

bedded beneath the ilio-psoas muscle on the left side of the fifth lumbar vertebra. In another case the wound of entrance was located on the anterior and inner aspect of the left thigh, with perforation into the peritoneal cavity below Poupart's ligament. The bullet, however, was found in the stomach, and there was a wound in its posterior wall near the greater curvature, with a second wound in the transverse mesocolon. In bullet wounds of the brain the amount of deflection may be considerable, so that the canal may pass through the superficial part of the cortex, from one side of the cranium to the other. The angle of deflection may be very acute. Thus in one case the wound of entrance was located over the left parietal boss, while the track passed downward and across the median line through the brain to the right side of the frontal bone, causing comminution at the junction of the orbital plate and perpendicular portion. A second canal was found in the right hemisphere leading to the bullet; the latter being very much flattened beneath the right parietal boss, which was excessively comminuted.

The discharge of a weapon at contact, provided the powder charge is sufficiently large, even though there is no bullet and consequently no bullet wound through the skin, may cause death. A case is reported of laceration of the heart through such a discharge at contact against the præcordial region. The skin presented the usual appearances with the exception of a bullet wound, *i.e.*, smoke stain, burn, and embedded powder grains were visible.

Cases have occurred in which the mouth was filled with powder, which was then ignited.

The extent of comminution of bone varies with the character of the bullet, its soft or hard consistency, its structure, its calibre, powder charge, and range; in addition the thickness of bone must be taken into account.

5. The decision whether a bullet wound was self-inflicted may be difficult to reach when the wound presents the appearance of a shot at contact, or within a range at which self-infliction is possible. Such wounds may of course have been inflicted by another individual. The wound in suicide, although usually inflicted at or nearly at contact, need not of course have been so inflicted. From the situation of the wound of entrance, and the direction of the track, valuable conclusions may be drawn; but the possibility of suicide should not be excluded except after the most careful consideration, since peculiar methods of handling the pistol may have been employed, such as steadying the barrel with one hand against the part and pulling the trigger with the other. From the reflection of smoke and powder grains the hand may become stained. Careful examination of both hands with this end in view should be made, and from the above it can easily be understood how the stain may appear, not only upon the hand used to discharge the weapon, but where the barrel has been steadied with the other hand this may be stained, and yet the stain be absent upon the hand that has pulled the trigger. This will explain, for instance, the presence of a bullet wound on the right side of the head, and a powder stain on the left hand. The palm and flexor aspect of the thumb should be examined for scratches or contusions that might have been produced by the recoil of the revolver. All attending circumstances should be noted. Of course, the revolver still grasped in the hand of the deceased does not necessarily prove suicide, as it is conceivable that before rigor mortis has set in such a condition may be directly produced post mortem.

The question of multiple self-inflicted wounds comes up for decision in cases in which one or more were necessarily fatal, and it may be important to decide whether one was immediately fatal. The presumption may arise that the second wound could not have been inflicted after the infliction of the first. Double bullet wounds in the heart have been self-inflicted. Whether a bullet wound of the brain necessarily prevents a further voluntary action, is often hard to decide. Of course, if a vital centre has been lacerated death must have occurred im-

mediately thereafter. Still it is quite possible that laceration of the brain, and sometimes quite considerable laceration, may occur in uncommon cases without being immediately fatal.

Bullet wounds and other injuries may occur in cases of suicide, all having been self-inflicted. In addition, numerous cases have been reported of poisoning and traumatism in the same individual.

6. The estimation of the relative importance of disease and injury and of their dependence upon each other is best considered regionally. Certain considerations apply in all cases. Thus, for example, it must be remembered that a wound infection—such as septicæmia, pyæmia, erysipelas, and tetanus—may follow an injury. Local tuberculous processes may be secondary to traumatism. Pneumonia may follow an injury and may prove fatal. When injuries occur in a subject of chronic disease, the injury and the disease should be separately considered, and the attempt should be made to determine the part played by each in the causation of death. Post mortem, the differentiation between the results of disease and those of traumatism should be made, and in this connection the subject of hemorrhage is important, as it may be the result of either. Mistakes may be made in determining the origin of hemorrhage.

