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VI. *Observations on Pot-ash; being an Inquiry how far the mischievous Effects of Septic Acid are restrained by Pot-ash and other Alkalies, particularly in respect to the Effects of Septite of Pot-ash (Nitre or Saltpetre) upon Animal Flesh intended to be eaten, and upon the Human Stomach; in a Letter from Dr. Mitchill to Dr. Priestley, dated Plandome, May 4, 1799. Communicated by Dr. MITCHILL.*

ON a former occasion (2 Medical Repository, p. 236 *et seq.*) an attempt was made to shew that the *septic* acid, which is formed in certain putrefactive processes, was materially different in its constitution and qualities from the *nitrous* acid obtained by distillation from saltpetre. Since the composition of that piece, I have observed that Juncker, in his view of the doctrines of Beccher and Stahl, (2 Conspectus Chimie, p. 280,) is of the same opinion, declaring, that in whatever manner the work of separating it from the putrescent or other bodies with which it was naturally mingled, was undertaken, “*ne micula tamen acidi nitrosi purè sistitur,*” *not a particle of pure nitrous acid can be obtained.* And he warns his reader, that in the observations which he offers he means that *spirit of nitre ONLY* which is liberated from its connection with an alkaline salt. On the native septic acid, which is, as he allows, furnished so largely by the animal kingdom, (p. 277,) and is by far the most active and interesting form of oxygenated septon, Juncker, like most other writers, has said scarcely any thing at all.

The highly destructive effects of this offspring of putrefaction have been pointed out in detail in a former essay (1 Medical Repository, p. 39, 40), in which it was observed that certain substances, and among others pot-ash in particular, possessed a power to restrain and curb its ferocity. The neutral salt, formed by the union of this pestilential acid with the fixed alkali, is the saltpetre or nitre of the shops and of commerce. Concerning the medicinal and economical qualities of this substance, it is manifest to me that there are many mistakes yet prevalent: and they appear to be worthy of being pointed out and corrected.

The

The septite of pot-ash has been denominated a salt of many excellent qualities, a *sal polychrestus*; and a great physician once wished, for the good of his profession, there could be found *one* other remedy so certain and steady in curing diseases as nitre. It has likewise been termed an *antiphlogistic* remedy, good for all manner of inflammatory diseases with phlogistic density of the blood; possessing fine attenuating powers, being in nowise acrimonious; and happily calculated to withstand a putrescent state of the body. It has further been called a *refrigerant*, a *diuretic*, and a *carminative*, and employed accordingly by those prescribers who are influenced by the *nominal* efficacy of remedies.

Such are some of the superlative effects ascribed to this compound of the acid of pestilence and pot-ash: and for a considerable time after I became acquainted with the mischievous effects, wrought occasionally by the naked septic acid, I remained in the belief that the strongest of the alkalis could hold it fast, and keep it entirely harmless. It therefore did not appear to me improbable that the character of the compound of the two might, as in a multitude of other cases, be exceedingly different from that of either the constituent acid or alkali.

But latterly I have been inclined to the opinion, that pot-ash is capable of combination with oxygenated septon in different degrees; that is to say, septon, before combining with the alkali, may have been united to *more* or *less* of oxygen; and also septon, in any of its degrees of oxygenation, may be united with pot-ash in different proportions: in other words, the acid may *vary in its strength*, and likewise, on every degree of strength, may be united to the alkali *in various proportion*. The *nitrum nitratum*, described by the older chemists, is an example of pot-ash *super-saturated* with nitric acid, and, strange to tell! has been extolled for its advantageous operation in ardent fevers, accompanied with thirst and with a dry and foul tongue. I have strong reason to think that there is a disproportion between the acid and alkali in other forms of nitre; as I have known litmus-paper to be turned repeatedly reddish by a watery solution of salt-petre, the residue of a quantity which was swallowed by

mistake, and which nearly deprived a man of his life. A set of correct experiments is wanting to elucidate more completely this part of a very curious and highly important subject.

Be these things as they may, all experience shews that the connexion between septic acid and pot-ash is easy to dissolve; at least, a portion of oxygen separates very readily from the nitre. The experiment of reddening blood by mixing powdered saltpetre with it, was known to Hoffman, and, I think, fairly evinces a partial decomposition of the salt. It seems to have a similar operation upon the residue of that fluid in the flesh of slaughtered animals, and the reddening of the lean and fibrous part of meat is evidently owing to the oxygen attracted from the nitre.

