are the blood and the contents of the stomach. If death have been rapid the urine will not contain the poison. The material to be examined is subjected to distillation in order to separate the acid in such form that the distinguishing tests may be applied. If the indications do not point very decidedly to hydrocyanic acid the distillation should be combined with the search for phosphorus and other volatile poisons, the tests being applied to the first portions of the distillate. When hydrocyanic acid (or a cyanic poison) only is to be searched for, the apparatus is to be somewhat modified and no precautions with regard to light are necessary. If the material under examination be the contents of the stomach, certain sources of error are to be provided against. In the subsequent distillation in presence of an acid, hydrocyanic acid would be produced if a thiocyanate, usually a normal constituent of the saliva, or potassium ferrocyanid, or the pips of apples, pears, and other fruits were present. The last-named bodies are to be searched for, with the aid of a magnifier if necessary, in a portion of the contents, and, if found, are to be removed from the portion to be analyzed by filtration of the liquid, with the least possible exposure to air. Potassium ferrocyanid may have been taken as such, or it may be present as an impurity of potassium cyanid, and in the latter event, if not separated, would affect the quantitative result with a plus error. A portion of the filtered contents is dialysed, and the dialysate tested for ferrocyanid and thiocyanate by acidulation with hydrochloric acid and the addition of ferric chlorid. A blue precipitate indicates the presence of a ferrocyanid, and a red color in the liquid that of a thiocyanate.

In the absence of ferrocyanids and of thiocyanates the liquids to be examined—blood or contents of the stomach—are diluted, if necessary, with a known volume of water; 100 c.c. of the liquid are introduced into a 200 c.c. flask, connected with a Liebig's condenser, the lower end of which communicates by an air-tight joint with a small tubulated receiver, from the tubulus of which a tube, bent twice at right angles, is in air-tight communication with one limb of a bulbed **U**-tube. About 20 c.c. of a strong solution of silver nitrate are placed in the receiver and in the bend of the **U**-tube. The 200 c.c. flask is now disconnected from the condenser, enough aqueous solution of tartaric acid added to its contents to render them strongly acid, and the flask again connected with the condenser without loss of time. The flask is supported on a piece of asbestos board, and the distillation is slowly proceeded with until 10 to 15 c.c. of liquid have distilled over, or until the drops of distillate, as they fall into the silver solution, cease to produce any further precipitate. If the distilled liquid contain hydrocyanic acid, a white, caseous precipitate will be formed in the silver solution, the non-formation of which may be considered to be proof of the absence of cyanic poisons. If silver cyanid have formed, it is to be collected with the usual precautions upon a filter, whose dry weight has been determined, washed, dried at 100° C., and weighed. The weight so obtained, minus the weight of the filter, multiplied by 0.20194, gives the weight of hydrocyanic acid (CNH) in the amount of material distilled. The precipitate of silver cyanid is formed in solutions containing one part of CNH in 250,000; beyond that dilution the reaction fails (Link and Möckel).

The filter, with the adherent precipitate, is then placed in a flask, moistened with a few cubic centimetres of water, agitated, treated with 0.74 c.c. of a decinormal hydrochloric acid (3.64 HCl in 1,000) for every 0.01 gm. of silver cyanid found, again thoroughly agitated after corking, allowed to clear by subsidence, and decanted through a filter. The clear liquid so obtained is to be used for the application of the tests described below.

If the materials to be examined contain a ferrocyanid or a thiocyanate the operation is conducted as above directed, except that the material is rendered strongly alkaline with sodium carbonate, in place of acid with tartaric acid. Should the cyanic poison be mercuric cyanid its presence may not be revealed by either of the above methods.

Tests.—1. *Thiocyanate Test* (Liebig, 1847).—Place a portion of the liquid in a porcelain capsule; add a few drops of a dilute solution of sodium hydroxid and a few drops of a yellow solution of ammonium sulphydrate; evaporate to dryness over the water-bath; add water; acidulate with hydrochloric acid, and then add two or three drops of solution of ferric chlorid. If the liquid contained hydrocyanic acid it will be converted by this treatment into sodium thiocyanate, which, with the ferric salt, gives a fine red color. Finally, add solution of mercuric chlorid, which discharges the red color formed by the thiocyanate, but does not affect a similar color formed by meconic acid.