HEAD.—Concussion of the Brain.—External signs of violence may be present, but cases may occur of even fatal concussion with little or no evidence of external violence. The brain is usually congested, and sometimes shows multiple and very fine contusions over the entire surface. The floor of the fourth ventricle is a spot where important evidence may be found in these cases, and it should be examined from above, the brain having been laid on its base with the cerebellum toward the observer. After section of the cerebral hemisphere on either side, a median incision is made through the cerebellum until the ventricle is reached. Then the incision is to be extended anteriorly to the corpora quadrigemina and posteriorly to the divergence of the restiform bodies. Finally, the separation of the two halves of the cerebellum will bring into view the floor of the fourth ventricle. In fatal concussion ecchymotic spots varying in number and extent are usually found here. Care should be taken not to confuse the prominent veins usually found on either side of the anterior part of the floor of the fourth ventricle, with ecchymoses.

Contusion of the brain is practically a minute surface laceration of the cortex. It is marked by red spots that remain after pressure on the pia and which on section prove to be a thin surface hemorrhage beneath the pia in the brain substance.

Laceration of the brain is always accompanied by hemorrhage and may be due to violence or to the effusion of blood from spontaneous rupture of a diseased vessel. In the latter case the typical location of the hemorrhage is in the lenticular nucleus, the blood having come from a rupture of one or another of the anterior perforating arteries, most commonly the lenticulo-striate. The hemorrhage and laceration may vary in extent; they may involve the inner capsule, the head of the caudate nucleus or the optic thalamus, and sometimes they extend into the ventricle; or the extension may take place in an outward direction through the outer capsule, the claustrum, and the cortex of the island of Reil. Violence, however, may cause just such a hemorrhage, although in such a case other lesions are likely to be present in addition. As a general rule, multiplicity of hemorrhages and lacerations points to violence. A spontaneous hemorrhage may occur in the usual site described above, and when the violence is due to a fall upon the back of the head following loss of consciousness multiple hemorrhages with laceration of brain tissue may occur in the brain substance and in the cortex. In laceration of the brain due to violence, the lesions are usually most marked in the cortex, on the surface, and they become less extensive in the deeper portion of the brain tissue. Such laceration may be due to a comminuted depressed fracture of the skull, the actual tearing being caused by fragments of

bone; far more commonly, however, the seat of laceration is directly opposite the point of application of violence as indicated by a lacerated scalp wound, contusion or hematoma of the scalp. The brain is apparently capable of enduring considerable compression without the occurrence of laceration. Where, however, the brain tissue is called upon to fill out an increased space, *i.e.*, where distention occurs, laceration results. When violence is exerted upon one point of the cranium, the convexity of the bone is suddenly reduced, while at a point directly opposite the convexity is increased by compensation. At the point of application, therefore, the brain may be compressed without laceration, while at the opposite point the brain is distended and laceration results. With a blow or fall upon the side of the head, with a hematoma in the temporal or parietal region, the surface of the caudate nucleus and optic thalamus on the same side is sometimes the seat of laceration, without laceration of the temporal or parietal cortex on that side. Here, again, the cortex has been compressed and an opposite brain surface, though an internal one, has become lacerated by distention. Laceration of the cortex, although commonly occurring with fracture of the skull, either at some point in the skull cap or at its base, may also occur without fracture, the bone having been sufficiently elastic to accommodate itself, without breaking, to the sudden change in shape due to the violence. With laceration of the brain a blood clot, more or less extensive, may form between dura and pia. When the laceration does not involve the pia mater, blood may be infiltrated in the meshes of the pia arachnoid and may infiltrate the sulci beneath the pia mater.

Injuries to the Cerebral Vessels.—Isolated laceration of one or another cerebral vessel may be due to violence either with or without fracture of the skull. The vessel may or may not have previously been the seat of fatty degeneration or of aneurism. In such a case the blood is usually poured out beneath the pia mater, more commonly at the base of the brain; it may infiltrate both fissures of Sylvius, and passing beneath the velum interpositum, through the large transverse fissure, may break through the single layer of epithelium constituting the ependyma and gain access to the ventricles. An accurate examination of all the cerebral vessels is a matter of considerable importance. In the case of an aneurism, spontaneous rupture is quite possible; but when the vessels are the seat of fatty degeneration and atheroma, spontaneous rupture is infrequent, if we except the lenticulo-striate and anterior perforating branches. Atheroma will, however, account for conditions—namely, vertigo and sudden loss of consciousness—which in themselves may be responsible for the occurrence of traumatism.

