Inaugural Dissertation

on

The History of Prussic Acid

comprising

Its Chemical, commercial History,

Its Physiological actions,

Its Topicalological History,

Its Therapeutic Influence.

By

John Mc Galloway

Candidate for
General Remarks. — This acid is by most toxicologists, considered a narcotic poison. By some, it is said to be both irritant, as well as narcotic; but owing to the rapidity of its action as a sedative, being so great, its irritant properties cannot be easily detected.

Chemical History. — It was discovered by Scheele, but was first obtained in the pure state by Gay-Lussac, and is known to chemists in two forms: as a pure acid and diluted with water and alcohol. The pure or anhydrous acid, may be obtained in a number of ways, but the best is to act on the ferrocyanide of potassium with diluted sulphuric acid. To prepare it, 15 parts of powdered ferrocyanide, are to be distilled at a gentle heat, with 9 parts of oil of nitric and 9, of water, mixed together, the product is to be received in a receiver, placed in a freezing mixture, and containing, 5 parts of chloride of calcium, in small lumps. It soon as a sufficient quantity of liquid has
distilled, to cover the chloride, the distillation is stopped, and the hydrocyanic acid, deprived of water, by the chloride of calcium, is, be decanted into a dry and well-stopped bottle. It may also be obtained by distilling, under like circumstances, cyanide of potassium, with the same acid. In both the methods above given, the acid is formed by the reaction of sulphuric acid on cyanide of potassium or its element. 

\[ K \cdot (NO_3)_2 + H_2SO_4 \rightarrow K_2SO_4 + H_2O \]

It may also be formed by passing a stream of (40) sulphuric acid hydrogen over bicyanide of mercury, gently heated in a tube.

It is also obtained for medical and chemical use, when animal matter is subjected to heat in contact with alkaline substances. Anhydrous hydrocyanic acid, i.e., a liquid, limpid and colourless, it possesses an acid pungent taste, which is accompanied with a sensation of acidity in the nostrils and back of the throat. The taste has been described by some, as that
This difference is very marked; the acid has no perfume, and the slight resemblance depends on the presence of the acid in the commercial oil. By hydrolysis of hydrogen, there is no resemblance in smell to hydrocyanic acid.
by others, bitter, (Perciva) When mixed with organic liquids it cannot be very distinct, excepting the dose be very large. The peculiar odour of this acid is a very characteristic and delicate test of its presence. When diffused it has a distant resemblance to that of bitter almonds, according to Dr. Christison; but Offiler says, the smell is similar to that of bitter almonds and imperceptible when no chemical reagent is capable of detecting it. The latter assertion is doubted by the former authority, as many persons have been known, nearly insensible to its odour, even when the sample was tolerably strong. It is a common impression that the odour of hydrocyanic acid and that of bitter almonds are very similar, if not the same. But, there is, however, a difference in them although all may not be able to perceive it. The only practical point requiring to be noticed is that the distinct odour of bitter almonds would probably be pronounced by many to
by others, bitter. (Perciv.) When mixed with organic liquids it cannot be very distinct, excepting the dose be very large. The peculiar odour of this acid is a very characteristic and delicate test of its presence. When diffused it has a distant resemblance to that of bitter almonds, according to Dr. Christison; but Affina says, the smell is similar to that of bitter almonds and perceptible when no chemical reagent is capable of detecting it. The latter assertion is doubted by the former authority, as many persons have been known, nearly insensible to its odour, even when the sample was tolerably strong. It is a common impression that the odour of hydrocyanic acid and that of bitter almonds are very similar, if not the same. But, there is, however, a difference in them although all may not be able to perceive it. The only practical point requiring to be noticed is, that the distinctly odour of bitter almonds, would probably be pronounced by many to
- This decomposition is quite uncertain. I have specimens 3, 4, and 5 years old, perfectly colorless. The last I had began to turn brown in two days. W. C.

- This is doubtfully. W. C.
indicate the presence of prussic acid, especially if there is any suspicion as to the mode of death; this is a point on which even the medical jurist may be deceived, and requires great caution before giving an opinion. In some persons it does not affect the olfactory nerves at all, but merely causes a sensation of constriction in the fauces. These facts may to a certain extent explain the differences in the statements when many have to give an opinion: but still it is much safer for several persons to make the experiment, than one or two.

Dry hydrocyanic acid at ordinary temperature decomposes spontaneously within a few hours, becoming brown. At 34° C. 0.6967 at 66°, at 59° it becomes a fibrous mass, in consequence of the presence of water, it boils at 80°, and freezes at 5°. Its vapour has a density of 0.9476. It is inflammable: a trace of (80°/40) sulphuric acid causes it to keep perfectly and in contact with the
This change is not caused by light, but depends on some common known cause. When the acid becomes brown at all, it must be thrown away, as the change cannot be stopped. If it remain colorless, it loses no strength, provided it be in a well-stopped bottle. W. G.
Strong mineral acids and water it is decomposed, being changed into amonia and formic acid: H₂SO₄ + 2NH₃ → H₂O + 2H₂N₂ + C₂H₂. Although properly considered an acid (possessing H), yet it only feebly reddens vegetable colours and does not neutralise the alkaline reaction of the bases with which it unites; it unites with water and alcohol.

