

An account of the preparation and use of the phosphorated soda : being an abstract of a paper on that subject, inserted in the Journal de physique for August 1788 / by George Pearson ... with considerable additions, by the author.

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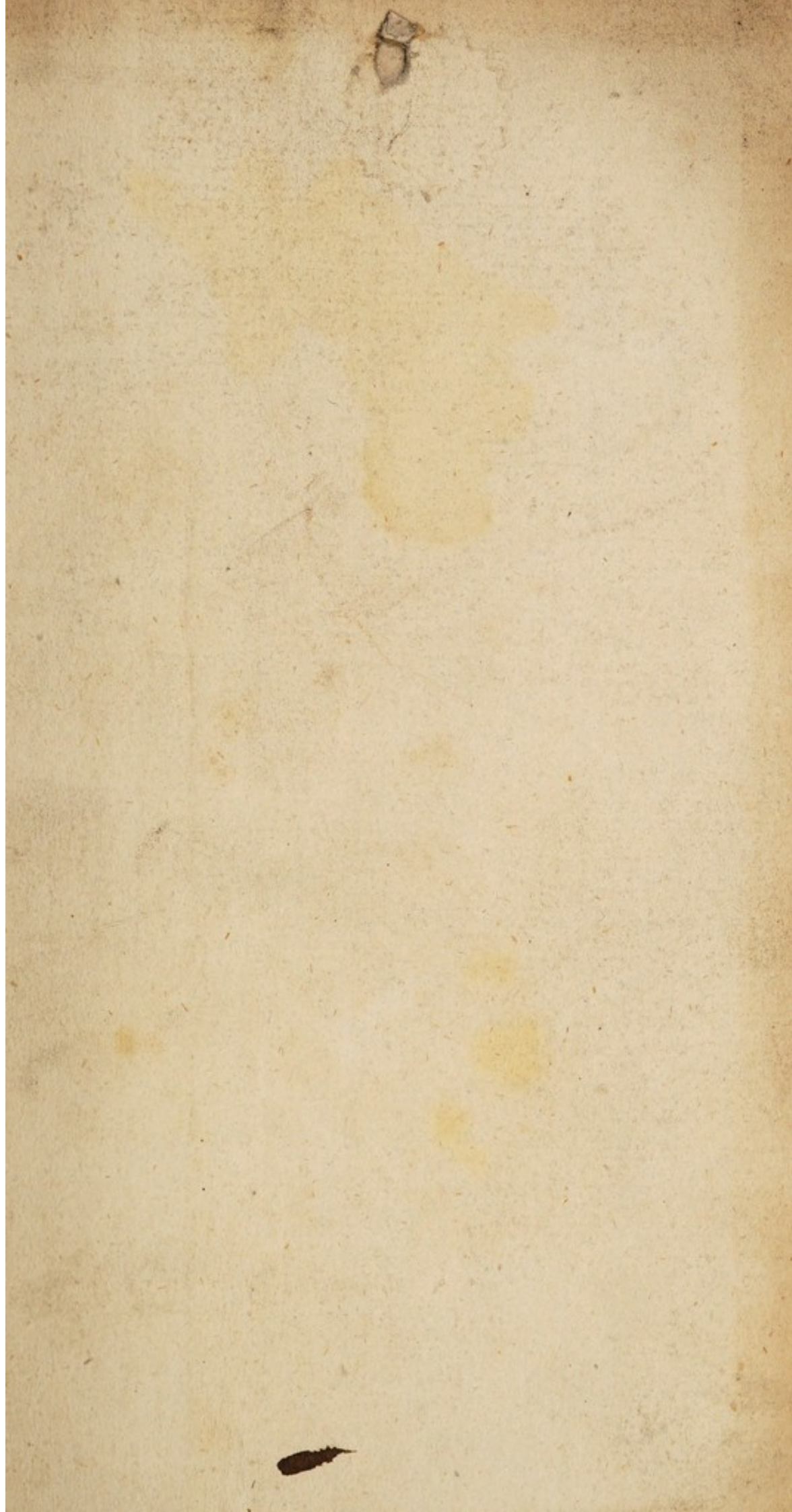
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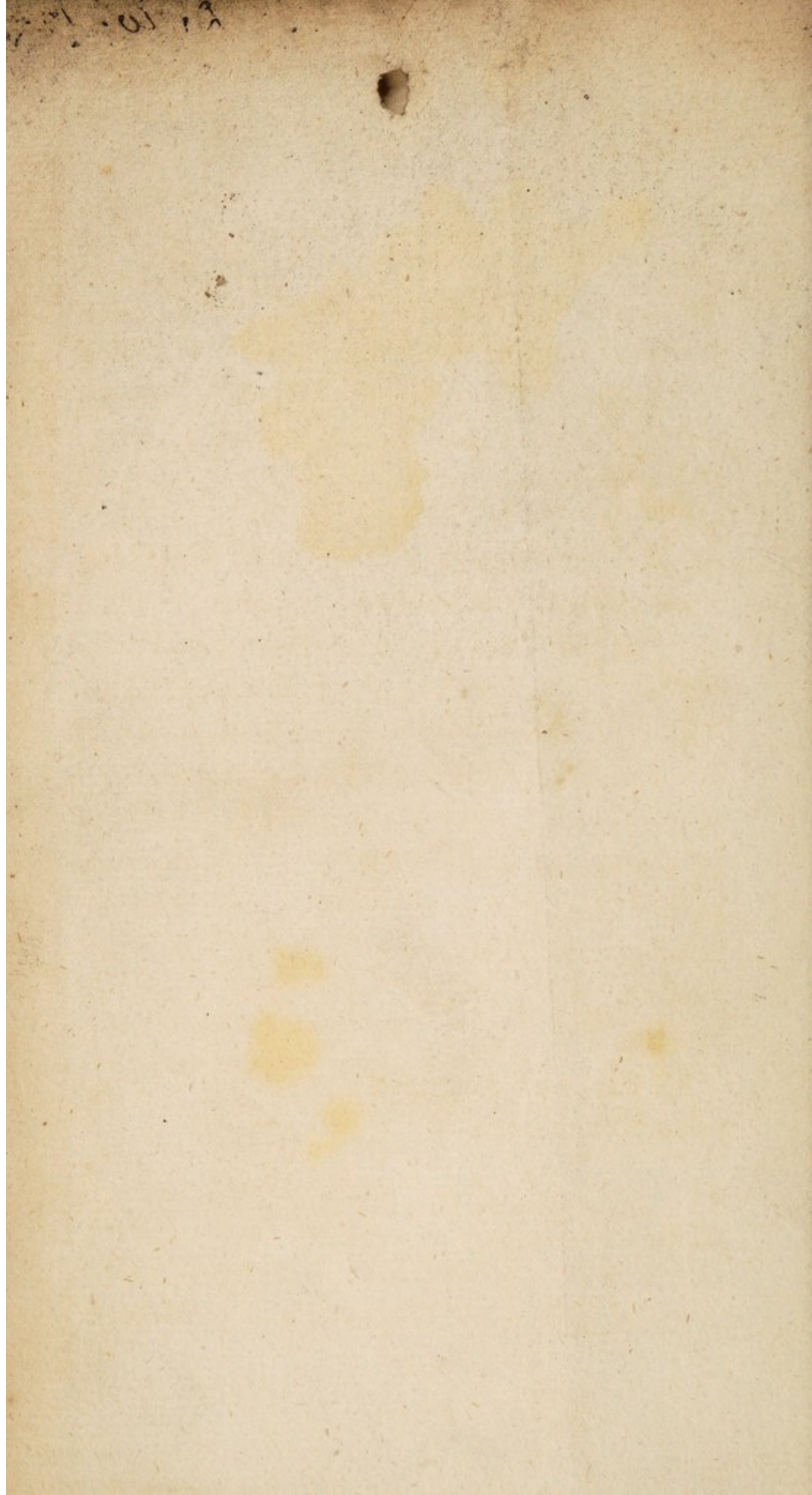
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An account of the preparation and use of the Phosphorated Soda ; being an abstract of a paper on that subject, inserted in the Journal de Physique for August 1788, by George Pearson, M. D. member of the college of physicians, physician to St. George's hospital, and lecturer on physic and chemistry in London, with considerable additions, by the author.*

THE new facts contained in this paper relate either to the chemical properties of this double salt, or to its use as a purgative.