Traumatic Meningitis.—Acute purulent or productive meningitis may occur from traumatism, and may be the immediate cause of death. Where a wound, with or without fracture of the skull, has opened the way for infection, or where fracture of the base of the skull has permitted infection through nasal, buccal, or aural orifices, the connection of a purulent meningitis with the traumatism, although indirect, is quite evident. Such a purulent meningitis may not follow the traumatism directly, as infection may take place later and is possible as long as the wound or fracture is not completely healed.

Where, however, a purulent or an acute productive meningitis is found without an apparent avenue of infection, but following a traumatism (as contusion of some part of the head with concussion of the brain), the connection between the meningitis and the traumatism is more difficult to establish. All other causes of meningitis would have to be excluded. In addition, the clinical history of onset of meningitis within at least a few days from reception of the traumatism, would be most important evidence. The stage of the inflammatory process as found at the autopsy is of great importance. Although it might not be possible to determine absolutely the duration of the disease, still it might be ascertained that the duration was or was not longer than a given time, namely, the date of the occurrence of the traumatism in evidence.

The important bearing of an inflammatory process, with invasion of pyogenic bacteria in some other portion of the body adjacent or remote, should not be forgotten as a possible source of infection.

The occurrence of acute exudative inflammations of serous membranes in subjects of chronic interstitial or diffuse nephritis without traumatism, would render the acceptance of these diseases as predisposing conditions of meningitis from traumatism quite plausible.

Hemorrhagic meningitis is not necessarily traumatic. It may occur as a complication of typhoid fever and other infectious diseases.

Acute pachymeningitis may be secondary to fracture of the skull, from infection, or to an infected scalp wound or erysipelas. The inflammation may affect the external layer of the dura (usually in the form of a purulent pachymeningitis) or the internal layer (in the form of a fibrinous pachymeningitis), or both layers may be inflamed.

Pachymeningitis interna hæmorrhagica may give rise to a hemorrhage with formation of clot between the dura and the pia. When one or more layers of tissue result from attacks of this form of inflammation—layers which may be stripped off from the dura—the diagnosis is readily made from a simple macroscopic examination. An excessive hemorrhage may, however, occur at an early stage when the membrane is as yet very thin, and when microscopic examination may be necessary to substantiate the diagnosis. Pachymeningitis interna hæmorrhagica must be suspected whenever a blood clot is found between the pia and the dura, especially over the convexity on one side, in the absence of laceration of the brain. Such a clot might, however, result from laceration of the veins in the pia as they pass over to the dura, to gain access to the longitudinal sinus. Pachymeningitis may at any time cause a spontaneous hemorrhage with compression of the brain and death. It is conceivable that violence, not necessarily excessive, may at any time determine such a hemorrhage; it should be remembered, however, that vertigo and loss of consciousness (common symptoms of this affection) may be responsible for the occurrence of trauma, which in its turn may determine the hemorrhage.

Meningeal Arteries.—Laceration is due to traumatism, and occurs most commonly with fracture of the skull (vertex or base), the site of laceration corresponding to the point where the line of fracture crosses the course of the artery. Laceration may occur without fracture. The middle meningeal or one of its branches is most exposed to laceration from its course and its position in a deep groove, or even a canal, of bone. The effusion of blood occurs between dura and bone, unless the dura is completely lacerated by a comminuted depressed fracture. Compression of the brain by the resulting clot is usually sufficient, if unrelieved, to cause death. However, when the effusion of blood is not too excessive the compression may not be sufficient to cause death. A clot three inches in diameter and three-fourths of an inch in thickness compressing the right frontal lobe, and due to laceration of a branch of the anterior meningeal artery, with stellate fracture of the right orbital plate, was found in a case in which death was due to pneumothorax from perforation of a tuberculous focus. There was no history of cerebral symptoms. The organization of the peripheral part of the clot showed that it must have been present for several weeks.

As regards fracture of the skull, vertex or base, as a cause for death, it should be remembered that the fracture in itself, except in so far as it may open the way for infection, is of minor importance. The lesions of the vessels and consequent hemorrhage, the accompanying concussion, contusion, laceration, and compression of the brain, are the important factors. The fracture is of importance, and its description should always be accurately made, as it may indicate not only the degree of violence sustained, but in addition may serve to indicate the character of the weapon employed or the manner in which the injury was sustained.