This is the most delicate of the tests for hydrocyanic acid, a distinct reaction being obtained with a solution of 1 to 4,000,000 (Link and Möckel).

2. *Prussian Blue Test* (Ittner, 1809).—Render a portion of the liquid alkaline by the addition of dilute caustic potash solution, add a few drops of a solution of ferrous sulfate which has become yellow by exposure to air, agitate, and let stand ten minutes. A dirty greenish precipitate is formed. Now add hydrochloric acid in slight excess, warm slightly, and, if no blue or green color be immediately observed, examine again after several hours' standing. In the presence of small quantities of hydrocyanic acid the liquid is colored green, and deposits Prussian blue only after long standing; with larger quantities the liquid is colored blue, and, immediately or after a short time, deposits a flocculent dark-blue precipitate, while the color of the liquid gradually changes to yellow. This test fails (Link and Möckel) when the dilution exceeds 1 to 50,000.

3. *Guaiac Test* (Schönbein, 1868).—Moisten a strip of filter paper with a freshly prepared three-per-cent. alcoholic solution of guaiac, dry, moisten with a drop of 0.05 per cent. solution of cupric sulfate, and then with a drop or two of the suspected solution. In the presence of hydrocyanic acid the paper is colored a beautiful blue. With very concentrated solutions (one per cent.) the reaction is attained by simply bringing the moistened paper over the solution. With highly dilute solutions a larger quantity of the suspected liquid is to be brought upon the paper by slow dropping from a pipette.

A distinct reaction is obtained (Link and Möckel) with a solution of 1 to 3,000,000, or (Hermann) 1 to 120,000,000.

This reaction is of value only as confirmatory of others, or as a preliminary test, as the same appearances are produced by ammonia, volatile ammonium compounds, hydrochloric acid, tobacco smoke, ozone, etc.

4. *Nitroprussid Test* (Vortmann, 1887).—Add a few drops of a sodium nitrite solution, then two or three drops of ferric chlorid solution, and, finally, enough dilute sulfuric acid to cause the brown color to just change to light yellow, heat to boiling, cool, add ammonium hydroxid solution, filter, and add to the filtrate a drop or two of very dilute ammonium hydrosulfid solution. A fine violet color is produced, which passes into blue in a few minutes, then to green, and finally to yellow.

Other tests have been suggested: With starch and potassium iodid (Schönbein); with cupric sulfate alone (Lassaigne); with picric acid (Braun); with cobaltous chlorid (Braun); with mercuric oxid (Henry and Humbert), and with uranic nitrate (C. Lea). These are, however, all inferior to those given above, which are sufficient to characterize hydrocyanic acid with certainty.

Cyanic Poisons other than Hydrocyanic Acid.—What has been said above concerning hydrocyanic acid applies in the main to all substances owing their poisonous qualities to the presence of that acid. A few points, however, of variation or special interest require mention.

Potassium cyanid is at present far more frequently the cause of death than the acid itself, the potency of which is in no way diminished by its being in combination in a soluble salt. The symptoms are those of hydrocyanic acid poisoning, to which, if death do not occur with great rapidity, are added symptoms referable to the cor-

rosive action of the potassium salt—burning pain in all parts with which the corrosive has come in contact. Vomiting is of much more frequent occurrence than in poisoning by hydrocyanic acid.

Potassium cyanid exerts a chemical action upon the skin, and is also readily absorbed through slight abrasions or excoriations. Serious poisonings, and even death, have in many instances resulted in this way in photographers, galvano-platers, or by the handling of plate-polishing powders containing potassium cyanid.