The diluted acid, as discovered by Scheele in the one most commonly used and possesses the same appearance, taste and odour, as the pure anhydrous acid, but differs from it in being less volatile, not inflammable and if kept from the light, may be preserved for some time, without change, but if proper care should not be taken, owing to its volatility it becomes weak and undergoes decomposition, being deposited in brown flakes, if not protected from the light and from this circumstance, the commercial acid is, liable to be very variable as regards its strength.
The diluted acid may be prepared by simply diluting the anhydrous acid with the necessary proportion of water, adding, for example, 97 grains of water, to 3 of acid, to obtain an acid of 3 per cent. which is about the usual strength of the anhydrous acid; or to one part by weight of the dry acid, 33 1/3 parts of water, by weight are to be added; or to one volume of anhydrous acid, 33 1/3 volumes of water. But the preparation of the dry acid is a troublesome one; therefore it is more convenient to distill, 2 parts of ferrocyanide, with 1, of sulphuric acid and 2 of water to dryness in a chloride of calcium bath and condensing in a Liebig's apparatus, the receiver of which contains 2 parts more of water. But by this means we procure 4 1/2 parts of an acid not anhydrous and far too strong for use, containing about 15 to 20 p.c. of dry
acids. Its exact strength may be found, and it is reduced, to the standard strength, in the following easy manner.

Let 40 grains of the acid, or any convenient quantity, be weighed out and dropped into a counterpoised vessel, containing about 2 drachms of nitrate of silver, dissolved in 2 or 3 oz. of water. The whole of this will be converted into cyanide of silver, but we prove this by testing with a drop of nitrate of silver. The precipitate is then collected on a filter, well washed and dried on a weighed filter, when the increase in weight of the filter will give the weight of the cyanide of silver formed. The cyanide is formed thus: \( 4\text{Ag} + (\text{HgO, 18}) = \text{Ag}_2\text{Hg} + (\text{H}_2\text{O, 2H}_2\text{O}) \), so that 1 gr. of hydrogen cyanide acid = 2 gr. 23, produces 1 gr. of cyanide of silver = 13 gr. 54, or 1 grain.
of anhydrous acid, will yield at most exactly, 5.93% of cyanide of silver; for 24.154.54:1.4.94:60 that the weight of the cyanide of silver, divided by 5, will give the weight of the anhydrous acid present, accurately enough for practical purposes. We have used 70 grains of our dilute acid, the strength of which we wish to ascertain. Supposing, for example, that our filter weights, when empty, 90 grains and with the cyanide of silver dried at 212° till it ceases to lose weight, 100 grains. The difference of 10 grains is the weight of the cyanide of silver obtained from 70 grains of our acid. This, according to the rule above given, divided by 5, 16.9%. The weight of anhydrous acid contained in the 90 gr. is consequently combined with 54 of (80) water. Now if it be necessary to know the percentage of this acid we find it by the calculation,
70:16::100:x and \( x = \frac{16 \times 100}{70} = 22.85 \) so that the acid contains 22.85 pperc. of anhydrous acid. If, however, it should be necessary to reduce the acid to a standard strength, as for example that of 30 pere., the foregoing calculation is unnecessary and we can proceed as follows: Acid of 30 pere. contains 3 grm. of anhydrous acid and 97% of water, so that, to find how much water is to be added to 16 grm. of dry acid, 3:97::16:x and \( x = \frac{27 \times 16}{3} = 57.3 \) grm. of water, which is the necessary to add to 16 grm. of dry acid to reduce it to the same strength as the 70 grm. of acid contains already, with the 16 grm. of dry acid, 54 grm. of water. Consequently, we require only to add to these 70 grm. 57.3 - 54 = 4.3 grm. of water and the same proportion of water for every 70 grains of the same acid. This is a simple and exact method.
of preparing the medicinal acid and ascertaining its precise strength. For it is seldom that any of the other methods given, as when obtained by distillation, will yield twice the same result. The superiority of this method over all the others is, that you may prepare the acid of the same strength any number of times and be able to ascertain its strength once more to prevent mistakes in the calculation. Acid of 3% yielding 15 grains, of cyanide of silver from 100 of acid. The process of Clarke consists in adding to 1 eq. of cyanide of potassium, dissolved in water 2 eq. of Tartaric acid, which separates the potassium as cream of tartar, the diluted hydrocyanic acid remaining dissolved. For every 100 gr of water 7.5 gr of cyanide of potassium.
and 16% of crystallised Tartaric Acid are required. But this process has an objection to it, viz. that the cyanide of potassium does not keep well, being liable, at all events to a certain extent, to be decomposed even in its preparation. It is more over an expensive salt. There is another method, that of Everest, who suspends cyanide of silver in water and adds an equivalent of hydrochloric acid; AgCl + HCl = AgCl + H₂ by; 15 grs of cyanide of silver being necessary for every 100 of water and 4 grs. of any HCl or 12 grs. of acid, Sp. gr. 1.21 being added. The chief objection to this process is that it is difficult to add the exact amount of HCl, an excess causing the AgCl to be converted into formic acid and ammonia. Different specimens of the commercial acid procured by Dr. Taylor were found to contain from 1.3 to 6.5 grs. of strong acid. Two varieties are commonly
met with 1. The acetic acid of the London Pharmacopoeia containing about 2 p.c. (Phillips) 2. Schieele's acid, which contains from 4 to 5 p.c. The continental medicinal acids, either alcoholic or watery, vary from 1 to 50 p.c. which will perhaps by plain the many cases of poisoning occurring there. Over-estimation of samples from different druggists in London (apothecaries' Hall included) which were found to vary from 5 to 14 p.c., although the acid of Schieele was asked for. In short there seems little certainty of the strength of any two speci mens sold as Schieele's acid re quiring on the part of the practitioner, great caution when prescribing it in disease. The following may be taken as the percentage strength in acetic acid, of the different varieties of this acid. Brit. J. Med. in aqueous solution on the acc. 
Acid of Schrader and Prima.

Acid of Schröder & Dubin Pharm.