Neck.—The injuries produced by strangulation and hanging are considered under *Asphyxia*. Contusion of the larynx may cause sudden death by shock, by reflex paralysis of respiration, or by spasm of the glottis. Fractures of the laryngeal or tracheal cartilages, from the edema of the submucous areolar tissue accompanying them, may cause occlusion of the respiratory passage and asphyxia. Laceration of the mucosa accompanying such fractures or occurring alone may be followed by cellular emphysema and by asphyxia. A case in point has been observed in which a laceration of the mucosa between the larynx and the trachea, followed by cellular emphysema of the neck, glottis, upper half of the thoracic wall, and mediastinum, although tracheotomy had been performed, caused death from asphyxia. The laceration in this case was produced by sudden over-extension of the neck, in a fall upon the chin.

Incised wounds of the neck, as in cases of suicide, may cause death from hemorrhage; more commonly, however, the larger vessels are not cut, but the incision passes between the hyoid bone and the larynx, through the larynx or trachea, into the respiratory passage. Death in such cases may be due to a complicating broncho-pneumonia from aspiration of the discharges from the wound.

Direct contusion of the posterior part of the neck may be accompanied by contusion of the medulla and spinal cord without fracture of the cervical vertebrae.

Fracture and dislocation of the cervical vertebrae are more often due to a fall or blow upon the vertex of the cranium than to direct violence upon the neck.

A wound of the jugular veins immediately above the thorax may be followed by entrance of air into the right heart and pulmonary circulation, causing sudden death.

Thorax.—Simple fracture of the ribs is not usually in itself a cause of death. If, however, an intercostal artery has been lacerated, or the lung or the heart punctured, death may follow hemorrhage or pneumothorax.

Compound fracture may be followed by cellular emphysema, and, if perforation of the pleural sac has occurred, by pneumothorax.

Contusion and laceration of the lung may accompany fractured ribs, or there may be few or no signs of violence in the thoracic wall. This is particularly likely to be the case in children. These lesions may produce ecchymoses, parenchymatous hemorrhages, interstitial emphysema, or pneumothorax.

Pneumothorax may result from the perforation of a tuberculous focus into the pleural sac.

Wounds of the lung may cause death by hemorrhage, pneumothorax, cellular emphysema, or by complicating pneumonia.

Pneumonia may be secondary to cerebral injuries, and to other injuries besides those of the respiratory tract mentioned. Infection of wounds may explain a secondary pneumonia in some cases; in others a condition of passive hyperemia, followed by "hypostatic" pneumonia, may be due to the confinement and enfeebled condition following such injuries, or to the advanced age of the individual.

Rupture of the heart may be spontaneous and due to fatty degeneration or necrosis of a portion of its wall from occlusion of the afferent branch of the coronary artery. Such rupture usually occurs in the anterior wall of the left ventricle. Contusion and laceration of the heart may occur from direct contusion, or from compression of the thorax. In the latter case, laceration is far more likely to occur in the wall of the right auricle. Laceration of the posterior wall of the left ventricle, where it comes in relation with the tendon of the diaphragm, was found in case of fall from a height; the accompanying lesions, in this case, being contusions, fractured ribs, and lacerations of both lungs.

Stab and bullet wounds of the heart cause death through the compression exerted upon the heart by the effused blood in the pericardial sac. This serves to explain the fact that death in such cases is not necessarily instantaneous. A few cases of recovery from such wounds are on record. Depending upon the character of the wound

and the rapidity or slowness of the resulting hemorrhage, a shorter or longer period may intervene between reception of the injury and death. Voluntary action may occur after a wound of the heart has been received. Thus the wounded person may run a short distance, or may close the clasp knife with which the wound had been inflicted. Multiple bullet wounds of the heart have been self-inflicted, usually with weapons of small calibre. Multiple self-inflicted stab wounds of the heart and other organs are on record.

Fatty embolism of the pulmonary artery may follow fractures of cancellous bone, especially if considerable comminution occurs. Embolism of the pulmonary arteries may also occur as a result of a primary peripheral thrombo-phlebitis due to injury.