But a heightening of colour is not the only effect which septic acid works upon provisions sprinkled with it. There are in many meats, especially of old animals, and of those which have been a long time salted, a *toughness* and *hardness* which render them difficult to be cut and to be chewed. The septic acid seems in some degree to be disjoined from the pot-ash, and evidently assists in decomposing, to a certain point, the vascular and fibrous structure of the meat. The quantity of nitre generally put on is small; was the proportion larger, the meat would be yet further disorganised, and be rendered more *short* and *tender*, almost even to *rottenness*. But the injurious effect of the nitre is prevented by the sea-salt commonly mingled with it, in the manner and upon the principle described in my "Observations on Soda." (2 Medical Repository, p. 292, *et seq.*) The use of saltpetre, then, in curing provisions, is to make them *reddish* and *tender*, and not to exercise an *antiseptic* and *hardening* power, as the muriate of soda does.

With all these considerations before me, I entertained great doubts of the truth of those fine things told over and again, and copied by one writer from another, about the mildness and wholesomeness of nitre, and of its wonderful effects as a calmer and soother of diseases. It seemed very strange to me, that the acid which before its union with pot-ash was capable of causing fevers, should be so suddenly transformed,

transformed, as, notwithstanding the laxity of their cohesion, to cure such diseases immediately afterwards.

While I was considering these things, a case fell under my observation, which allowed me fully to witness the operation of this boasted *cooler, carminative, and febrifuge*. It shews, beyond a doubt, that septic acid, though coerced by pot-ash, is in some degree septic acid still. Its native virulence does not even then wholly forsake it. Nitre ought to be ranked among the poisons; for, in a sufficient dose, it is truly a poison. Though it may be administered in small quantities without exciting terrible symptoms, it resembles in that respect most other venomous substances, which can be swallowed without detriment, and even often with advantage, when their dose is not too large. It is time for writers of Dispensatories, and on Materia Medica, to know the facts concerning nitre and its operation, and to publish them for the sake of undeceiving their readers. Too long has the medical world been the dupe of idle and partial opinions on this subject. Read the following accident, and judge of what I have said from the symptoms induced by swallowing septic acid of pot-ash or saltpetre:—

A carman, of middle age, had followed his business as usual on Saturday the 20th day of April 1799. On Sunday morning he determined to take a saline cathartic for an indisposition too trifling to require the advice of a physician. Accordingly his wife dissolved an ounce of what she believed to be sulphate of soda (Glauber's salt) in water, and gave it to him at a draught. He swallowed it. Soon after he was severely incommoded by what he termed "a great weakness about his heart." Nausea came on, and was followed by vomiting of the contents of the stomach, mixed with considerable quantities of blood at each time. His strength was exceedingly impaired: and a sensation of coldness over the whole body was remarked by him, particularly in the extremities. I did not see him until after the bloody vomiting had continued at times for several hours, and then his pulses at the wrist were very slow. He was however quite rational, and said he then felt much better than he had done. On examining what kind of salt he had taken, for some crystals of it remained in a wide-mouthed bottle, I found it to be septic

tite of pot-ash (saltpetre.) This was about eleven o'clock before noon, and he had taken it at six in the morning. As it had had no purgative effect, I ordered him some castor-oil, and almond milk sweetened with sugar, or some milk-whey, and some water-gruel.

In 35 Commentar. de Rebus, &c. p. 176, a case is mentioned of death from taking an ounce of nitre: and if a part of the quantity which this man took had not been vomited up, he probably would have died too. The ol. ricini purged him gently, and he gradually got better, but complained very much of weakness about the præcordia.

There are numerous other accidents not materially unlike these. Such occurrences give us no very favourable account of the benignity of nitre as a medicine. It is a pity that practisers of physic do not better understand the component parts of their prescriptions. How few know that, in administering nitre, their patients are made to swallow a portion of the nauseating and sickening acid of putrefaction!

