ing of the British Medical Association (1901), advised the introduction of aseptic air into the ventricles at the same time that the fluid was drawn off. This he accomplished by the introduction of two cannulæ into the right sphenoparietal region, allowing the fluid to escape by the one, and permitting carefully filtered air to enter by the other. He claimed for this method a more complete evacuation of the ventricular fluid, and an avoidance of the danger resulting from the sudden and complete removal of pressure. In one of the cases which he reported he removed in ten separate tappings fluid amounting in all to eleven pints. At the time the report was made the condition of the child was greatly improved. Any such operation, however, rarely affords more than a temporary benefit.

Lumbar puncture, advocated in this affection some years ago by Quincke, has in a few cases appeared to be of some benefit, but it offers a hope of service only in those rare cases in which there is no blocking of the channels of exit. Considering the excellent temporary results obtained in many cases by aspiration during the past few years, efforts have been made by some surgeons to establish permanent drainage of the ventricles by establishing an artificial communication between them and the subarachnoid space. Sutherland and Cheyne report three cases in which a small opening was made in the dura, and one end of a number of strands of catgut tied together was passed into the ventricle while the other end was retained in the subdural space. The results, however, were unfortunate, although temporary improvement followed in two cases. Drs. Barlow and Lees, however, report one case treated in this way as a remarkable success.

More recently Mr. McAdam Eccles reports continuous improvement in a case on which he operated, using horse hair instead of catgut as a drain, passing one end of the strands under the dura mater and the other into the right lateral ventricle. The possibility of thus replacing the natural channels of exit from the ventricle into the cavity of the subarachnoid or even into the subcutaneous spaces appears, by the results obtained in these operations, to be feasible, and we are hopeful that with improved technique we may yet be able to do much in the way of relief for this very unfortunate class of cases.

Alexander D. Blackader.

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HYDROCHLORIC ACID.—Muriatic Acid, HCl. Under the title *Acidum Hydrochloricum*, Hydrochloric Acid, the United States Pharmacopœia recognizes "a liquid composed of 31.9 per cent., by weight, of absolute hydrochloric acid, and 68.1 per cent. of water." Such grade of acid is "a colorless, fuming liquid, of a pungent odor, and an intensely acid taste. Specific gravity: about 1.163 at 15° C. (59° F.). Miscible, in all proportions, with water and alcohol" (U. S. P.). Hydrochloric acid must be kept in glass-stoppered bottles and protected from the light.

The physiological effects and therapeutic applications of hydrochloric acid so closely resemble those of nitric acid that a separate description is unnecessary (see *Nitric Acid*). For medicinal use, proper, the following official preparation is established by the United States Pharmacopœia:

Acidum Hydrochloricum Dilutum. Diluted Hydrochloric Acid.—This preparation is a simple dilution of the strong acid of the Pharmacopœia with distilled water. It represents ten per cent. of absolute hydrochloric acid, is a colorless and very sour fluid, irritant though not corrosive, and of the specific gravity 1.050. Dose, from ten to thirty drops, largely diluted with water, and the mouth to be rinsed well after the taking of each dose.

Edward Curtis.

HYDROCOTYLE. See *Umbelliferæ*.

HYDROCYANIC ACID.—Hydrocyanic, or, as it is so commonly called, *prussic* acid (HCN), is, in pure or anhydrous condition, a thin, colorless, very volatile, very unstable, and fearfully poisonous fluid. Being so unmanageable in the concentrated state, the acid is used in medicine only in dilute solution in water or in alcohol and water. In continental Europe solutions of various strengths are to be met with, ranging from two to twenty-five per cent. What is known as *Scheele's* acid is an aqueous solution from four to five per cent. in strength. Under the title *Acidum Hydrocyanicum Dilutum*, Diluted Hydrocyanic Acid, the United States Pharmacopœia establishes "a liquid composed of two per cent., by weight, of absolute hydrocyanic acid, and ninety-eight per cent. of water." This preparation is made by distilling a mixture of potassium ferrocyanide and diluted sulphuric acid, receiving the distillate in a receiver containing water. The product is finally brought to standard strength, as determined by assay, by the addition of distilled water. Diluted hydrocyanic acid may also be prepared extemporaneously by the following process, officially authorized: "Silver cyanide, 6 gm.; hydrochloric acid, 5 c.c.; distilled water, 55 c.c. Mix the hydrochloric acid with the distilled water, add the silver cyanide, and shake the whole together in a glass-stoppered bottle. When the precipitate has subsided, pour off the clear liquid." In this process double decomposition ensues between the silver cyanide and the hydrochloric acid, with the formation of hydrocyanic acid which remains in solution, and silver chloride which precipitates.