It appears that M. Lavoisier united the acid of phosphorus with the fossil alkali, but without having succeeded in obtaining crystals from the combination. This compound, he says, was gummy, gluey, and of the consistence of turpentine, &c.

M. Fourcroy confirmed the result of M. Lavoisier's experiment.

* Extracted from the London Medical Journal, Vol. IX. part IV.

M. Sage differed from these two chemists in obtaining non-deliquescent crystals, by combining the acid of phosphorus with the fossil alkali, but the other properties or figure of these crystals he does not describe.

Mr. Klaproth relates that he composed a salt similar to the *sal mirabile perlatum* of Haupt, or the *sal fusibile*, with the base of natron of Rouelle, by combining this acid with the above alkali; the figure of which double salt, however, is totally different from the salt I composed of the same substances.

Lastly, Mr. Proust having made a lixivium of the salt for making phosphorus of urine, in order to obtain the fusible or microscomic salt, he procured parallelogramic crystals, which he concludes were composed of an acid analogous to the sedative salt that, united with the soda, forms the *sal fusibile* with the base of natron, whereas the microscomic salt is principally phosphorated volatile alkali. Professor Bergman adopted this opinion, and admitted this salt, supposed to be analogous to the boracic acid, as a particular acid, and gave it a place under the title of the *Perlate Acid*, in his tables of single elective attractions. M. de Morveau considered this substance in the same light, and called it,

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in his dictionary, *Acide Ouretique*. Afterwards this fusible salt, with the base of natron, was decomposed and shewn to consist, not of a peculiar acid, analogous to the sedative salt, but of the phosphoric acid and fossil alkali.

These were the facts already discovered concerning the phosphorated soda, when I made it the subject of investigation. The salt I composed, by the combination of the phosphoric acid with the sal soda, is evidently very different in most of its qualities from that combination made by the above chemists; and also different from the sal fusibile with the base of natron, of Rouelle, Proust, &c. and from the perlate salt of Haupt.

In order that other inquirers may account for the difference in the results of the experiments, I shall relate particularly the manner in which I composed the salt which is the subject of this paper.

1st. The phosphoric acid was procured by dephlogisticating phosphorus by the nitrous acid: Five hundred grains of phosphorus, added, in small quantities, successively, to three or four times that quantity of the nitrous acid, the specific gravity of which was 1.5 and diluted with distilled water, afforded, on evaporation, one ounce and two drachms measure, or about 1100

grains, in weight, of a transparent brown fluid, which had the unctuousity and consistence of oil of vitriol; its specific gravity was 1.80 to 1.87. Undoubtedly by this method the phosphoric acid is obtained in the greatest degree of purity, but the salt prepared with it must necessarily be very expensive, and it has been found, that the lixivium of the acid of bones evaporated to a due degree of specific gravity, will answer equally well; for then it contains little or no vitriolic selenites, and consequently no glauber's salt will be formed and mixed with the phosphorated soda. But attention should always be paid by the manufacturer to the figure of the crystals; and if he perceives any of the shape of glauber's salt, such crystals may easily be removed.

After procuring the phosphoric acid in the above way, I dissolved 1400 grains of crystallized soda (obtained by decomposing marine salt, with litharge, at Mr. Turner's manufactory) in about 2100 grains of distilled water, heated to 140 or 150° of Fahrenheit's Thermometer, to which solution I added, by degrees, 500 grains of the above acid of decomposed phosphorus, and the effervescence having ceased, and the mixture boiled a few minutes, I set it to stand in a shallow

low vessel, in a temperate heat of the air, and thus rhomboidal crystals formed at the bottom of the vessel, the quantity of which was from about 1450 to 1500 grains. After having, by repeated evaporations, obtained this weight of rhomboidal salt, a sediment or liquor remained which would not crystallize; this, when dry, weighed from 150 to 200 grains.