The post-mortem appearances differ markedly from those observed in cases of poisoning by hydrocyanic acid. While in the latter class of cases the autopsy may be said to reveal nothing of moment if the odor be absent, in cases of death from potassium cyanid the appearance of the stomach and intestines is highly characteristic if the poison have been taken in the solid form or in strong solution. Lesser ("Atlas d. gerichtl. Med.," Pl. ix., xiv.) has illustrated the appearances in a typical case. The mucous surface of the stomach is rugous, and of a light purple-red color, fading to a more brownish tint in the pyloric portion. The mucous membrane is more transparent than normal, and the red color is due more to an imbibition of the epithelium with blood pigment altered by the poison than to fulness of the vessels. If the autopsy have been long delayed, post-mortem corrosion may be extensive. In the duodenum, at the pylorus, is a narrow band of normal tissue; below this the mucous membrane is of an intense light-red color, and of greater transparency than normal. The remainder of the small intestine presents portions of normal tissue irregularly alternating with sections which are of the same light-red color as the duodenum, hyperæmic, and marked here and there with patches of extravasation varying in size up to the diameter of a quarter-dollar.

When pure, potassium cyanid contains forty per cent. of hydrocyanic acid. The commercial article usually contains carbonate, and sometimes potassium ferrocyanid, the former frequently in considerable quantity.

Other metallic cyanids, if capable of yielding hydrocyanic acid on contact with an acid in the cold, produce, when taken, the effects of the acid. Those which are decomposed by an acid only with the aid of heat are inert. *Mercuric cyanid* behaves more as a mercurial than as a cyanic poison, having produced effects very similar to those of corrosive sublimate in the few recorded cases. In a recent case in which it was administered, mixed with a powder capable of liberating free hydrobromic acid, it was decomposed and caused death in twenty minutes from cyanic poisoning. The *metallocyanids* are for the most part non-poisonous.

Potassium thiocyanate is possessed of poisonous properties which are, however, referable to the potassium rather than to the acid. *Mercuric thiocyanate* is the material of which the toys called Pharaoh's serpents are made. A few cases of irritant poisoning produced by swallowing these toys have been recorded.

Bitter almonds on contact with water at a slightly elevated temperature produce hydrocyanic acid by decomposition of the amygdalin which they contain. A few cases of poisoning by eating bitter almonds have been recorded. They do not differ from cases of poisoning by small doses of hydrocyanic acid.

Oil of bitter almonds, when insufficiently purified, contains as much as ten to fifteen per cent. of hydrocyanic acid, and, being in common use by confectioners and in the kitchen, is a prolific source of so-called accidental, as well as of suicidal poisoning. The symptoms are similar to those caused by potassium cyanid, and are usually comparatively slow in their development, although in some instances the action has been as rapid as that of hydrocyanic acid. From twenty to forty drops is the probable lethal dose for an adult.

Cherry-laurel water contains about 0.25 per cent. of hydrocyanic acid, and produces effects similar to those of the dilute acid. It is of historical interest, having been used in medical practice and, as a poison, as the precursor of hydrocyanic acid. It was the agent used by Donellan in the murder of Sir Theodosius Boughton, in 1781; and by Price, the last claimant to the discovery of the transmutation of baser metals into gold, to make away with himself, in 1784, when the falsity of his claim was about to be demonstrated.

Medico-legal Questions.—The following points have arisen in trials for murder by prussic acid, and have proved to be the questions upon which the case mainly turned:

1. *Was death due to prussic acid, and not to apoplexy?* As, in the absence of a distinct and unmistakable odor of hydrocyanic acid, there exists no post-mortem appearance which is characteristic of this poison, and as the symptoms in some cases closely resemble those of an apoplectic seizure, it is highly desirable that in cases of suspected poisoning a distinct answer to the above question be had in unmistakable chemical evidence of the presence of the poison in the blood.

There are certain points of symptomatology and of morbid anatomy which are of great value in this connection if they exist. If a person poisoned with hydrocyanic acid do not die within a short time, there occur violent convulsions, with opisthotonus and rigidity of all the muscles. In apoplexy there may be rigidity of an extremity, but never of all the voluntary muscles. But if the poison cause death rapidly, the convulsions do not usually occur.