Diluted hydrocyanic acid is "a colorless liquid, of a characteristic odor and taste, resembling those of bitter almonds. As it is very poisonous, great care should be taken in tasting it. It is completely volatilized by heat" (U. S. P.). The acid is more or less prone to decompose, thereby losing strength, and in such decomposition commonly turns dark, even getting in time to look like a thin ink. This decomposition will certainly and rapidly go on under exposure to the air in an open vessel, and is also hastened by the action of light. The preparation must, therefore, be put up in small, dark, amber-colored vials and kept in a cool place protected from the light. An important point is to have the vials *cork*-stoppered, and not *glass*-stoppered, since, for some reason, the preparation deteriorates much faster in glass-stoppered bottles than in those closed by cork. The acid will keep better, furthermore, according to Squibb, if, in dispensing, quantities be drawn from the stock bottle by a pipette instead of by pouring.

Physiologically, hydrocyanic acid is remarkable for deranging, swiftly and strongly, the functions of nerve apparatus, apparently irritating and quickly exhausting certain nerve centres, and also tending to destroy the conducting power of nerves and the contractility of muscles generally. Probably by virtue of these actions, hydrocyanic acid is a peculiarly speedy and powerful poison. (See *Hydrocyanic Acid: Toxicology.*)

The application of hydrocyanic acid in *therapeutics* does not amount to much. By reason of its poisonous nature, the medicine can be used only in insignificant doses, and the only medicinal virtues that such doses possess are to allay pain or irritability of the stomach, and, less certainly, the irritability of the air passages in disease that leads to dry cough. The local use of hydrocyanic acid solutions as lotions in skin disease, to allay pain and itching, is not without danger of inducing constitutional poisoning by absorption through unobserved abrasions.

Hydrocyanic acid in the form of the dilute solution of the United States Pharmacopœia is commonly prescribed in doses of from two to four drops only, but there certainly is no danger in doses of 0.50 gm. (℥ vij. or viij.), and such doses are used by many practitioners. Furthermore, since the effect of the drug is very evanescent, and there is no evidence of any so-called cumulative

action, there is no objection, physiologically, to the repetition of even a full dose so often as every hour. The dose may be administered in water, or syrup and water, and may be combined with alkaloidal salts, but not with salts of the metals. For a skin lotion, the pharmacopœial acid is variously diluted from ten- to fifty-fold by different practitioners.

Quite recently there has been published * an account of some interesting experiments by Jacques Loeb and Warren H. Lewis in the Hull Physiological Laboratory of the University of Chicago, on the prolongation of the life of the unfertilized eggs of sea-urchins by potassium cyanide. Ordinarily such eggs, kept in sea-water at a temperature of about 20° C., lose their power of development, on fertilization, in from twenty-three to forty-eight hours, or less. But if to the sea-water be added a certain percentage of potassium cyanide (one part of an "$\frac{n}{10}$" cyanide solution to 100 parts of sea-water), the time during which the capacity for fertilization persists is very materially lengthened—from one hundred and twelve to one hundred and sixty-eight hours, according to degree of development attainable. And such prolongation obtains for parthenogenetic as well as for sexual development. The experimenters account for these results by the theory that normal death of the unfertilized eggs is due to "specific mortal processes" which "are checked or modified by the process of sexual or osmotic fertilization," and which also may be checked by potassium cyanide, "which substitutes for the destructive action of these processes a condition of suspension of life ('vie latente' of Bernard)."