From the quantity of sal soda required to form the above weight of double salt, the manufacturer will readily calculate the expence of it; for that of the acid of bones is very well known. It is thought proper to make another observation in this place, of great consequence, viz. that great care must be taken to use pure sal soda, at least, that there be no vegetable alkali mixed with it; for in this case there is reason to believe, from specimens of it now in the market, that this double salt will contain the vegetable alkali, and on that account be rather disagreeable to the taste. It is not easy to perceive the contamination with the vegetable alkali, if the manufacturer uses the salt from barilla, even in its crystallized form; a portion of potash being so intimately mixed with the fossil alkali as not to be entirely separable by crystallization. We cannot be certain of

avoiding the mixture of the vegetable with the fossil alkali, if the barilla alkali be employed. Perhaps the only pure aerated fossil alkali in the market is that prepared by Mr. Turner, in his extremely ingenious process of decomposing sea-salt by litharge. It was with his fossil alkali that I prepared the phosphorated soda possessed of the qualities here described. This precaution with regard to the choice of the alkali, used in manufacturing this salt, seems particularly necessary, lest a most agreeable and useful medicine should be lost by the Public, in consequence of want of information, or motives of gain.

If 150 or 200 grains of the phosphoric acid more than the quantity above mentioned (viz. 500 grains) be added to 1400 grains of the sal soda, the only difference in the result will be, that the liquor remaining after the crystallization, is an acid, mucilaginous liquor, which reddens turnsole juice, &c. and with more fossil alkali forms phosphorated soda.

2dly. If, on the contrary, 100 or 200 grains of sal soda more than the above quantity (viz. 1400 grains) be added to the quantity of acid already mentioned (viz. 500 grains) the only difference in the issue of the experiment will be that the fluid remaining after the crystallization is

is completed, contains superabundant fossil alkali, which will form phosphorated soda, on the addition of more phosphoric acid.

3dly. Dissolve 100 grains of phosphorated soda in an equal quantity of boiling water, and add 5, 10, or 20 grains of acid of decomposed phosphorus as above described, and, on crystallization, phosphorated soda will be found in an acid liquor which will redden syrup of violets and turnsole, effervesce with aerated alkali, and shew no property indicating a chemical union between this acid and the double salt.

4thly. On adding, in different proportions, the sal soda to the phosphorated soda, I did not perceive any chemical union between them, but on crystallization a mixture of phosphorated soda in rhomboidal crystals, and of sal soda in differently figured masses.

These four observations appear to be decisive, that the phosphoric acid and sal soda unite together only in *one* proportion, by which the rhomboidal salt here treated of is formed; and that if the perlate salt of Haupt, and fusible salt of Rouelle and Proust, are composed of the phosphoric acid and fossil alkali, they cannot unite with a fresh quantity of fossil alkali; or, if they can unite with this alkali, it is an error to affirm, that they
consist

consist of the acid of phosphorus and fossil alkali. Mr. Klaproth's observation cannot be just, viz. that the phosphoric acid, added to the phosphorated soda, forms a compound which changes syrup of violets green; and that phosphoric acid, with excess of fossil alkali, composes the fusible salt, with the base of natron of Rouelle; and lastly, that the salt observed by Mr. Proust, supposed to be analogous to the boracic acid, might be produced by taking away the excess of soda in the fusible salt of Rouelle, by the addition of vinegar, or phosphoric acid.

The size of the rhomboidal crystals is various, according to the quantity of the ingredients, the quantity of water, and the temperature of the atmosphere. The largest and most exact rhombs form in warm weather in such a quantity of water as holds much of the salt in solution; for, at this cold season (December) the crystals are small and very imperfect. The manufacturer therefore, who wishes to prepare this salt in the neatest manner, should crystallize, in winter, in the heat of a stove, of about 90° .