After death from hydrocyanic acid the meningeal vessels and the cerebral sinuses are found gorged with blood; but never, as in sanguineous apoplexy, is there extravasation of blood into the ventricles, the membranes, or the substance of the brain, nor are there clots.

In a classic French case, "l'affaire Héritier," tried at Cambèry, in 1841, the prisoner was sentenced, and would have been executed had not Orfila shown from the *facts* of the evidence that the death of the deceased, Praslin, was due to apoplexy, and that the *opinions* of the chemical and medical experts upon which the conviction was based were of the most flimsy character, even for that period.

2. *Are certain symptoms and appearances necessarily present?* The argument has been frequently advanced that death could not have been due to hydrocyanic acid because a certain supposed characteristic symptom, such as the shriek, convulsions, or involuntary evacuations, was not observed or could not have occurred.

When rabbits and other animals are poisoned with hydrocyanic acid they usually emit a loud cry or shriek. In some of the earlier trials for poisoning by this substance the defence was raised that death was due to other causes because this cry had not been heard. The records of numerous cases of undoubted death from prussic acid show that in the human subject the occurrence of this cry has not been observed.

Attempts have also been made to argue that death could not have been due to prussic acid because the deceased was found calmly disposed in bed, reposing upon and covered by clean and evenly folded bedclothing, and consequently neither convulsions nor involuntary evacuations could have occurred. Convulsions are not usually observed when large doses of the poison have been taken, and when they do occur they are frequently of a mild type. In the greater number of the many cases in which the body is found without any observation of symptoms having been had, the countenance bears a calm and placid expression, which would not indicate that convulsions had occurred.

Involuntary evacuations of fæces or urine, or both, have occurred in about one-half of the recorded cases.

The characteristic *odor* of hydrocyanic acid, which may be described as that of bitter almonds, does not belong to any other known substance, except the oil of bitter almonds (benzoic aldehyd) and nitrobenzol; the former, in its pure state, a substance only found in chemical laboratories, the latter an active poison.

In some instances of death from the cyanic poisons the odor is easily recognized and distinct. Sometimes it may be observed on entering the apartment in which is the corpse; sometimes, during life, in the expired air, or, after death, at the mouth; sometimes only after opening one of the cavities of the body, or the stomach, or on cutting into the lungs or liver.

When the odor has been *distinctly* recognized by more than one person, its existence is a factor of great moment in the evidence to prove the cause of death: but a failure to detect the odor is by no means of correspondingly great significance in the opposite direction. Several instances are recorded in which analysis has proved the presence of the poison, although the odor could not be distinguished either during life or after death.

3. *Was a person killed by hydrocyanic acid capable of certain voluntary acts?* Because hydrocyanic acid is capable, if taken in sufficient quantity, of destroying the power of voluntary motion almost instantaneously, within a few seconds after having been swallowed, it has been argued that death could not have been suicidal in a case in which the deceased was found in such a position as implied voluntary acts on his part after having taken the poison, or the presence of another person. Numerous cases are recorded, however, in which the person was capable of considerable voluntary effort after having voluntarily taken a dose of hydrocyanic acid sufficient to cause death.

4. *Was the hydrocyanic acid, detected in the body by analysis after death, introduced during life?* is a question which may arise upon a trial for murder by this poison. The defence may adopt either of the following methods of accounting for its presence:

(*a*) *It was introduced after death.*

(*b*) *It was given medicinally.* These claims, if false, are to be met in the same way whatever poison has been used, consequently they require no particular consideration in this place. It cannot be claimed that hydrocyanic acid was used for embalming.

(*c*) *Hydrocyanic acid is a normal constituent of the body.* The only cyanogen compound which has been shown to exist in the normal human body is the thiocyanate of the saliva and urine. If the precautions mentioned above have been taken, this substance cannot be mistaken for hydrocyanic acid.