Aneurisms in this region may rupture spontaneously, or rupture may follow an injury of comparatively minor violence.

Abdomen.—Shock with comparatively slight evidences of injury due to contusion of the abdomen or of the solar plexus, may occur. Contusion, compression, and laceration of organs without apparent injury of the abdominal wall, are not infrequent. Laceration of an artery may occur alone from traumatism, and without previous disease. In other cases the artery may be the seat of some disease like aneurism or tuberculosis, and a spontaneous hematoma or hemorrhage may occur, or such hemorrhage may be the result of an injury otherwise of insufficient violence to cause rupture. Septic peritonitis may follow perforation of a hollow viscus due to disease, or perforation may have been immediately brought about by injury. Hemorrhagic peritonitis, hemorrhagic pancreatitis, with or without fat necrosis, may be mistaken for the results of injury. Hematoma of the suprarenal capsule due to excessive passive hyperemia, with or without rupture into the peritoneal cavity, is another condition that may be mistaken for the result of violence.

Pelvis.—Spontaneous rupture of the bladder without disease may occur in subjects of hysteria. A case with fatal hemorrhage, in which traumatism was absolutely excluded, has come to notice. Septicemia may follow infiltration of urine due to laceration by careless catheterization. Injury to the female genitalia, not only in cases of criminal abortion but also in non-pregnant cases, may be produced by direct violence, or during coitus. Such injuries are commonly lacerations of various extent, either simply involving the hymen or ostium vaginae, or extending upward into the vagina, or involving the fornix and perforating into the peritoneal cavity. In such cases death may be due to hemorrhage, or to septicemia, or to septic peritonitis. Rupture of the pregnant uterus may be the result of a fall or blow; on the other hand it may occur spontaneously. In the latter case, however, rupture occurs after labor pains—that is, contractions of the uterus—have set in, and usually after a more or less prolonged duration of labor due to obstruction to delivery.

ABORTION.—The questions for investigation are: Has abortion occurred? If so, has it been induced? Is it responsible for the death of the individual?

Abortion may be defined as the termination of gestation before the viability of the fetus, this term being accepted as about thirty weeks or seven calendar months. The conditions post mortem upon which the diagnosis of gestation that has been terminated may be based, may readily be remembered by recapitulating the changes produced in the uterus and ovary by gestation. If in addition some portion of the products of conception is still retained in utero, its demonstration affords positive proof. Nevertheless, if no such portion be found, the changes produced in the uterus and ovary are sufficiently characteristic, provided too long a time has not elapsed, to warrant a positive diagnosis.

If a portion of the fetus, or its membranes, more especially chorionic or placental villi, be demonstrated, this alone is proof of gestation, but is not in itself proof of criminal abortion. The signs, so far as the uterus and ovary are concerned, may individually, at least in part, be

produced by other conditions. These signs are, in the first place, enlargement of the uterus, especially its body, and enlargement of its cavity; second, hypertrophy of the uterine wall, a softer consistency, and enlargement of its veins with formation of sinuses, especially at the placental site; third, thickening of the endometrium with the characteristic change in its morphology—namely, the production of the true decidua of pregnancy, and over the anterior or posterior wall at the fundus, where the chorionic villi become attached to the decidua serotina, the formation of the placenta. Even though all the chorionic portion of the placenta has been separated, a raw surface is left, differing from the otherwise smooth lining, which can readily be recognized, even from the gross appearances, as the placental site.

The size of the uterus will vary, in the first place, according to the period of gestation that has been reached, and, in the second place, according to the time elapsed between the cessation of gestation or abortion and death. The consistency of the uterus will vary according to the period of gestation, the presence or absence of metritis, and the advancement of post-mortem changes. The decidua will vary according to the time at which gestation was interfered with, according to the time which has elapsed between then and death, and also according to the degree of inflammatory reaction that may have taken place.