Edward Curtis.

HYDROCYANIC ACID. (TOXICOLOGICAL.)—As the various cyanic poisons—hydrocyanic acid, the cyanids, impure oil of bitter almonds, cherry-laurel water, etc.—all owe their poisonous qualities to the presence in them, or liberation from them, by the action of the liquids of the economy, of hydrocyanic acid, their action is in the main the same. The rapidity of their action depends upon the proportion of hydrocyanic acid which they contain, and is modified somewhat in kind by the nature of the substance with which the acid is combined, as in the case of potassium cyanid.

Although Dioscorides casually mentions the poisonous nature of bitter almonds, and Madden, in 1731, called attention to the toxic powers of cherry-laurel water, the toxicological history of hydrocyanic acid itself begins with the year 1803, when its poisonous nature seems to have been first recognized by Schrader. The existence of the acid had been discovered twenty years earlier (1780) by Scheele, whose death has been frequently attributed to accidental inhalation of its vapor. It would seem, however, from the account given by Crell at the time (*Annalen*, 1787, i., 192) of Scheele's last illness, that his death was due to disease and not to poison.

According to Stillé, Borda (1804) first suggested the use of the artificially prepared hydrocyanic acid as a remedy in cases in which cherry-laurel water had been previously used. A few years later (Hufeland's *Journal*, 1813, p. 113) occurred the first case, of which we have been able to find record, of death of a human subject by the action of this poison. This was the case of a child who swallowed a quantity of the dilute acid which a physician had prescribed for the mother. Within the few succeeding years deaths occurring in a similar manner, from misadventure, or by reason of the varying degree of concentration of the medicinal acid used, became very numerous, and in consequence the drug fell into disrepute.

In more recent years the extensive use of the cyanids of potassium, silver, etc., in the processes of photography, electroplating, and gilding has placed these active poisons at the easy disposal of many, has led to numerous cases of poisoning through carelessness and misadventure, and has brought potassium cyanid into prominent notice as one of the most frequently employed of poisons.

* The American Journal of Physiology, January 1st, 1902.

The statistics of poisoning in different countries afford somewhat contradictory information as to the degree of frequency of the use of the cyanic poisons. Tardieu gives a table of criminal poisonings in France from 1851 to 1863, including 617 cases, of which there is none by the cyanic poisons. The Reports of the Registrar-General of Great Britain for 1863–67 include 2,350 poisonings from all causes, of which 151 were caused by hydrocyanic acid and potassium cyanid, a number only exceeded in the cases of laudanum and the salts of lead. During the same period there were 6,696 suicides, of which 673 were by poison, and of these the cyanic poisons head the list with 121 cases. Of 1,263 murders 19 were by poison, and of these, 5 were by laudanum and 4 by the cyanic poisons. Lesser gives a table of 431 cases of poisoning occurring in Berlin, from 1876 to 1882, of which 74 were by potassium cyanid and 12 by hydrocyanic acid, while the only substance which caused a greater number of deaths than the former is carbonic oxid, 185. In our own country statistics of poisonings are exceedingly meagre, and such as exist are valueless by reason of insufficient and inaccurate data.

Murder by the cyanic poisons does not seem to be frequently attempted. By suicides hydrocyanic acid is often the agent selected, because, probably, of its rapid action, while the facility with which potassium cyanid can be obtained by any one is a reason of its frequent use for the same purpose. Accidental poisonings by the cyanic poisons are the result of carelessness or ignorance. A solution of potassium cyanid has been hastily drunk in mistake for water. The same substance in the solid form, bought to clean brass buttons, has been swallowed in mistake for another solid purchased at the same time. Numerous poisonings by oil of bitter almonds used for flavoring articles of food are recorded. Instances of death or serious poisoning caused by the medicinal administration of hydrocyanic acid are by no means as infrequent as they should be. In several cases the intent of the physician has been called in question, and a trial for murder or manslaughter has resulted.

