ACIDUM HYDROCYANICUM, ACIDUM PRUSSICUM.

Hydrocyanic, or Prussic Acid.

In a paper laid before the Academy of Sciences in November, 1817, I made known the successful results which followed the employment of prussic acid in the treatment of diseases of the chest. Since that period this medicine has been used by a great number of medical men, not only in Europe, but in several towns of the United States of America. Every where the success has been the same; so that this formidable substance may now be considered as one of the most interesting remedies which we possess.

Scheele discovered the prussic acid in 1780; but he only obtained it mixed with a varied proportion of water. M. Gay-Lussac first procured it in a state of purity[a].

PHYSIOLOGICAL PROPERTIES.

This acid is liquid, transparent, and colourless, at the ordinary temperature. Its taste is

[a] *Annales de Chimie,* tom. lxvii. p. 128, and tom. xcv. p. 136.

at first cooling, but soon becomes acrid and irritating. It slightly reddens the tincture of turnsol, has a very powerful, and, it may be, deleterious, odour, which is only supportable when mixed with a very large quantity of air. It is then found to be the same as the odour of bitter almonds.

CHEMICAL PROPERTIES.

Prussic acid is very volatile; in fact, it boils at 26°.5 (79.7 Fah.) under a pressure of $0^m.76$ [b], and at 10° (50 Fah.) it sustains a column of mercury of $0^m.38$; still its congelation takes place at 15° (59 Fah.). Also, when a few drops are put on paper, the portion which

[b] $0^m.76$ probably means $\frac{76}{100}$ of a metre; if so, it is equal to 29.9 English inches, and $0^m.38 = 14.95$. With regard to the $0^m.38$ as the measure of a column of mercury, it may be useful to remark, that it is not uncommon to estimate the force of the expansion of all fluids at any temperature by the column of mercury which they will sustain. This is done by introducing into a Torricellian vacuum a small portion of the fluid to be examined, and applying heat thereto. The apparatus is a curved tube, with two pretty nearly equal legs, one of them being sealed, and the other open to the atmosphere. The force of the vapour is shewn by the depression of the mercury in the sealed leg, and its elevation in the other; the difference in the height of the two columns being the measure of it.—Tr.

almost immediately evaporates, produces enough cold to crystallize the rest. It is the only liquid which possesses this property.

Prussic acid is but little soluble in water; hence, when shaken with ten or twelve times its volume of that fluid, it again collects on the surface like the oils and the ethers. Alcohol easily dissolves it.

When left to itself in close vessels, it sometimes becomes decomposed in less than an hour. It rarely preserves its integrity for more than a fortnight.

MODE OF PREPARING THE PRUSSIC ACID.

Hydro-cyanic acid is obtained by digesting the crystallized deuto-cyanuret of mercury, in two-thirds of its weight of liquid and slightly fuming hydrochloric acid, in a tubulated retort, which communicates with a receiver containing fragments of chloruret of calcium and chalk, and which itself communicates with a much smaller receiver, destined to collect the product. These receivers must be surrounded by a mixture of ice and salt. After the deuto-cyanuret of mercury, and the acid have been successively put into the retort, a slight heat is to be applied; a little ebullition soon succeeds, arising in part from the evaporation of

the prussic acid, which is formed, and is condensed in the first receiver with a little hydrochloric acid and water. When the quantity of water becomes very sensible, the operation must be suspended, in order that the product already obtained may be purified; this is performed by isolating the first receiver from the retort, taking away the ice which surrounds it, and replacing the ice by water at 32 or 33 degrees (89.6 or 91.4 Fah.) Under these circumstances the hydro-cyanic acid passes alone into the smaller receiver; for the water and the hydrochloric acid, which were at first volatilized with it, are now retained in the first receiver; the water by the chloruret of calcium, and the hydrochloric acid by the lime.

[M. Gea Pessina, a pharmacien at Milan, has recommended the following process for obtaining the hydrocyanic acid from prussian blue of a uniform strength: —

Eighteen parts of the ferruginous prussiate of potass, are to be introduced in a state of fine powder into a tubulated glass retort, to which a small globular and tubulated receiver is adapted; whence a tube issues, which is dipped into a flask containing a small quantity of distilled water. A refrigerated mixture, of nine parts of concentrated sulphuric acid and twelve of water, is then poured into

the retort: the tubulure closed, and the whole left at rest for twelve hours: the globular receiver being surrounded with ice, and the neck of the retort constantly cooled with wet cloths: the materials are afterwards heated, and the heat kept up until the striæ which are observed in the neck of the retort during the operation become more rare, and until a blue matter is ready to pass into the receiver. The fire is then to be removed: the whole allowed to cool, and the contents poured into a proper vessel. According to M. Pessina, the hydrocyanic acid thus obtained has a strong and penetrating odour. Its s. g. is from 0.898 to 0.900 at the temperature of 13° or 14° Reaumur, (62° or 64° Fah.), and it possesses every property of the pure prussic acid.[c].]