1.6 to 2.82 (Donovan), London Pharm.

2. improperly altered from that of

Vaugelieu. Acid of Gobel 3.5, Eidi.

Pharma 3.3, Vaugelieu and Giese


50. Among the alcohoic solutions

of the acid. Schrader 1.5, Bavarian

Pharma 4, Dufres 9, Pfaff 10, Keller

25, p.e.

The antidote to this acid when taken as

a poison, are not often of service owing
to the rapidity with which it acts, but

if symptoms of life remain, the follow-
ing may be used with great success.

The main object in this as well as in

other cases, ought to be, to render the

substance taken, incompatible.

In poisoning by Sibb. This may be ef-

fected by administering a mixed

dissolution of carbonate of the protoiodo-

and peroxide of Iron acid and one of car-

bonate of potash, as recommended

by Mr. Smith of Edinburgh, by
S. Taylor.

D. Traill.
means of which, the acid in the stomach is made insoluble, being changed into Prussian blue. We are further justified by experiments in using stimulants, such as diluted ammonia, to the nostrils, with friction of compound camphor liniment to the chest. Cold affusion as found in experiments on animals is a most efficacious mode of treatment and one capable of being easily and readily applied. Electricity, in the course of the spinal column, has also been proposed. Ammonia, diluted, taken internally is very useful. Chlorine is, a powerful antidote, first proposed in 1832, by Bianco, at Milan, water containing about 1/10 of its vol. of this gas may be most advantageously employed and inspired with out risk. In the experiments of Orfila, it was found that animals recovered in ten minutes, after in-haling the diluted chlorine in this manner. A solution of chloride of sodium with the addition of a
Dr. Beech.

Dr. Christiansen (Dr. Robinson's case)
Little hydrochloric acid may be given, when chlorine is not easily obtained. If there should be an inability to swallow, on the part of the patient, a handkerchief may be dipped in the liquid and applied to the nose. Pouring cold water impregnated with common salt and nitre on the occiput and spine, was found to assist in the recovery of some rabbits, which had taken large doses sufficient to cause death. Bleeding from the jugular vein has been found, in some experiments of D'Orsmanick and D'Consdale, of signal service in diminishing the turgescence of the heart by this effect to assist in the recovery of the animal. Magendie mentions a case of a young lady poisoned by too large a medicinal dose; she was treated with ammonia and section of the jugular vein and recovered. Summary of the antidotes, cold
affusion applied to the head and phine.
Inhalation of diluted ammonia and chlorine. Fenecetion at the jugular
vein and the administration of.
the mixed solution of sulphates
of the protopide and peropide of iron
and carbonate of potash, when med-
ical aid is immediately called in.

Tests.

Sulphate of copper. First prepared
by Cassaigne, along with that of nit-
rate of silver, forms, with hydrox-
amic acid, when rendered alkaline
with a little potash, a greenish pre-
cipitate, which becomes nearly white
on addition of a little hydrochloric
acid. The use of the (HCl) is, to redis-
solve some oxide of copper thrown
down by the potash. The precipitate
is then the cyanide of copper, which
will yield cyanogen when heated.
This will according to Cassaigne, act
on the poison when dissolved in
20,000 parts of water.
If (HCl) in solution is acted on successively
Dr. Gregory, since the quantity of H.G. is very small this test produces at first only a greenish blue on the liquid but on standing 2 1/2 hours Prussian blue is deposited.
W.G.
by protoperdulphate of iron, by potash, and by an excess of hydrochloric acid, Prussian blue is formed. The first two tests form the prussian blue, the last dissolving the excess of oxide of iron, brings the blue into view. It is very important to understand the distinction taken by Dr. Turner. The formation of Prussian blue (he observes) from hydrocyanic acid, by admixture with a salt of iron and potash, does not occur when the iron is strictly at its maximum of oxidation. A very minute quantity of the protopride, however, gives rise to the production of Prussian blue, which is rendered obvious by distilling the precipitated oxide by a slight wreck of sulphuric acid.

Nitrate of silver, this is a delicate and very characteristic test for hydrocyanic acid. A white cloud of cyanide of silver is formed in a very diluted solution, distinguishable from other white salts of
silver, by being insoluble in nitric acid at ordinary temperatures, but
at its boiling temperature soluble in that acid. The precipitate when
dried and heated emits cyanogen gas easily recognised by the colour of
its flame; it may be further proved to be cyanide of silver by its redissolv-
ing on adding a drop of caustic ammonia: the white cyanide is ex-
actly like the chloride in appearance.
In the employment of the nitrate of silver as a test for the vapour of the
poison, it is usual to place a few drops of the solution of nitrate of silver
in a watch glass, and insert it over another containing the suspected
fluid; an opaque white film of cyanide of silver in the solution is
directly produced, if the acid be only in a moderate state of concentration.
The drop of the medicinal acid (containing 5 to 6 grains) produces speedily
a visible effect. If the prussic acid be much diluted a few minutes are
austrian medical weekly publication

march 27, 1847. 396
necessary, the film begins to show itself at the edges of the silver solution, in the latter case the heat of the hand may accelerate the action. The iron test may be employed in the same manner as the nitrate of silver above described.