Possibly these remarks may have a tendency to remove the doubt contained in your letter of April 11, 1799. You will hereby perceive that *my native acid of septon* is a combination of this basis with oxygen and water; whereas your *artificial acid of nitre* undergoes a partial decomposition by the heat of distillation, and is adulterated besides with whatever happens to be mingled with it during and after its combination with the vegetable fixed alkali. And both these forms of acid differ from atmospherical air; inasmuch as the former are *chemical* mixtures, the latter is *mechanical*.

It would be better for science if the word "nitre" was rejected altogether from use. *Nitria*, whence the term comes, was, you know, a district of ancient Egypt, famous for the quantity of mineral alkali which it afforded. (D'Anville's Geograph.—Egypt.) This saline substance has thence been called by the names *nitrum*, *nitre*, &c. In confirmation of which, I observe, in the Dictionary of Calepinus, printed at Basil in 1538, that what they called *nitrum* was a material employed to cleanse clothes, and wash the bodies which wore them. And S. Bochart remarks, (1 Opera. Chanan, L. II, cap. xiv.) that the ancients made a kind of ley from *ashes*,
soda,

soda, and *bole*, (*cinere, nitro, et cimoliâ,*) for more effectually clearing their bodies from nastiness when they bathed. I need not remark to you, that I employ the word “nitre,” not in its ancient, but modern sense.

It is highly desirable that some of our men, whose opinions have weight with the public, would peruse the work of Lancisi, physician to Pope Clement XI, on the noxious exhalations of marshes. (*De Nox. Palud. Effluviis.*) By the persevering and luminous researches of this great man, it was found, as long ago as the year 1716, that marsh-water, by simple distillation, (*Ibid.* Lib. II. c. xii.) manifested an *acid* quality; and that *calcareous* stones (*Ibid.* Lib. II. c. ii.) were better for paving the streets of cities than *siliceous* ones, because the *alkaline nature* of the former was adapted to imbibe the noxious moisture of the air, and sweeten the *acid salts* with which it abounded. Indeed, much of the matter detailed by the writers of our days on local sources of distempers, may be found better observed, and better stated, by Lancisi, than in their writings. By the by I observe he mentions the English philosopher Mayow, (*Ibid.* Lib. II. P. ii. cap. 2.)

If the philosopher of Rome had reasoned upon his own discovery, he could not have failed to draw the inference, that by *alkaline substances* might the HYDRA of pestilence be overcome.—As I have mentioned this monster, I shall pause a little to give you my opinion of the allegory among the ancients concerning her: and I attempt the explanation the more willingly, as I believe Lord Verulam has said nothing about it. The fable is this:—In Peloponnesus, between Mycenæ and Argos, there was a fen or marsh of some extent called Lerna. This muddy and stagnating pool was inhabited by Hydra, a horrible and devouring monster with several heads; some say seven, others nine, and others fifty. The malignity of her poison was such that a wound from an arrow dipped into it was instantly mortal. She made dreadful havoc among the people of the surrounding country, and devoured a great number of their sheep and other cattle. In obedience to the orders of the tyrant Eurystheus, Hercules went to fight this destructive and formidable creature. On his

his approach, a crab came forth to the assistance of Hydra. but Hercules crushed the crab, and afterwards slew Hydra. Of the heads of Hydra, it was reported, when one was cut off, two would sprout from the wound, unless prevented by the immediate application of fire. Hercules, availing himself of the aid of fire, succeeded in his undertaking. In the ninth figure of Montfaucon's 66th plate, there is a figure of Hercules with crabs near his feet, having, as the learned father curiously enough remarks, a relation to some mystery which he does not comprehend. (1 Antiquity explained, Art. Hercules, chap. ix.)

Now, it appears to me, this is an allegory expressive of the pestilential vapours emitted by the bog of Lerna, and of the means found by experience useful to drain off its stagnant water, and to clear the adjoining and surrounding morasses.