Experiments on Animals.—*Method of Action.*—As in the great majority of cases in which the human subject has succumbed to the action of the cyanic poisons, the clinical history has reached the last chapter before, or shortly after, the arrival of the physician, what knowledge we possess concerning their mode of action has been derived mainly from experimentation. Unfortunately the experimental method has, in the hands of different observers, led to widely varying opinions regarding the mode of action of these poisons.

The following is the usual train of appearances following the administration of a lethal, yet not overwhelming dose of hydrocyanic acid to a warm-blooded animal: There is dyspnœa, beginning with a few hurried respiratory movements, the animal staggers and falls in a powerful tetanic spasm, with opisthotonus, during which the diaphragm is fixed in contraction; the pupils are dilated; the tongue and eyeballs protruding, the latter glassy; there is involuntary evacuation of urine and fæces; the pulse rapidly diminishes in force and frequency, and, if the dose be large, the animal dies without any further symptoms. If the animal do not die at this point, the muscles relax; the condition of tetanus passes into one of general paralysis, with total loss of reflex irritability; respiration is resumed, the expiratory acts being quite long and the inspiratory very short, and the intervals between the movements being very long. The pulse is irregular, frequent, and barely perceptible. If the animal recover, the respiration and pulse gradually return to the normal; if it die, the intervals between the respirations increase in length, the pulse becomes imperceptible. No further convulsive movements are observed, except, immediately preceding death, a single convulsive expiratory effort attended by a piercing cry or shriek.

That hydrocyanic acid destroys life by the disorders of respiration which it produces may be regarded as certain; but concerning the underlying causes of these disorders no such certainty can at present be said to exist.

Preyer, from a number of carefully conducted experiments, has concluded that hydrocyanic acid causes death by irritation of the peripheral branches of the vagus in the lungs and heart. In his experiments doses otherwise certainly lethal did not kill animals in which the vagi had been previously divided; and when animals so prepared were killed by larger doses of the poison, they did not die from suffocation, as they otherwise would have done, but from the paralyzing action of the poison upon the heart. Preyer has further shown, not only in his earlier experiments, but in others, made subsequently to the publication of Böhm's views (see below), that while rabbits and guinea-pigs were invariably killed by 0.2 c.c. of a two-per-cent. solution of hydrocyanic acid, they did not die, but recovered after more or less severe symptoms of poisoning, if the same dose was administered to them shortly after they had received hypodermatically 0.5 c.c. of a one-per-cent. solution of sulphate of atropin. Atropin having been shown to produce paralysis of the peripheral branches of the vagus, an antagonism of the two drugs is explainable on the supposition that hydrocyanic acid possesses the power of irritating those nerves.

Böhm not only does not substantiate the views of Preyer, but reaches very different conclusions, which he thus summarizes: "1. The action of hydrocyanic acid is upon the central nervous system, whose functions are destroyed by larger quantities after a short period of stimulation. 2. The disturbances of respiration and circulation have their origin in analogous modifications in the activity of their centres in the medulla oblongata. 3. The vagus plays no part whatever in the action of hydrocyanic acid upon the respiration or upon the heart. 4. Atropin is no antidote to hydrocyanic acid. The only rational method of treatment of this form of poisoning is in the early use of artificial respiration."

It may be said in support of the views of Preyer, as against those of Böhm, that, while the experiments of the former were performed upon rabbits or guinea-pigs in a condition as near the normal as possible, and free from restraint, those of the latter were conducted upon cats, confined in the dorsal position, upon which tracheotomy had been performed, the jugular vein being in communication with a cardiograph, and which had been narcotized with varying quantities of chloral. Certainly the conditions of Preyer's experiments were the more likely to afford evidence of the normal action of the poison.