Baron Liebig's Sulphur test, for the detection of prussic acid as a liquid: If a small quantity of hydrodulphuric acid of ammonia (containing a little excess of sulphur) be added to a few drops of the solution of prussic acid and the mixture be gently warmed, it becomes colourless, and on evaporation leaves sulphoethylate of ammonia, the sulphoethylate of ammonia being indicated by the intense blood-red colour produced on adding to the residue a solution of a perusal of iron. This colour immediately disappears on adding one or two drops of a solution of corrosive sublimate. This is a delicate test, and some care is required in the application.
of it: Should the boiling and evaporation be not carried far enough, the per-
dalt of iron will be precipitated black by the undecomposed hydro-
sulphuret of ammonia and if the
heat be too prolonged, the sulphi-
uranate of ammonia may itself
undergo decomposition and conse-
quently be lost. An objection may
be made to this process on the score
of a longer time being necessary;
it's greatest utility is, as a test for
(to) in a state of vapour, being in
this respect better than any yet
discovered. The application of it
consists in placing the diluted
Berthelot's acid, in a watch glass and
inverting it over another, holding
in its centre one drop of hydro-
sulphuret of ammonia. No appar-
cut change takes place in the hy-
drosulphuret, but if the watch
glass be removed after the lapse of
3 or 5 minutes, according
to the strength and quantity of
Prussie acid present, sulphocyanate of ammonia will be obtained, on gently heating the drop of hydro-sulphurb, and evaporating to dryness if the acid be of from 3 to 5 per cent. 10 seconds are sufficient to complete the action. On the addition of 1 drop of per. sulphate of iron to the dried residue, the blood-red colour is instantly brought out, which is intense in proportion to the quantity of sulphocyanate present; the warmth of the hand may serve to expedite the evolution of the vapour, if the Prussie acid is excessively diluted. In detecting vapour the sulphur test-ach more rapidly and more delicately than the silver one, but they may be employed together in corroborating each other. If a suspected liquid, placed, in a watch glass, produce a film on a drop of nitrate of silver, the reaction will be very speedy with the hydro-sulphuric. The silver test-ach
Dr. Gregory's chemistry.

In Malaguti (S. Taylor)
visibly) and serves therefore as a guide. The sulphur test acts invisibly, there being no apparent change until the glass be left so long that the ammonia is spontaneously evaporated and the sulphur opacitated or deposited. Any liquid suspected to contain H₂S by ought first to be distilled with the addition of a little sulphuric acid and the test applied to the first ounce that comes over.

Substances containing hydrocyanic acid and owing their poisonous qualities to its presence in them.

Cyanide of Potassium (KC₅H₃). This substance is now much used in the arts, for electroplating and finishing. It is used as a medicine on the continent and has been known to act fatally when taken in large doses by mistake; less than 3 gr of the cyanide in solution has been known to kill a dog in a few minutes.
Janest January, 1843

(Deutsche Zeitung der P.A. 1843.)
(Annales d'Alg. 1843. 1. 404.)
and that the largest dose of this medicine to a human being is 2 oz. in
Cases of poisoning, from this substance, have taken place, in the human subject, at St. Malo, and Breslau; in the latter case 154\textsuperscript{2}
had been taken, by the man, which were prescribed for him by his medical attendant, death took place in a quarter of an hour. It is a solid, often crystallized, sometimes seen in the form of a white chalky looking powder; is known by the
odour of its solution in water, which is rendered more perceptible by acid by the action of nitrate of silver, which precipitates cyanide of silver soluble in excess of cyanide, and by tartaric acid or chloride of platinum which indicate the presence of potash. Pruss.
ian blue is formed by adding a solution of sulphate of iron and \( \text{H}_2\text{O} \).
Exposed in the air it absorbs oxygen and is converted into cyanate of potash.
\( \text{K}_2\text{O} + \text{O}_2 = \text{K}_2\text{O}_2 \), its solution, attracting
(Dr. Weitrum of Hammeln)

(Magendie's Formulary by D. Gully)
carbonic acid (CO₂) from the air, gives off hydrogen cyanide; and hence its smell. The hydrocyanate of ammonia, potash, are as poisonous as the original acid, as has been proved by the experiments of Brannon, Robiquet, Magendie and Schobart, but the ferrocyanates do not possess poisonous qualities. Sulpho-cyanic acid, acts with little energy on animals.

Sulpho-cyanate of potash is very energetic in its effects; 2 drapels of it dissolved in water killed a dog in pain. Hydrocyanic ether has the properties of the acid, but in a milder form. The injection of drops of it into the jugular vein, was quickly followed by phenomena as in that from hydrocyanic acid. We come next to those vegetable substances, containing elements which by combining with the hydrogen of water constitute the poisonous ingredient. First then of the Amygdalus communis (Bitter almonds)

When the almonds are pounded and taken
in sufficient quantity, prove highly de-
leterious, as has been shown by numer-
ous experiments; it was once used exten-
sively in medicine and is still much
employed by confectioners for flavour-
ing puddings etc. The bitter almond
depends for its activity on the essential
oil, common to all vegetable poisons,
of this class. According to the experi-
ments of Robiquet, Biot, and Liebig, the oil does not, like
common essential oils exist ready
formed in the almond, but is only
produced when the almond pulp
comes into contact with water;
nor can it be separated by any
process whatever, from the almond
without the aid of water, neither
by the action of ether, nor by the
action of absolute alcohol, nor by
pressing out the fixed oil. The
presence of (skew) in it is easily shown
by dissolving it with agitation in water
and treating the solution with car-
salic and followed by the mixed
(Sociologie générale ii. 1779)