ACTION ON ANIMALS.

One drop of pure prussic acid placed in the throat of the most vigorous dog makes it fall stone dead, after two or three deep and hurried inspirations.

The effects of placing a small quantity of the acid in the eye are similar and almost as sudden.

[c] [*Giorn. di Fisica*, August, 1822; and *Journal de Pharmacie*, 1823, p. 16.]

A drop of acid mixed with a few drops of alcohol, when injected into the jugular vein, kills the animal instantly, as if he had been struck by lightning.

Scarcely any traces of irritability can be found, a few moments after death, in the muscles of animals thus poisoned by prussic acid.

ACTION ON MAN IN A STATE OF HEALTH AND IN DISEASE.

Pure prussic acid produces the same effects on man as on animals. Even the vapour of it must be cautiously avoided; for, if breathed, it produces considerable pain in the chest, and a feeling of oppression, which often remains for several hours.

[We are told by Professor Orfila, that a professor of Vienna having prepared a pure and concentrated prussic acid, spread a certain quantity of it on his naked arm, and died a short time afterwards.]

When properly diluted, however, it has the effect of calming the increased irritability which resides in certain organs when in a state of disease.

Even when given in proper doses, if the intervals be too short, it will produce headache; and a species of vertigo, which goes off in a few minutes.

CASES IN WHICH IT MAY BE PRESCRIBED.

Properly diluted prussic acid may be given with success in all cases of augmented irritability of the pulmonary organs. Hence it is proper in the treatment of nervous and chronic coughs, of asthma, of hooping-cough, and in the palliative treatment of consumptions. Nay, numerous observations would seem to shew that it will cure this latter disease when not beyond its first degree. In England it has been used with success for that hectic cough which is sympathetic of an affection of another organ, and in dyspepsia. In Italy it has been found to calm the too great irritability of the uterus, even in cases of cancer, and to moderate the activity of the heart in almost all sthenic diseases.

MODE OF PRESCRIBING IT.

The medical properties of prussic acid, prepared according to Scheele's method, are not sufficiently determinate, on account of the arbitrary nature of the process. It is better, then, to use M. Gay-Lussac's acid, when properly diluted by adding six times its volume, or 8.5 times its weight, of distilled water. A mixture is formed, which I call *medicinal prussic acid.*

I commonly use the following forms: —

MISTURA ACIDI HYDROCYANICI.

Mixture of Prussic Acid.

(*Mélange pectoral.* MAGENDIE.)

Take of

Medicinal prussic acid, 1 gros (gr. 59.07 troy.)
Distilled water .... 1 pound (15 oz. 6 dr. 1 gr. troy.)
Pure sugar ..... 1½ ounce (11 dr. 10 gr. troy.)

Take a dessert-spoonful every morning and evening at bed-time. The dose may be gradually increased to six or eight spoonfuls in the twenty-four hours.

It is necessary to shake the mixture every time it is used, lest great inconvenience arise from the acid being accumulated on the surface.

POTIO ACIDI HYDROCYANICI.

Potion of Hydrocyanic Acid.

(*Potion Pectorale.* MAGENDIE.)

Take of

Infusion of ground ivy ....2 ounces (1 oz. 7 dr. 45 gr. troy.)
Medicinal prussic acid ..15 drops.
Syrup of marshmallows, 1 ounce (dr. 7.52 troy.)

A dessert-spoonful to be taken every nine hours, always shaking the bottle.

SYRUPUS ACIDI HYDROCYANICI.

Hydrocyanic Syrup.

Take of

Clarified syrup ····· 1 pound (15 oz. 6 dr. 1 gr. troy.)
Medicinal prussic acid·· 1 gros (gr. 59.07 troy.)

This syrup may be added to common pectoral mixtures, and be used as other syrups are [e].

[e] In this country Scheele's method of preparing prussic acid is used almost exclusively, and forms the preparation which is obtained from Apothecaries' Hall and other places. We shall, therefore, give this process below. The dose of this preparation is from ♏ij. to ♏viij. given in distilled water, or in almond emulsion. The Translator's doses, however, are regulated by a different rule. He thinks that the advantageous effects of prussic acid, as well as of other powerful remedies, as digitalis, can only be obtained by increasing the dose to the required amount, let that be what it may. But he dare not, with such views, entrust the rate of increase to the patient's discretion: he, therefore, gives nearly every dose himself, regulating the increase and the interval by the effect produced. He makes these observations here, because he is sure that powerful and valuable remedies like these have fallen into disuse, on account of the insufficient or evil effects which have followed a less methodical or cautious exhibition of them.