Amory differs from both Böhm and Preyer. He holds that artificial respiration neither prevents poisoning by hydrocyanic acid nor materially aids its elimination, although it may prevent the occurrence of convulsions or muscular spasm; that muscular irritability and nervous conduction are not impaired by hydrocyanic acid, if artificial respiration have been maintained, until after cessation of cardiac pulsations; that death from hydrocyanic acid is due to some other cause than asphyxia, "and it may be suggested that the fundamental cause is a state of blood-poisoning, due to some alteration either of the physical or the chemical condition of the blood."

The last sentence of Amory, quoted above, expresses a view which is conceded by Preyer, Böhm, and all other observers, that whatever may be the action upon any portion of the nervous system, a distinct change in the chemical composition of the blood occurs in poisoning by hydrocyanic acid. Upon this point much light has been shed by the observations of Preyer, Hoppe-Seyler, and Gaethgens. Cl. Bernard observed that under the influence of hydrocyanic acid the venous blood becomes red. According to the observations of Gaethgens, at the moment when the convulsive seizure marks the beginning of the action of the poison the venous blood assumes a bright red color, and a similar change in color from the usual venous tint to bright red is seen in the blood of the right heart. At a later stage, however, the venous blood in the cavæ, portal vein, and the right heart assumes a darker hue than that of normal venous blood; and this dark-colored blood is found in the veins of warm-blooded animals which have died from the action of the poison, even if the autopsy be made immediately after death. Quantitative analysis of the gases absorbed and exhaled by animals under the influence of hydrocyanic acid showed that in the beginning of the poisoning, while the venous blood is bright red, less carbon dioxid is produced than normally, and at the same time the expired air is richer in oxygen than usual—conditions which are the opposite to those observed in ordinary suffocation. In the later stages the elimination of carbonic acid is increased. Gaethgens also showed that prussic acid does not destroy the power of reduced hæmoglobin of taking up oxygen from the atmosphere; that fresh blood, saturated with oxygen, does not give up any of its oxygen by the action of hydrocyanic acid; that blood containing hydrocyanic acid does not give up carbonic acid to an atmosphere free from that gas; and that the separation of oxygen from fresh blood is impeded by the presence of hydrocyanic aid.

Preyer, and also Hoppe-Seyler, have obtained, by the action of hydrocyanic acid upon oxyhæmoglobin, a crystalline product, formed without separation of oxygen, which differs materially from oxyhæmoglobin and from reduced hæmoglobin in appearance and in properties, which has not the power of ozonizing oxygen, and which is not converted into oxyhæmoglobin by exposure to atmospheric air.

It seems clear, therefore, that hydrocyanic acid has the property of preventing the proper appropriation of oxygen by the tissues, as well as the formation, or at least the elimination of carbon dioxid, by entering into chemical composition with the blood pigment. It is probable also that this property is an important factor in the action of the poison upon the animal economy, although it can hardly be stated that this is its only method of action.

Symptoms.—*Inhalation.*—Owing to the ready volatility of hydrocyanic acid, its absorption by the pulmonary surfaces is rapid. Coullon observed that "the odor of the acid caused one to fall unconscious and motionless." Ittner suffered from "constriction of the chest, interference with respiration, vertigo, lassitude, and shuddering," in consequence of having inhaled the vapor. Heller mentions a case in which severe tetanic spasms were produced by smelling a bottle containing a five-per-cent. solution. Dr. Letheby was rendered unconscious by smelling a bottle containing the concentrated acid. Taylor relates the case of a lady who "was immediately seized with dizziness, stupor, inability to stand, and faintness," from inhalation of the vapors produced by spilling a quantity of the five-per-cent. solution upon her dress. A student, engaged in preparing the acid in an apparatus whose joints permitted the escape of vapor, was found, after several hours, insensible, with closed eyelids, widely dilated pupils, cold limbs, and barely perceptible pulse. The muscles of the arms and legs were firmly contracted, the patient was in a condition of profound coma, but recovered after several hours (Regnauld). Coullon records a case in which inhalation of prussic acid vapor destroyed human life—that of a chemist who died in consequence of having spilled a quantity of the acid upon his naked arm. As but little, if any, absorption could have occurred through the skin, the fatal result was probably due to inhalation of the vapor.