Sulphates of iron and sulphuric acid
the essential oil of bitter almonds acts
evitably; the symptoms it produces
in animals are, trembling, weakness,
paraly, convulsions often of the tonic
kind and lastly coma; the animal
may recover by vomiting, which often
takes place before the other symptoms
commence; one drop produced death
in a cat when applied to the tongue,
in 5 minutes. While performing this
experiment Mr Brodie touched his ton-
gue with a probe that had been
 dipped in the oil, he immediately
experienced, a sensation of nausea
in the epigastric region and a weak-
ness of the limbs. According to Orfila,
30 almonds will kill a dog in 6 hours,
by being taken into the stomach and
the gullet be tied; and 6 drops will kill
it in 4 days if applied to a wound.
Two cases have occurred at Montpelier,
of children poisoned by eating bitter
almonds. A probable case of death from
eating bitter almonds is given by Mr
Kennedy in his "JOURNAL of the Medical Society of London," relates a fatal case of poisoning with it. There is one which occurred to Mr. Chavasse of Birmingham, where 300 of "almond flavour" was swallowed by mistake, producing alarming symptoms, but the person ultimately recovered. Dr. Hall of Hereford mentions a case where 17 drops destroyed the life of a woman aged 40 years, in half an hour. The morbid appearances are the same as from prussic acid. The vapour of oil of bitter almonds may produce vertigo, oppression, but unless long respired, not likely to cause death. This oil, often called peach-nut oil, has a pale yellow colour and a strong odour of bitter almonds, by which it may be at once known. It gives a greasy stain when dropped on paper not wholly disappearing on application of heat. It dissolves in water and readily combines with alcohol.

Amygdalus Persica: The kernels of the peach are often distilled for the
surface of imregnating Eau deNegue and if it contains too much of the oil it may prove serious; fatal cases are said to have occurred in England from swallowing a quantity of this liquor. Two cases of poisoning with the peach-blossoms are quoted from Bouillon: the symptoms were violent purging, convulsions and stupor, but these are rather the symptoms of a narcotic-acid. A case of suicide with the oil happened in England in Dec. 1831. It is mentioned in the same Journal vol. xliv. p. 229 that Mep. O. Henry and Boutron-Charlard have made a chemical analysis of the juice of the bitter yucca and came to the conclusion that its poisonous principle is identical with hydrocyanic acid. Henry has detected the same in the Jatropha manihot.

Prunus lauro-cerasus (Cherry-laurel)

It was Schrader, an apothecary at Berlin, who first discovered that prussic acid is contained in agua-

(S. R. New?)
laurocerasi and the distilled water of the flowers of the peach-tree, as well as in the infusion of bitter almonds. It has been proved, by many experimenters, that the distilled water of this plant is poisonous. In the list, one finds according to Orfila the name of Maddon, Mortimer, Brown, Langfeld, Nicholls, Seruzelius, Weber, Watson, Vater, Pattray, Abbé Razier, Duhault, and Fontana, also Robiquet and Vadde. Nearly all the parts of the plant are poisonous, with exception of the pulp of the cherry, which is not. Age also affects the amount of oil contained in the leaves, being most abundant at the earlier periods of the plant's existence. The symptoms are, when applied (the distilled water) to wounds to animals, vomiting, convulsions, great prostration of strength, clonic sensibility and death. The convulsions are more violent, accompanied by the foregoing symptoms and tetanus of the extremities, when in
(Philosophical Transactions 1817, p.84)

(Sodero, u. D. Beck) 1819.
jected into the stomach and rectum; but it acts most rapidly when injected into the jugular vein. Some cases are on record of its effects on the human subject, one in Dublin in 1728 when several persons died from drinking of this water; others mentioned by Jodère, at Turin, 1784. And he also gives a case of several children at a boarding school having nearly lost their lives from partaking of some custard which had been flavoured with the leaves of the cherry laurel. It was also used in the well-known case of Sir J. Throgmorton of Warwick in 1780, who was poisoned by Captain Donellan; it was at Donellan's trial that the celebrated John Hunter was summoned as a witness, perhaps the only time when that distinguished man appeared before a court to testify on a case of poisoning. Cherry laurel oil is probably not so powerful a poison as the oil of bitter almonds.
(Journal de Pharmacie vol. 29 p. 514.)

S. Christian

Barton’s Materia Medica, Part I. p. 11; Part II. p. 23.

Dr. Beck
*Prunus padus.* Hydrocyanic acid exists in the essential oil of this plant to the extent of 9.25 p.c. according to Schrader and its distilled water as likewise the essential oil, are poisonous to animals and even its fruit is injurious to them. Leicester asserts that this oil is identical with the oil of bitter almonds. In the kernels as in the bitter almond, the essential oil is not readily formed, but is developed only when in contact with water. Dr. Procter detected (they in its bath of water of Centreville, Ohio) remarked that in 1834, a number of cases of child new, who had eaten freely of wild cherries, being seized with vomiting, hyperdilated and insensible pupil, loss of strength, pulse small and frequent, pale skin, clenched jaws, inability to speak and cold extremities, they recovered under treatment with, aqua ammonica, digitalis to stomach and extremities, injections of Epsom salts and featherties.
*Prunus virginiana* (Black cherry trees). The infusion of its bark or cider has been found poisonous to some persons.

*Prunus baroliniana* (Wild orange). The leaves of this plant, in the spring of the year, have been known to poison cattle which had eaten freely of them.

