood and bile. Equal quantities of theſe fluids, when ſuffered to become putrid, in a combined ſtate, had a ſtrong, bitter taſte, imparted a red tinge to water, and, in other properties, had not the leaſt reſemblance to the black flaky ſubſtance of the vomit.

With reſpect to the third opinion, viz. that the black vomit conſiſts of the villous coat of the ſtomach, in a ſtate of diſſolution, produced in conſequence of inflammation, terminating in mortification: That black vomiting may be induced by gangrenous termination of inflammation, few will be diſpoſed to deny; but, that the black vomit, in yellow fever, and that from mortification of the ſtomach, are the ſame, the reſult of almoſt every diſſection muſt oppoſe. The former of theſe ſubſtances appears to come from the liver, while the latter conſiſts, principally, and particularly its flaky portion, of the villous coat of the ſtomach. Beſides, the black vomit is frequently thrown up in large quantities, when the ſtomach, after death, has not been found much inflamed or ſphacelated. In theſe caſes, it certainly could not conſiſt of the villous coat of the ſtomach in a ſtate of diſſolution, but muſt be derived from ſome other ſource. This opinion is ſtrongly countenanced by the diſſections of Dr. Jackſon, and other writers, on the ſubject of yellow fever. That experienced phyſician remarks,

that the black colour of the vomited matter was evidently owing to a mixture of vitiated bile; the paſſage of which might be eaſily traced from the gall-duct into the pylorus.* Dr. Lining, of Charleſton, obſerves, that the black flaky ſubſtances are, the bile mixed or adhering to the mucus of the ſtomach; for, upon diſſecting thoſe who died of this diſeaſe, not only in this, but in former years, I always obſerved, ſays this accurate phyſician, that the mucus of the ſtomach was abraded, and the bile, in its cyſtis, was black, and ſometimes very viſcid; and, in ſome caſes, had the conſiſtence of venice turpentine, and was extremely tough.† Mr. Deſportes, of St. Domingo, remarks, that they found, on diſſection, the gall-bladder full of black bile, the colour of ſtrong coffee.‡ This circumſtance of the colouring-matter of the vomit being derived from the gall-bladder, is ſtill farther corroborated by ſome diſſections made by Dr. Phyſick and myſelf, at the hoſpital, at Buſh-hill, during the prevalence of the diſeaſe in 1793. In two perſons who died at an advanced period of the diſeaſe, the ſtomach contained, as did alſo the inteſtines, a black liquor, ſimilar to what had been vomited, and purged, before death. This liquor appeared to be a fluid, in all reſpects, of the ſame quality with that

* See treatiſe on the fever of Jamaica, p. 173, and 174.

† See obſervations, phyſical and literary, vol. ii.

‡ See diſeaſes of St. Domingo, p. 202, vol. i.

which was found in the gall-bladder*. Theſe diſſections, without adducing any other of a ſimilar nature, muſt, no doubt, convince every impartial obſerver, that the black matter of the vomit is derived from the liver, and does not conſiſt of a diſſolution of the villous coat of the ſtomach.

The difference in the ejected matter being now eſtabliſhed, and, in a manner, proved to be the effect of different cauſes, I ſhall proceed to conſider the fourth and laſt opinion, viz. that the black vomit is bile, changed to a black colour by meeting with the nitric acid in the ſtomach, and inteſtinal canal. The preceding diſſections clearly prove this opinion to be erroneous, as they evidently ſhow, that the black flaky particles, or colouring-matter of the vomit, come from the gall-bladder; therefore, it could not receive its brown or black colour from meeting with the nitric acid, ſuppoſed to be generated in the ſtomach and inteſtinal canal.

The black vomit conſidered as an altered ſecretion from the liver.