The most perfect and regular crystals were about one inch in length, and three-fourths of an inch in breadth. They had six tetrahedral surfaces of a rhomboidal figure; the angles being measured

as exactly as possible with a goniometer*, were 60° and 120° .—the solid angles were equally 60° and 120° ; so that the extremity of the crystal presented a triehedral pyramid, the angles of which were 60° . This double salt has no alkaline taste, altho' it sometimes changes syrup of violets green; its flavor in water and mucilaginous liquids, as in broth and gruel, is that of common salt, without the least mixture of any nauseous or bitter taste. It effloresces very speedily in the heat of the hand, or in a dry and warm room; but its crystals are permanent in close vessels, or even in a cool and moist air. In its crystallized form it contains about $\frac{1}{6}$ its weight of solid water; so that less than half the weight of the deaquated salt will produce the same purgative effects as above twice its weight when crystallized.

From six to ten drachms of this rhomboidal salt operates as a cathartic, with not only as great mildness, but perhaps with less irritation than any other purgative. This dose, in a pint of gruel or broth, without any common salt, renders them agreeably salt. It serves the purpose

* An instrument, called also the anglometer, invented by M. Romé de Lisle.

of giving the flavor of common salt, and resembles it so much, that many patients have taken this purgative in these liquids without perceiving that they were not flavoured with sea-salt. This quantity of phosphorated soda in half a pint of gruel or beef tea, makes them unpleasantly salt, altho' not nauseous, to most people. Experience has shewn that in many cases, where the stomach was in so irritable a state that any other purgative salts would be immediately rejected by vomiting, or occasion intolerable nausea, the patients could retain, with little or no attending sickness, the phosphorated soda given in dilute solution, as in beef tea, barley water, &c.

It must be remembered, that this salt is very unpleasant exhibited with sugar, or in any distilled waters, *e. g.* mint, peppermint, &c. It is as disagreeable as common salt with any saccharine liquids, or distilled waters. But, like common salt, its taste is agreeable to almost all palates in any insipid, or mucilaginous liquid.

The phosphorated soda has been found particularly acceptable to habits that are naturally costive, or rendered so by opium and other medicines, for which state it is very disagreeable to take the purging salts in use ; and yet, the nature of their disorders, as in hectic cases, would not allow

allow any other kinds of laxatives. In such cases from three to six drachms in a pint of broth or gruel, in the course of a day, has removed their costiveness, without, at the same time, their palates being offended or stomach rendered uneasy.

The phosphorated soda is not so purgative as an equal weight of Rochelle salt; on account of the greater quantity of water which the former contains: nor perhaps is it in most constitutions quite so active as the glau-ber salt, in which there is also above $\frac{6}{10}$ solid water, but it is found that in doses of from six to ten or, at most, twelve drachms, it is generally a pretty considerable purgative.

In the present state of chemistry the phosphorated soda cannot be manufactured at nearly so little expence as the glauber salt, nor even as the Epsom salt; but it is a happy circumstance for the Public, that it is already prepared at a price not much higher* than the Rochelle salt, or soluble tartar; and this places an agreeable medicine within the compass of most patients, to whom palatableness is any great object.

* Mr. Willis offers the phosphorated soda for five shillings a pound.

The demand for this new salt has occasioned several manufacturers, besides Mr. Willis, to prepare it. The salt I have seen prepared by him, in the summer, was well crystallized, very neat, and apparently free from any extraneous substance; but altho' I have entire confidence in his fidelity, and the best opinion of his accuracy, yet I cannot help expressing a wish that he would employ (if he does not do so already) the fossil alkali, obtained by decomposing sea-salt or glauber salt, having, as already explained, reason to believe this article is liable to be contaminated by the mixture of the vegetable alkali always in the barilla. The composition of this salt, however, with the alkali of glauber or sea-salt must necessarily render it more expensive.

THE END.