**Physiological Actions**

Several physiologists have experimented on animals with hydrocyanic acid. Those of Wagner with the concentrated acid are considered the best. He found that if one drop be put into the throat of a dog, the animal after making two or three deep, rapid respirations, instantly drops down dead; he ascertained also that if dropped under the eyes, it causes death almost as quickly; and that when injected into the jugular vein, the animal is instantly killed.
(Annales de Chimie et de Phys. VII, 347)

M. Christison,
or lightning). His experiments were
repeated by Dr. Christison, with the
view of ascertaining the exact time
when the poison begins to act, and
the shortest period in which it proves
fatal. It was found that a single
drop, weighing scarcely 3 of a grain
dropped into the mouth of a rabbit,
was fatal in 83 seconds and began
to act in 63 seconds; that 3 drops
weighing ½ of a grain vii.ighman
never killed a strong cat in 30 se-
conds and began to act in 10
seconds; that 4 drops weighing
a grain and one fifth, did not
affect a rabbit for 20 sec., but killed
it in 10 seconds more, and that 25
grains equal to an ounce and a
half of medicinal acid began to
act on a rabbit as soon as it was
poured into its mouth and kil-
led it in 10 seconds at the most.
Three drops projected into the eye
acted on a cat in 20 seconds and
killed it in 20 seconds more; and the
(Edinburgh Med. Surg. Journal i. 50)

(Proc. Trans. N.S. 3. p 75.)
same quantity dropped on a fresh
wound in the larynx acted in 45
and proved fatal in 105 seconds.
Dr. Loudale is treating on this
subject days that a drachm of
Scheele's acid, would affect an or
ninary adult within the minute.
and if the dose were 3 or 4 drachms
it would show its influence in
10 or 15 seconds. Dr. A. J. Thompson
days that he has seen the concen-
trated acid kill a powerful dog
in 3 seconds. It has been found by Mr.
Bunney, that in some instances, the
poison was so active, as to prevent any
exhibition of voluntary motion, but
in the majority of dogs, about 20 sec.
passed before any symptoms were
manifested. It is alleged, however, by
W. Blake that all the accounts, repre-
denting the action of the acid to con-
mence earlier than 10 seconds, are ex-
aggerated, as he could never find it
act more quickly even when 30
minims of concentrated acid were
at once injected into the femoral vein. But the experiments of Dr. Christison made for the express purpose of ascertaining the shortest interval, render his observation of little value. Dr. Bereche gave a teaspoonful of concentrated acid to a doe, which produced symptoms instantaneously and in 3 seconds the animal was dead. And Mr. Mascoulay of Leith, found that a dog was killed in 3 seconds. In one case, where a man was found, seated on a water closet, dead and the bottle from which he had taken the prussic acid, was found in his pocket, latched. And in the case reported by Mr. Gunnelley, the man was able to speak nationally and answer a question after having swallowed a fatal dose. The case of a servant girl is related who swallowed a small glass of an alcoholic solution, which had been carelessly left in her way, and fell dead
at the expiration of two minutes, as if struck with a fit of apoplexy. In the case of the Pennsylvania epileptics, where \( \frac{3}{2} \text{oz} \) was the dose, by the time it had been given to the seventh, the first died, and the death of the others took place in 10 minutes afterwards. From these facts, and numbers of others on record, it would seem that although insensibility may come on from a large dose of this poison, in a few days, yet the individual sometimes possesses the power of performing various actions, i.e., seizing, consciousness, volition, and locomotion. As to the important question, how much may be necessary to destroy life?, one fact ascertained must not be forgotten, namely, that beyond a certain dose the weak and strong acid seem to act with the same rapidity. There is a case reported by Mr. Nick's, where a healthy adult...
female, swallowed a dose equal to 
20 of a grain of dry acid and died 
in 30 minutes. In another case, a 
healthy man took the same quan-
dity and remained insensible for 
4 hours, after which vomiting 
began and he ultimately recov-
ered. There was no odour in the 
matters vomited. In the case re-
ported by Dr. Banks, the female 
swallowed 30 drops of prussic acid 
and recovered; the strength of the 
acid was not known. In the one 
mentioned by Mr. Bishop, 40 min-
of an acid at 34, being equi-
valent to about 1/3 of a grain of dry 
acid, the man after exhibiting 
various symptoms of poisoning 
recovered in a short time from the 
application of proper remedies. 
Dr. Taylor thinks that a quantity 
of Scheele’s at 5F (above 20 drops) or 
one grain of anhydrous acid, or an 
equivalent quantity of any other acid, 
would be sufficient to destroy the life
of an adult person. If the individual survive 40 minutes, he will commonly recover.

The symptoms of poisoning by hydrocyanic acid, as given by various authors, insensibly the eyes appear fixed and glistening, the pupils dilated and unaffected by light, the limbs flaccid, the skin cold and covered with a clammy sweat, convulsive twitching, gasping respiration, and at long intervals, the act of expiration remarkably deep and lasting for a long time, sometimes the respiration ceased altogether for a few seconds; distortion of the mouth and appearance of apoplexy; convulsions and coma, imperceptible pulse and occasional in voluntary stools. In a case mentioned by Simon, on which occasion an oz had been taken, the symptoms were as above given besides coldness of the hands and feet and absence of pulse, and if the time had been large the breath has a strong odour of the acid; the nails of the fingers are some dines of a livid colour, with the hands tightly clenched. If the acid is weak it only a small
(Annales de Chimie vol II p. 59)


(See, cases of Mr. French, Mr. Weeks & Co. of Mr. Taylor)

(S. Christie, M.)
quantity of it taken, between 20 or 30 drops. The symptoms are often slow in appearing, although in some experiments made, the diluted acid of Vaucoullieux, 32 gr of which contain one of pure acid, began to operate in 15 seconds, and terminated fatally in 25 more. Hydrocyanic acid acts most energetically in the form of vapour, as shown by the experiment of M. Robert. Breathing this substance, when diffused in the state of vapour through his laboratory, caused ui & Other, oppression, painful respiration, giddiness, vertigo, burning heat. Vomiting has accompanied the other symptoms, but foaming at the mouth is more frequently observed; the former is often the forerunner of recovery. It is now generally agreed that persons poisoned by this acid, do not, as the last act of respiration utter a shriek or scream, although it has been stated that such was the case. If the concentrated acid has been used, death of course is very speedy, preceded by laborious breathing, convulsive movements of the upper & lower extremities; in dogs it terminated in violent useless convulsions & emphysema. After death the
eyes are glistening as in poisoning from carbonic acid, the extremities are often composed and the abdomen drawn in.