(*d*) *Hydrocyanic acid is a morbid product of the economy.* Hydrocyanic acid has been, it is claimed, detected in the urine in dropsy (Brugnatelli), typhus, cholera, and hepatitis (Fourcroy, Osborn), and in the fluid of ascites (Goldefy-Dorhs). Although Buchner admits the possibility of the formation of hydrocyanic acid in certain pathological processes, Husemann very properly considers that, even if these somewhat doubtful observations be accepted, they have no forensic interest, as it is not in the urine or in pathological exudations that prussic acid is found in cases of poisoning.

(*e*) *Hydrocyanic acid is a product of putrefaction.* This argument was advanced by the defence in two English trials, cited by Taylor, and is based solely upon opinion. Several writers upon toxicology—Orfila, Buchner, Bonjean, Preyer—admit the *possibility* that hydrocyanic acid *may be* one of the numerous products of putrefaction, yet no writer has yet asserted that it *is* so produced, and numberless analyses of contents of stomach, blood, etc., in every stage of decomposition, have been made by many chemists without any evidence of its presence.

Rudolph A. Witthaus.

HYDROCYANIC ETHER.—This body, chemically *ethyl cyanide*, $C_2H_5.CN$, is a colorless ethereal fluid miscible with water, alcohol, and ether, and possessed of poisonous properties analogous to those of hydrocyanic acid. It is not used in medicine. *Edward Curtis.*

HYDROFLUORIC ACID.—Hydrofluoric acid is a pungent, corrosive gas, very soluble in water. The acid of commerce is an aqueous solution containing from thirty-six to thirty-eight per cent. of the anhydrous acid; it emits fumes which are extremely irritating. When applied to the skin it destroys the epithelium and underlying tissue, rendering the parts hard and structureless.

Hydrofluoric acid is an efficient bactericide and antiseptic, and for this purpose Dujardin-Beaumetz advocated its employment in the treatment of tuberculosis by inhalation. He vaporized one grain in an air-tight compartment of the capacity of 22 cubic metres. In this the patient is placed for an hour daily, the period being gradually prolonged. In some instances the results were very favorable, but in others it produced an irritation of the lungs and increased the pulmonary trouble. Inhalations have also been used in diphtheria and whooping-cough. In the latter much benefit is reported from the use of a tablespoonful in a quart of water, in an inhaler, every second day.

Internally, hydrofluoric acid is a marked depressant, acting upon the vaso-motors and lowering the force and frequency of the pulse. In excessive doses it causes death by profound collapse and failure of respiration.

As a vaso-motor dilator its employment has been suggested in chronic rheumatism, epilepsy, and goitre. In the latter condition it was thought to be of especial value by Woakes, of London, but it has not proved to be of much service.

The alkaline fluorides are selected for internal administration. The fluoride of sodium or of potassium in doses of one grain are quite unirritating, and may be used for a prolonged period.

Locally, solutions of the strength of one part in three thousand may be used for ordinary antiseptic purposes. Under the title of *fluorol*, sodium fluoride has been used in a two-per-cent. solution to replace perchloride of mercury. The solutions are unirritating and free from any toxic action. A half-per-cent. solution may be used for the eye. *Beaumont Small.*

HYDROGEN DIOXIDE.—Hydrogen dioxide, H_2O_2, commonly called *peroxide of hydrogen*, is formed by reaction between barium dioxide and mineral acids in the cold. Obtained in concentrated condition, this body appears as a colorless, transparent, heavy, oily fluid, of specific gravity 1.452, neutral to test paper, remaining fluid at temperatures far below the freezing point of water, but rapidly and even explosively suffering decomposition into water and gaseous oxygen upon even a slight elevation of temperature, or upon contact with charcoal and certain metals and oxides. Even at ordinary temperatures the same decomposition occurs spontaneously to a greater or less extent.