Scheele's Process, as given by Mr. Thomson, p. 23.—" Mix two ounces of prussian blue with six ounces of

[LOTIO ACIDI HYDROCYANICI.

Hydrocyanic Lotion.

Take of

Hydrocyanic acid	f. ʒiv.
Rectified spirit of wine ..	f. ℥j.
Distilled water	f. ℥xss.

This lotion has been used with the utmost benefit by Mr. A. T. Thomson in impetigo: it

red precipitate of mercury, and add six ounces of water: boil the mixture for some minutes, constantly agitating it, when the blue colour will disappear, and the mass assume a yellowish grey hue. Pour the whole on a filter, and wash the residuum with a little hot water, which is to be added to the filtered liquor. Pour this upon an ounce and a half of clean iron filings, and add three drachms of strong sulphuric acid. Shake this mixture well, and after the powder subsides, pour the fluid into a retort, and distil one-fourth part of it over into a well-luted receiver. This is the hydro-cyanic acid, containing an admixture of a little sulphuric acid, which is readily separated by means of barytic water. La Planche recommends $\frac{1}{6}$ only to be distilled over, and this to be rectified by means of a gentle fire over $\frac{1}{200}$ of carbonate of lime, drawing off afterwards, by means of a gentle fire, $\frac{3}{4}$ only of the whole, thus treated by a second distillation. The acid is obtained of a uniform strength by this method."

Other practitioners again prefer *laurel water*, made

completely allayed the distressing and intolerable itching and tingling with which the subjects of this severe affection are tormented, in two cases, where other external applications and the internal use of anodynes had been of no avail; the discharge was diminished by it and rendered milder: alterative doses of mercury, combined with sarsaparilla, formed the internal treatment[f]. Mr. Thomson has also found this ointment useful, in combination with small doses of oxymuriate of mercury, in *acne rosacea*, and several other cutaneous diseases.]

REMARKS ON PRUSSIC ACID.

It is not without reason that we have objected to the employment of *Scheele's prussic acid:* in fact, this acid is never constant in the proportion of the real acid and the water which it contains, if Scheele's process be followed

by distilling two drachms of fresh leaves chopped with four ounces of water, recommitting the distilled water twice afterwards on the same quantity of fresh leaves, and, making, ultimately, four ounces of the menstruum; of which, from ♏ xxx. to f. ʒj. every six hours, may be given until a sedative effect is produced.—Paris's *Pharmacologia*, vol. ii. p. 23.

[f] [*London Medical and Physical Journal*, February, 1822.]

in the making of it: this is owing to the difficulty which exists in uniting the same circumstances in each operation. If, in order to avoid this inconvenience, we wish to prepare the acid called *Scheele's*, with the pure acid of M. Gay-Lussac, by diluting the latter acid with water, what quantity must we add to it? M. Robiquet (*Journal de Pharmacie*, 1818) proposes to employ two parts of water to one of the pure acid. The acid of Scheele, thus prepared, is twice as strong as the acid which I have recommended, and is consequently attended with greater inconveniences in its employment. These inconveniences are made still greater by the incorrect manner in which M. Robiquet's process is detailed in the *Codex de Paris*. In this formulary it is recommended, quoting at the same time M. Robiquet's *Mémoire*, to dilute the prussic acid with an equal quantity of water. After describing this process, the same work gives the form for a syrup in which the prussic acid, thus prepared, enters in the proportion of one part to nine of simple syrup. The syrup, so prepared, can only be administered by drops[g]. Should, unfortunately, an ounce (7 dr. gr. 52.56 troy) be mixed in a potion, it would produce death.

Notwithstanding what we have just said

[g] Several serious accidents have followed the employment of this syrup of the new Codex.—M.

regarding the strength of the *prussic acid of Scheele*, prepared according to the *Codex*, and the process of M. Robiquet, the majority of physicians represent it as much weaker than my *medicinal prussic acid*, and sometimes order it in the proportion of more than *a gros* (gr. 59.97 troy) in a potion of four ounces (3. oz. 7 dr. 30 gr. troy) to be taken by spoonfuls. The *pharmaciens* of Paris are in general so much accustomed to see the *prussic acid of Scheele* enter in a large dose into medical prescriptions, that, in order to avoid accidents, they prepare this acid by diluting the prussic acid of Gay-Lussac with *forty parts* of water. This perfectly arbitrary quantity of water, permits them, at least, to fulfil, without danger, the orders which they receive, when, from the high dose of the acid, they observe that it is not my *medicinal acid* which the physician could have meant in his prescription.