Poisoning by Opium contrasted with that by Hydrocyanic acid. — The following general differences exist when we compare the effects of these two poisons. In both you find coma, but in the case of opium it comes on gradually to perhaps not earlier than fifteen minutes, while in that of prussic acid, it is instantaneous; seldom delayed beyond two minutes. If the acid has been given in weak doses.

Then in poisoning by Opium the pupils are contracted, if by prussic acid they are generally dilated. Convulsions are more frequent in poisoning by prussic acid than by Opium; no remission or intermission of the cerebral symptoms take place in poisoning by Hydrocyanic acid, but they are well marked in the case of Opium. A difference also exists as to the time at which death may take place, from poisoning by these substances; in the case of prussic acid it takes place generally in less than an hour; while in that of Opium, the average period
of fatal termination, is from 6 to 12 hours. And as a well marked symptom when it exists, there is a smell of the acid about the mouth. It has been supposed that the after-symptoms might be mistaken for those of opium, but then there is the history of the case, with the odour of the breath, which would assist us in forming a diagnosis.

Topical History:--Post-mortem appearance. The odour of the acid is often exhaled from the body (particularly from the breath in recent cases). Its absence may be caused 1. by exposure to the open air or rain; 2. from the quantity taken having been small; 3. its removal by absorption or elimination, when but a small clue has been taken; 4. its dilution with other liquids and from being concealed by odorous bodies taken along with it. In one case where the dose was large, e.g., the
Body was examined 28 hours after death took place; the odour of the acid was so powerful, when the stomach was opened, as to cause the inspectors to feel giddy and obliged them to leave the apartment quickly, therefore it is necessary to be very cautious in conducting such examinations. When death has been speedy, the knife large & the examination taking place a short time afterwards, all the cavities of the body as well as the blood have the odour of the acid. The post mortem indications are not very well marked, the body is generally found laid in appearance of the skin, of a violet colour, the nails coloured blue, fingers clenched and the toes contracted, with foam about the mouth, the face swollen & bloated, and the jaws tightly closed, the eyes have been noticed to look glazy, prominent & glistening, but these latter symptoms after death from other causes. The brain is generally found natural, sometimes its vessels are turgid & once an extravasation of blood was found by Schubarth, between its
membranes, in the horse. The heart & great vessels are distended with dark-coloured blood, generally fluid & sometimes evacuated. The lungs also are often found congested, sometimes they are of a pale colour. The stomach and intestines have been found congested & inflamed, the former presenting in some cases a reddened appearance, as is found from poisoning by arsenic. If it was empty at the time the poison was taken, the viscera was found much contracted & of a brick-red colour. This redness was noticed in the stomachs of the Parisian epileptics & in a case mentioned by Dr. Cooghegan of Dublin. The blood was found by Welker, in one case, by a microscopic examination to contain no fibrin. The bile was often a dark blue hue. According to Hydriacoholic purgative to effectually exhaust the irritability of the heart & voluntary muscles, as to render them insensible to the action of galvanism, but the diluted acid has not always this effect. Cullen & Mr. Blake, however, state that this effect does not always take place.
And Schwabarth says that the heart is never contractile, although the voluntary muscles of intestines, still possess contractility. Dr. Loudon from his experiments, has been led to conclude that, the heart is not perceptibly influenced by the diluted acid, but that the pure acid infeebles it, if introduced into the stomach & arrests its action; if injected into the trachea. It has been shown by the experiments of Boullon & Krivner, that it is through the serous membranes next upon the stomach that the diluted acid acts most powerfully; it acts upon cellular tissue. When applied to the trunks and ends of nerves or to a fissure made in the brain or spinal cord, it produces no effect. Or if the distribution of blood to a part be cut off, by tying the vessel, before the part is touched with the acid, its action is prevented; but the same thing does not take place if the nerves only are divided. Yet it would seem improbable from the many experiments made by
(vide case of West and Taylor.)

Chevalier Annales d'Hygiène Publique 18...

X. 337
Various observers have stated (Boyer) must first enter to mix with the blood before producing its effects. It has been proved by the experiments of Wedeneyser that (Boyer), acts upon the spinal cord independently of its action on the brain; it acts on the brain also as shown by the coma produced. This acid affects all animals equally, all suffer nearly in the same manner. From the observations of Mr. Bichuert it would appear as if it could affect the system even through the sound integument.

Detection of the poison when mixed with animal matters. As proposed by Lad, Designe & Leuret, they found that if the body of an animal poisoned by this acid be left unburied for 3 days, it cannot be detected either from volatilization or decomposition but if buried within 24 hours the poison may be found after a longer interval but never after 8 days. In one case mentioned, distinct proof of the presence of the poison was obtained 7 days after death although the body had not been buried.
(Annales d'Hygiène, vol 14, p. 422)

(Lanceet N.S. Vol 7, p. 816)