Hydrogen dioxide mixes in all proportions with water and dissolves also in ether. As a medicine, it is used in solution in one or other of those fluids, the aqueous solution being commonly known as *oxygenated water*, and the ethereal as *ozonic* or *ozonized ether*. The *aqueous* solution in common use contains three per cent. of hydrogen dioxide by weight, a strength representing a charge of ten volumes of oxygen to one of the water of the solution. Such a solution is official in the United States Pharmacopœia under the title *Aqua Hydrogenii Dioxidi*, Solution of Hydrogen Dioxide. It contains a little sulphuric acid, purposely allowed to remain, as a preservative, from the charge of acid used to clarify the solution. This solution is a sparkling, clear, colorless aqueous fluid, odorless, but having an acidulous and disagreeable chlorinous taste, and producing a curious sensation and a soapy froth in the mouth, through evolution of oxygen. Its specific gravity ranges from 1.006 to 1.012 at ordinary temperatures. It tends to decompose spontaneously into water and oxygen, and accordingly will deteriorate by age, especially if exposed to light or to warmth. If subjected to evaporation at a temperature not exceeding 140° F. the solution will gain in strength through loss of water, but if heated rapidly it is liable to decompose at once and with explosive violence. Because of these various properties, the solution should be kept in dark amber-colored bottles, *loosely* stoppered and in a cool place. A tight stopper may be blown violently from the bottle, or the bottle itself may be burst, if the stopper be immovably seated. Furthermore, since deterioration by keeping is inevitable, a freshly made sample should be

procured always, when possible, for use. Old specimens will certainly be under standard in strength, and even may be wholly spoiled and inert.

Solution of hydrogen dioxide is neither corrosive nor poisonous, and is irritant only to especially sensitive parts, such as the eyes, the urethra, or raw surfaces. Its use in medicine is because of its ready decomposition, with yield of free oxygen. Such decomposition is determined by mere contact of the solution with many things, among which are the organic matters found in blood, mucus, pus, and other morbid discharges, diphtheritic membrane, the bodies of pathogenic micro-organisms, and decaying organic substances generally. It coagulates albumen powerfully. By virtue of the yield of oxygen the solution destroys, by oxidation, the morbific quality of animal secretions and excretions. When added to pus, brisk effervescence ensues and the pus corpuscles are quickly disintegrated. Similarly, when washed over a secreting surface, frothing occurs, crusts of dried secretion are loosened, and foul odors disappear. The foaming will continue till all adhering pus or mucopus is destroyed, when, after washing, the surface will be found to be perfectly cleansed and of healthy appearance. Solution of hydrogen dioxide is thus powerfully detergent and disinfectant to all styles of morbid surface conditions, whether of skin, mucous or serous membrane, or wounds or ulcers. The action, however, is evanescent and does not seem to include any intrinsic healing virtue, such as is shown by silver nitrate. For ordinary purposes, the pharmacopœial ten-volume solution may be used in full strength, but for application to sensitive surfaces such as the eye, the upper nasal passages, or the urethra, it should be diluted with from one to four or more parts of water. It may be applied by swabbing, by injection, or by spraying, but only instruments or utensils of hard rubber, glass, or porcelain should be allowed contact with the solution. To affect the surfaces of the stomach or intestines the solution may be given, without fear, by swallowing or by enema. From one to two or three teaspoonfuls may be given at a dose by the mouth. This dose should be well diluted with water and taken from a vessel of porcelain or glass. Other medicines should not be combined with the solution.

Attempts have been made to utilize the solution of hydrogen dioxide as an oxidizing agent within the system for the cure of disease. But when given by swallowing, a dose of the solution is almost wholly decomposed in the stomach, and, when administered hypodermatically, similar decomposition takes place at once in the juices of the part receiving the charge. In either case, therefore, but little of the solution can enter the blood unchanged, so that there is at best but small chance for a constitutional effect of any moment. If injected into the veins, the solution is instantly decomposed by the blood, and, in cases in which this procedure has been tried upon animals, it has often been followed quickly by death from embolism, due to coagulation of the blood by the disengaged oxygen.

Aqueous solutions of hydrogen dioxide stronger than that of the Pharmacopœia are to be found in the market (so-called "hydrozone"), and also solutions with glycerin as the basis (so-called "glycozone"), and solutions in ether ("ozonic ether": "pyrozone"). The ethereal solution is, naturally, highly inflammable.