Industrial poisoning by inhalation of prussic-acid vapor sometimes occurs in workshops devoted to electroplating and gilding, in which, by reason of imperfect ventilation, the vapors constantly emanating from the cyanid baths are allowed to accumulate. Persons exposed for a number of hours to such an atmosphere suffer from shooting pains in the forehead, pain in the region of the heart, palpitation, difficult respiration, a sense of constriction of the throat, and fits of weakness and somnolency.

By the Stomach.—The action of hydrocyanic acid, when taken by the mouth, varies with the magnitude of the dose, the degree of concentration having little, if any, influence. When taken in quantities above the medicinal dose, but still below that capable of causing death (♏ x. to xx. of the U. S. P. acid), it causes a sense of

constriction of the chest, a feeling of impending suffocation, irritation of the throat, a sense of heat in the epigastrium, dizziness, impeded locomotion, a sense of constriction and heaviness of the head, and in some cases nausea or a craving for food. Salivation and ulceration of the mouth frequently occur.

When small poisonous doses are taken, the patient, in the act of swallowing, notices the hot, bitter taste of the acid, and almost immediately a sense of constriction of the throat. In the course of one or two minutes there are severe pain and sense of pressure in the head, increasing vertigo, progressive confusion of intellect, obscuration of vision, insensibility, with loss of muscular power. The face is pale and bloated, the eyes are prominent and glassy, the mouth is marked with froth. The patient is then seized with convulsions of a tetanic character, with the jaws firmly clenched. The pulse is quick, the respiration slow and stertorous, and mucous râles are heard over the chest. Vomiting is uncommon; if it occur, it is usually the beginning of recovery. The vomited matter, as well as the breath, has the odor of bitter almonds. If the case terminate in death there are usually strong tetanic convulsions, involuntary evacuation of urine and fæces, opisthotonus; then succeeds a condition of general paralysis, and death from asphyxia follows in a period varying from two hours to two days. When recovery occurs, it does so gradually, the respiration and circulation slowly returning to the normal condition without any further complications.

With large doses subjective symptoms are entirely absent. In less than a minute consciousness is suddenly lost and the patient falls if standing or sitting. Then usually follows a short convulsive seizure, during which there is in most cases involuntary evacuation of urine and fæces. After this the patient lies perfectly still, with prominent, glassy eyes, jaws firmly clenched, mouth covered with foam, face at first bloated, afterward pale and sunken, pupils dilated and insensible, surface cold and clammy, and muscles completely relaxed. The pulse, at first somewhat more frequent than normal, rapidly becomes weaker, until in the later stages it is imperceptible. The respiration is spasmodic, the inspirations are short, and immediately followed by a protracted expiration, after which succeeds a pause of considerable duration, increasing as the case progresses to a fatal termination. Death occurs during one of these pauses, the only apparent difference between the condition of the patient before and that after death being that no succeeding inspiration occurs.

Lethal Dose.—The determination of what is the minimum lethal dose of any poison is difficult, and more difficult in the case of hydrocyanic acid than in that of any other poison. This is chiefly because of the great variation in the strength of the medicinal acid, which, even if made of the proper degree of concentration originally, deteriorates rapidly by exposure to light or air.

Two cases are recorded in which the lives of adults were destroyed by ♏ xx. of Scheele's acid (= one grain or 0.065 gm. anhydrous acid, if the preparation was of the proper strength). It is probable, therefore, that one grain of anhydrous hydrocyanic acid (= ♏ xlv. U. S. P. acid) is the minimum lethal dose. It by no means follows that this amount is necessarily fatal. In a case in which so large a dose as 2.4 grains (0.156 gm.) of anhydrous acid was taken, the patient recovered under active and immediate treatment. Records of large doses, followed by recovery, are to be regarded, however, as of little value unless the true strength of the acid has been determined. Thus, in a French case, in which an adult male took ʒ ij. of Scheele's acid in two doses, without ill effects, and subsequently ʒ ij. of Vauquelin's acid (in all 10.2 grains = 0.66 gm. of the anhydrous acid), from which he suffered the usual symptoms, but finally recovered, the former preparation probably contained little, if any, hydrocyanic acid, and the latter was much deteriorated.