The colouring matter of the vomit appears, from the authors already quoted, to be generally traced, after death, to the gall-bladder. This poſition being incontrovertibly eſtabliſhed by diſſections, the power of the liver to ſecrete that ſubſtance will be admitted, of courſe, as it could not

* See a medical ſketch of the Yellow-Fever, publiſhed in 1794.

be ſecreted by the gall-bladder, or tranſmitted into that viſcus through any other paſſage, but by the hepatic duct. If this view of the ſubject be, in any meaſure, juſt, it is a fact aſcertained, beyond the ſhadow of a doubt, that the black flaky ſubſtance of the vomit is an altered ſecretion from the liver. This matter, being ſecreted by the liver, and depoſited by the hepatic duct, in the gall-bladder, in the laſt hours of this diſeaſe, is from thence forced, by the contractions of the gall-bladder, and cyſtic duct, in conjunction with the violent action of vomiting into the ſtomach. It there receives the addition of the yellow-coloured fluid, which is almoſt always ejected with the flaky ſubſtance. That this fluid is combined with the flaky matter in the ſtomach, and not in the gall-bladder, every enquiry into the appearances, after death, fully confirm. This circumſtance renders the yellow-coloured fluid ſubject to ſome difference in its properties, according to the nature of the fluids received into the ſtomach a ſhort time before vomiting; but, all that I have had an opportunity of examining, have nearly the appearance we have already deſcribed. That the ſecretory œconomy of the liver may be ſo far arreſted in its healthy action, by the progreſs of diſeaſe, as to aſſimulate a fluid having not the leaſt analogy to bile, every work, on morbid diſſections, certainly prove. Lieutaud mentions a caſe from Rivalerius, in conſequence of a diſeaſed liver, where the fluid, in the

gall-bladder, reſembled milk; and Storke relates a caſe of a dropſy ſucceeding an intermitting fever, where the fluid, in the gall-bladder, reſembled the white of an egg. To theſe, I may add one, that came under my own obſervation, of a gentleman who died dropſical, in conſequence of an enlarged liver. The gall-bladder contained a fluid, of a dark-colour, having not the leaſt reſemblance to bile. Theſe, and many more caſes, could be adduced to prove the power of the liver, under certain circumſtances, to ſecrete a fluid diſſimilar to bile; but, it would be needleſs to recite them, as the inſtances already quoted, are, no doubt, ſufficient to eſtabliſh the fact. This peculiar condition of the ſecretory veſſels, in the yellow fever, is not confined ſolely to the liver; for, we find that other ſecretory functions are ſometimes affected in a ſimilar manner, during the ſame diſeaſe, and nearly at the ſame period of time. In confirmation of theſe obſervations, I believe moſt phyſicians muſt have remarked, that, in ſome caſes, the kidnies, during the period of black vomiting, ſecretes a fluid of a dark-colour, which has a thick pellicle on its ſurface, and appears almoſt as different from urine, as the black vomit does from bile. This diſcharge is frequently a precurſor to a ſymptom, which never fails to predict a ſpeedy diſſolution, viz. a paralyſis of the ſecretory functions of the kidnies.

The more I conſider the material change produced in the different ſecreting veſſels, during the laſt ſtage of this diſeaſe, the more this theory appears

to be ſupported by reaſon and the plauſibility of truth. But, though a morbid condition of the glandular œconomy of the liver may produce the coffee-ground coloured vomit, it does not ſeem probable that the black inſpiſſated mucus-matter which was ejected in the caſes that proved mortal in 1797, is derived from the ſame ſource; for, the liver, under no condition of diſeaſed action, that we are acquainted with, is capable of ſecreting mucus of ſuch an appearance; therefore, we think it moſt reaſonable to refer it to the ſurfaces, which are deſtined, in a ſtate of health, to ſecrete mucus. Now, admitting the axiom, "that ſimilar cauſes produce ſimilar effects, under ſimilar circumſtances," why may not the glandular ſtructure of the ſtomach be affected in a ſimilar manner to that of the liver and kidnies, ſo as to enable it to ſecrete the mucus-matter above-mentioned? This opinion, I think, may be affirmed by other analogies, not only in the ſthenic, but in the aſthenic condition of ſecreting ſurfaces, in which there are equally as great a deviation from healthy ſecretion as the one alluded to. This we have clearly exemplified in veſſels deſtined to ſecrete mucus in a ſtate of health; but, when labouring under inflammation, evidently ſecrete pus. Other caſes, of a ſimilar nature, might be adduced, to prove this power in ſecreting veſſels. But, it would be taking up the time of the ſociety to little purpoſe, to recite other inſtances to eſtabliſh a fact which appears to be already fully confirmed.

E N D.