Solutions of hydrogen dioxide *bleach* powerfully, and are much used for such purpose. *Edward Curtis.*

HYDROPERICARDIUM: DROPSY OF THE PERICARDIUM.—By hydropericardium is meant a collection of non-inflammatory fluid in the pericardial sac. It is distinctly a transudate and not an exudate. Some authorities include all collections of fluid in the pericardium, inflammatory and non-inflammatory, under this one term. By general consent, however, hydropericardium and hydrothorax are understood to mean transudates. A few cubic centimetres of fluid are practically always found in the pericardial sac after death. The fact that the amount varies with the lapse of time before the autopsy,—the longer the wait, the larger the amount of fluid,—suggests that most of this fluid is a post-mortem transudate. It may amount to even two or three ounces. Not until the fluid exceeds 100 c.c. (about three ounces) is the condition spoken of as hydropericardium.

Anatomic Alterations.—Like transudates in other parts of the body, this fluid is light yellow, or slightly greenish-yellow in color, usually clear, of low specific gravity, and containing few formed elements. There may be some floccules of coagulated albumin. It may contain urea or bile, especially in renal and hepatic diseases. The percentage of albumin, according to Reuss, is less than in pleural transudates, and greater than in peritoneal transudates. The quantity of fluid varies very much, depending on many circumstances. It may reach from 500 to 750 c.c. Corvisart has reported the enormous quantity of eight pounds—about 4,000 c.c.

The pericardial sac is distended according to the amount of fluid; in the large collections the lungs are compressed and the diaphragm is forced downward. The pericardium proper is thinned, or if the case is of long duration may be thickened. In chronic cases, the subserous fat about the heart disappears, the subserous cellular tissue appears œdematous, and the endothelia are relaxed, swollen, and of granular opacity. The muscular substance of the heart is pale and flabby.

Scientific opinion is as yet divided in the explanation of the presence of transudates. By many transudation is considered a process of filtration; others hold that the capillary walls are to be regarded as living organs, with a capacity for secretion, under the stimulating influence of irritating substances in the blood.

Etiology.—Hydropericardium is never a primary disease, but always secondary to some other disease. In comparison with the frequency of similar collections of fluid in the pleural and abdominal cavities, and the subcutaneous tissues, it is a rare condition. The explanation of this fact probably lies in the incessant activity of the heart. It occurs occasionally as a very rapid collection of fluid in some cases of acute nephritis, as in scarlatinal nephritis. Most commonly it is a part of a chronic dropsy associated with diseases of the heart and kidneys. Less commonly it is found in the various cachexias which produce an anæmic condition of the blood, such as tuberculosis, cancer, scurvy, and the severe anæmias. In these diseases the pericardial dropsy almost always follows transudation into the pleural cavity. Very rarely the dropsy has a predilection for the pericardial sac, rather than for its usual locations. Probably some local alterations in the pericardium would explain this. It may occur as a result of some local interference with the circulation, which hinders the return flow in the pericardial or cardiac veins. Atheroma of the coronary arteries, aneurism, disease of the lungs, pleura, or the heart itself, tumors and inflammations of the mediastinum, all may impede the circulation in these veins. In rare cases the sudden development of a pneumothorax is followed by hydropericardium.

Symptoms.—These are very indefinite, and can scarcely be separated from those of the associated disease. The condition comes on insidiously and would not be recognized were it not for careful physical examination. A familiarity with the possible complications of chronic heart and kidney disease puts the physician on his guard. The dyspnœa and cardiac distress rarely may be chiefly dependent upon the hydropericardium. There is never any acute præcordial pain, as in inflammation of the pericardium. Pericardial friction sounds are never present. If the fluid is large in amount compression of the lungs may add to the dyspnœa.

Physical Signs.—The reader is referred to the article on *Pericarditis* for a discussion of these, as they are the same except for the fact referred to above—viz., that pericardial friction sounds are never present in hydropericardium, either before the collection or after the absorption of the fluid. The transudate is said to move more quickly with change of body position than the inflammatory exudate.