Treatment.—As a rule the patient will be found well under the influence of the poison, frequently apparently lifeless; yet treatment should not be neglected, however desperate the case may seem. The clothing should be instantly removed and cold water dashed upon the head and spine, which are then to be rubbed dry with, preferably warm, towels, and the cold affusion repeated; this should be done even if the patient is in convulsions. Any poison remaining in the stomach is to be removed by the use of the siphon, the stomach being subsequently washed out with warm water. Artificial respiration is strongly recommended by some authorities, by others considered to be useless. The constant current from twenty-five cells may be applied, one pole over the apex of the heart, the other over the pneumogastric in the neck, contact being made and broken coincidently with the inspirations. Friction with hot liniment is to be applied to the chest and abdomen. Ammonia and chlorin by inhalation have been frequently recommended. When used they should be much diluted with air; the former obtained by saturating a cloth with liq. ammon. dil., the latter by moistening chlorid of lime in a wide-mouth bottle with dilute vinegar. Ammonia and chlorin do not act as chemical antidotes, but as stimulants to the capillary circulation, an effect which is best attained by the injection of ammonia into a vein. Atropin hypodermically administered is regarded by Preyer as the physiological antidote of hydrocyanic acid, but, although Preyer's experiments have shown that animals already under the influence of atropin are more or less protected from the action of hydrocyanic acid, the use of atropin in cases of poisoning by hydrocyanic acid does not seem to be of much benefit. Although a mixture of persulphate and protosulphate of iron acts as a good chemical antidote to hydrocyanic acid, by converting it into the insoluble Prussian blue, its value is much diminished by the fact that it cannot usually be administered in time to prevent the absorption of the poison. It should be administered if possible; ʒ ij. of magnesia are first given to neutralize the acidity of the contents of the stomach, and immediately afterward a mixture composed of liq. ferr. tersulphat., ʒ ij., and ferri sulph. præcip., gr. xv., dissolved in water; afterward, in a few moments, the stomach should be washed out.

Post-Mortem Appearances.—Rigor mortis usually sets in early, and persists sometimes for days, particularly in the lower jaw. As in sudden death from any cause, putrefaction is rather more rapid than usual. The face is usually placid, sometimes bloated; the eyes are prominent and glassy, the pupils dilated; the mouth is more or less covered with foam. The veins everywhere are distended with dark, fluid blood. The brain tissue is normal, the cerebral vessels are full of dark, fluid blood. The left ventricle of the heart is usually firmly contracted and empty, the right heart full of dark, uncoagulated blood. But if death occur very rapidly, the blood may be bright red in color (see above). The larynx and trachea are filled with a bloody foam, and the lungs are highly congested. The stomach frequently presents no abnormal appearance, but usually it is red and inflamed, either over its entire extent or in patches. The most distinctive character noticeable is the odor of bitter almonds. This, in some cases, may be distinguished before any incision is made, sometimes only on opening the cranial cavity, the stomach, or the pericardium; while in some cases of undoubted poisoning by hydrocyanic acid the odor cannot be detected with certainty.

Detection after Death.—Owing to the great volatility and instability of hydrocyanic acid, the probability of its detection by analysis in the cadaver diminishes rapidly as time elapses, particularly if the conditions favoring putrefaction obtain. The analysis, therefore, if one be desirable, should be made as soon as may be after death. Nevertheless, instances are not wanting in which the presence of the poison has been demonstrated several weeks after death. Thus Brame detected hydrocyanic acid one month after burial in winter; Reichardt, two months after death, in a corpse undergoing putrefaction; and Tillner, four months after death.

Analysis.—The parts which should be first examined