(Aaaales, vol 1, p. 493)
A case, in which Lassaigne could not be tested, the acid after 38 hours is given by Leveuf. For the detection of (Hb) in mixed fluids, Lassaigne advises that a piece of towed paper moistened with caustic potash, be dipped in the mixed fluids. The paper should then be touched with a solution of the sulphate of iron & if any (Hb) is present, the usual blue colour, with a tinge of green, will appear & becoming more blue by exposure Purified animal charcoal alone, without heat, will sometimes destroy the color of the fluid & permit it to be tested by the reagents previously spoken of. If neither of these modes should succeed, the fluid should then be distilled. De Chastelain recommends that the filtered contents be previously neutralised with sulphuric acid, if they are alkaline, so as to fix the ammonia which may have been eluted, gaged by putrefaction & then distill the product slowly from a vapour bath, till an x part has passed over it into the receiver. The distilled fluid ought then to be tested with the protosulphate of iron. An
This is very doubtful. If the head has not exceeded 212° and water be left in the retort, any Hg occluded must have come from the acid itself or from a cyanide.
objection has been made to the last process, viz., that, (Asby) may be formed during the distillation, by the decomposition of animal matter. Undoubtedly in some instances it appears to have been thus generated; but in the present state of our knowledge all that can be done to avoid this occurrence is to lessen the heat of the bath too much. Asby asserts that from hydrochloric syrup only 3 of the acid can be distilled over, to caution the analyst against estimating quantity by such means. There is a process proposed by Mr. Atwood Kenyon to condense the acid in distillation, by which it is obtained in the form of cyanide of氢。But this is rendered unnecessary by using a good refrigeratory; no difficulty will be found in condensing every particle of the acid with no other aid than cold water. It has been ascertained that (Asby) is formed in the course of the story of putrid cheese; it has been supposed to exist in spurned rye by Robert. It denied by Wiggers who supplied more definite information on the subject, besides it
Pretence would not account for the peculiar effects of Ergot.

Detection of Prussic acid in the tissues.
As a proof how far prussic acid is absorbed into the system, it is only necessary to state that it has been detected in the blood, urinations, or any of the soft organs by placing them in a bottle, to the wide mouth of which a watch glass has been previously fitted as a cover & the liquid allowed to approach to within one or two inches of the concave surface of the glass. The solution of nitrate of silver is then to be used as a trial test. If the two of a grain of Prussic acid be present, & not too much diluted, it will be detected at 60° by the drop of nitrate of silver, being converted into an opaque white film of cyanide of silver, the chemical change being first noticed at the margin; after which the hydro sulplphuret of ammonium may be substituted for the nitrate of silver & proceed as before described. By this process (they may be detected in a tissue even after it had been well washed & exposed to a current of water.
Therapeutic influence. - The symptoms most apt to be induced by too large a medicinal dose are, nausea, salivation, hurried pulse, weight of pain in the head, followed by a feeling of anxiety lasting about 6 hours. During its medicinal use, a peculiar sensation on the back of the throat, sluggishness of the tongue, salivation, ulceration of the mouth are sometimes observed. It is not considered that pity is a cumulative poison, i.e. liable, from continued use of small doses to be gradually and silently accumulated in the system to then break out suddenly, with violence and danger to the patient, the case however is on record, when it would be seen that the very reverse took place, published by Dr. Baumgartner of Freiburg: The medicine, 10 drops of bittern acid daily, including one grain, was taken for 2 months, with and producing any toxicological effect, until the man was suddenly seized with symptoms of poisoning, one morning and after various remedial measures were resorted to, he recovered; this case
however is looked upon, with some disfavour. Hydrosylvic acid is chiefly used in Medical practice as a calming and drying tonic in spasmodic, and dyspeptic affections, and is used in such diseases as are benefited by the kind of remedies above mentioned. It is generally considered to act on the circulation, by subduing its force, to lessen nervous irritability, pain, distemper, besides to cause a more active state of the digestive functions, and gently move the bowels. It has been used in diseases of the eye, of all kinds, apparently with great success; in these cases, the vapour of the acid externally as well as the acid itself internally was used. It has been of service in cough of every kind: in pneumonia, catarrh, phthisis, coryzal, laryngeal, and whooping cough; moreover it seems to be particularly serviceable where the cough is of a nervous kind. It is useful in dyspepsia arising from irritability, when there is pain, at short times after food is taken, or heartburn and pyrosis or rejection of the food very soon after it has
been received into the stomach. It has been exhibited with benefit in cases of chronic vomiting, whether organic disease be present or not. It is useful in neuralgia, palpitation, hysteria, and rheumatism, the hemicrurae as an anthelmintic, it has been found beneficial in allaying the pain or irritations, attending many chronic eruptions. In diminishing the pain of cancers and other painful ulcerations. Medical salt is frequently adulterated the common impurities are sulphuric and hydrochloric acids, arising from the methods by which it is prepared when made by acting on the mercuric chloride with sulphuretted hydrogen. The latter not applied in excess there is a trace of the mercuric chloride present. Either of the above acids are present, they may be shown by the precipitate with nitrate of silver being only partially dissolved by boiling nitric acid, as indicated by the London college a red precipitate of bichromate mercury is produced by the double salt of iodide of potassium and mercuric oxide.
mercury. Hydrocyanic acid is administered by beginning with 1 or 2 drops in a tablespoonful of a simple menstruum and increasing the dose by one drop at a time until some physiological or therapeutic effect is observed. As its action is of short duration, it is necessary to repeat it frequently, not less than once in 3 hours if prescribed for irritating cough or neuralgia; it may be given hourly or oftener. To use it with any degree of confidence its operation must be diligently watched until the proper dose has been ascertained. It is best administered either in water or with the addition of a little sugar; one part in 20 parts of water, which may be afterwards increased to two or three times that proportion, i.e., the proper strength for a lotion, eruptions or painful ulcerations. The dose of its only official forms are, Acidum Hydrocyanicum L., Acidum Prussicum D. Min. I., admin. V.
Acidiurii Hydrocyanici um Dilatum L.,
min ii ad min viij.

A satisfactory compilation W.C.