The word "hydra" is derived from ὑδρῶν, *water*. This fluid then, detained upon the marsh of Lerna, favoured occasionally the production of unwholesome exhalations. Such vapours, being at once invisible and injurious, were ascribed to some preternatural enemy or destructive monster; and being diffused, or wafted around the country, and oftentimes cutting off both man and beast, were fancied to be the effect of the supposed monster's poison. According to their extent and virulence was she reported to have fewer or more heads for preparing and inflicting this poison. The mere draining off the water, and leaving the mud and slime bare, was termed cutting off an head; and the increase of deleterious gases, in consequence of exposing such a naked surface, was aptly expressed by the sprouting forth of two in its place. By cauterising, or searing, was understood either the solar heat in drying the ground after the water was drained away, or the burning up of the trees, shrubs, and obstacles to free ventilation by ordinary combustion, or perhaps both. The crab, who was Hydra's ally, perhaps does not refer to the sun's place in the constellation Cancer, so much as to shew the frequent recurrence of the difficulties, and the superior strength and skill requisite to overcome them. In the whole allegory "Hercules" may be understood to mean "insuperable courage and industry." North America, at the close of the 18th

century, wants a Hercules. This interpretation is confirmed by another consideration, that the ancients had not only their *Hydra*, who lived in the water, but their *Cberfydra*, who remained after the marsh or fen was dried up. *Cberfydra*, being derived from the two words, *χερσος*, *land not fit for the plough*; and *υδρα*, *the monster of the fens*; will thus mean the venomous and sickly condition of the neighbouring atmosphere after the water was exhaled, and the ground at the same time not rendered arable thereby, typified by a poisonous serpent: and was thus expressive of the rage of pestilential effluvia, which sometimes, and under certain circumstances, continue in a virulent state, in dry weather, near their dried sources.

Hydra is seemingly mentioned by Virgil (*Æn.* vi. v. 576.) as a *fiction* or *poetical* animal. Bochart, however, with his usual prodigious erudition, appears desirous to make the whole story *literally* intelligible. (*Hierozoici pars poster. Lib. III. cap. xiii.*) But Lancisi, with a more clear and discriminating mind, perceives that important physical truths are concealed under this two-fold allegory, and shews how they are to be unriddled. (*De Nox. Palud. Effl. Lib. II. p. ii. cap. 3.*)—In considering these matters you will not fail to recollect that the classical writers, and others, use the word “*hydrus*” as well as “*hydra*,” and some of them apparently confound the two. The former noun of the masculine gender is probably the name of the *real* animal, the *water-snake*, the latter of the *imaginary* one.—But of this enough.

If pestilential matter, as I observed before, can be subdued by alkalies, then the formation of septite of pot-ash in the alimentary canal must be a very frequent and common process. It is universally agreed that pestilential matter may be taken into the stomach by swallowing; and no reasonable doubt can be entertained of its production within that organ, and other parts of the intestinal tube, from the corrupted remains of food. The whole tenor of prescription, as explained in my letter concerning the use of alkaline remedies in fevers, (*1 Medical Repof. p. 265.*) goes to shew that the offending cause is of an acid quality: and in its worst forms, I think the acid engendered has septon for its basis; since aliment,

containing this principle only, is capable of yielding that most noxious compound. When septic acid thus exists in the alimentary canal, and carbonates, tartrites, &c. of pot-ash, are taken down, the stronger acid is attracted, and a proportional quantity of nitre or saltpetre is formed. Thus, in abundance of cases, the practisers who are fond of prescribing septite of pot-ash might spare themselves the trouble, as that saline compound is, in certain cases, formed in the stomach and bowels in considerable quantity. What precise effect the *nitre so formed* has on the intestines, and on the constitution at large, deserves to be inquired into with great care; for I am not without apprehension that some of the sad symptoms, occasionally attendant on fevers, are modified by the septite of pot-ash formed within the belly.—I believe, however, I must now stop, and trouble you no further for the present than by assuring you, that I hope much from your aid in this inquiry, which you inform me you consider “as a happy train of discovery;” and that I am, very respectfully, yours,

SAM. L. MITCHILL.

To Dr. Priestley.

VII. *Description of a Mercurial Gazometer constructed by Mr. W. H. PEPYS jun. Communicated by the Author.*

THE difficulty attending the exhibition of acid and alkaline gases, was the first inducement to Priestley, Lavoisier, and others, to use mercury for such experiments; but the great expence and enormous weight of this fluid obliged many accurate and experienced chemists to relinquish them almost entirely, as there appeared no other likely means of succeeding but by its means and that of the exhausted receiver. A contrivance to lessen the quantity of mercury necessary for such experiments was therefore a desirable object; and by introducing the dome used by Mr. Watt in his hydraulic bellows, I have succeeded in constructing an apparatus in which both of the above-mentioned requisites are obtained at a comparatively small expence. As it is hardly possible