The ovary that has supplied the ovule which has been fructified presents a change in its Graafian follicle that is quite characteristic, especially in the earlier periods of gestation, namely, the true corpus luteum. At the end of the third week, this presents a cyst of 2 cm. in diameter, with a wall 3 mm. in thickness and of a characteristic yellow color, usually distended at this period. Shortly thereafter this wall shows a slight convolution, while the cavity is often filled with a clear, slightly viscid fluid, sometimes blood-tinged, or entirely bloody. From this period onward the change consists in a gradual shrinkage of the entire cyst with more marked convolution of its yellow wall, and with absorption of its fluid contents, coincident with a growth of connective tissue which occupies the place of the fluid. The corpus luteum persists throughout the entire period of gestation, and does not diminish markedly in size until the end of four or five months. Although in structure the corpus luteum of pregnancy does not differ from the normal corpus luteum of menstruation, yet from its larger size, and its persistence in size up to the fourth or fifth month, together with the thickness of its yellow border, it forms a valuable additional sign of gestation, especially during the period when criminal abortion is more commonly committed. The corpus luteum of menstruation under certain diseased conditions—as, for instance, when there are fibroid tumors of the uterus, or cystic oöphoritis—may reach 1 cm. or even more in diameter. It is then filled with clotted blood and has a yellow margin, sometimes convoluted, and measuring 1 or 2 mm. in thickness; yet its appearance, when one has become familiar with the true corpus luteum of pregnancy, is quite different. Moreover, a number of such corpora lutea are usually found. The absence of diseased conditions in which they occur would be additional evidence in doubtful cases.

To recapitulate, the only positive evidences that a fetus in utero has existed are these: The presence of chorionic villi, which from their adhesion to the placental site may be readily enough found, and the demonstration of a true decidua of pregnancy, both of which structures must have their true character verified by microscopical examination. To these two, perhaps, should be added a third, viz., the demonstration of a true corpus luteum in one or the other ovary. All the other signs are not in themselves positive, but taken together they may form sufficient evidence of recent gestation.

Signs of Abortion having been Induced.—Induction of abortion may under certain circumstances and after consultation be perfectly justifiable. When there is no lawful reason for the termination of gestation, induction of abortion is criminal. What signs may we rely upon, in

the post-mortem examination, to conclude that abortion has been criminally induced? In the first place, the examination of the fornix of the vagina and cervical canal, especially at and just below the internal os, for punctures and lacerations, may furnish strong evidence of such interference. A large number of cases of criminal abortion are produced by mechanical means, employed by persons lacking anatomical knowledge and surgical skill. A stilet, sound, catheter, or syringe is introduced, or the cervix is clumsily dilated with some instrument, all these procedures leaving a mark by reason of their unskillful employment. Examination of the fundus, the anterior wall or the posterior wall of the uterus may show a partial or complete puncture or laceration. The effect of certain corrosive fluids may be quite noticeable upon the endometrium, for these fluids—such as carbolic acid or bichloride of mercury solutions—are sometimes used as intra-uterine injections for the production of abortion.

The effects of the mechanical means mentioned above are, to cause the uterus completely to empty itself; and, provided the woman escape infection or withstand it, death may not result. In many cases, however, the abortion remains incomplete and hemorrhage from the partially separated placenta, or from the actual lesions, lacerations, or perforations produced, may prove fatal. Or infection may take place, and death may result from a septic endometritis, metritis, parametritis, and peritonitis.

Besides mechanical means for the induction of abortion, there are numerous drugs and nostrums which are taken internally for this purpose. The danger in their use is twofold: in the first place they may cause direct poisoning, since many of them in increased doses are intense gastro-intestinal irritants; in the second place, the effect is usually partial, the fetus being killed but not expelled, or its membranes and the placenta are either incompletely expelled, or they remain in the uterus and subsequently lead to death from hemorrhage or from septic infection.

ASPHYXIA.—Asphyxia may be due to mechanical causes preventing the entrance of oxygen into the lungs, or interfering with the movements of respiration; or it may be due to the presence of irrespirable gases or to causes acting upon the respiratory centre in the medulla. The following list includes many of the different ways in which asphyxia may be produced in a mechanical manner: Occlusion of the mouth and nose, larynx, trachea, and bronchi, either by foreign bodies or by intrinsic tumors; occlusion of these same channels by pressure exerted from the outside—as by an aneurism, a new growth, or an enlarged thyroid gland, or by an accumulation of fluid or air in the pleural sac; compression of the chest wall, direct compression of the trachea, or more commonly the compression of the hyoid bone, base of the tongue, and epiglottis, over the aditus laryngis, as in strangulation; aspiration of stomach contents in vomiting; entrance of pus from a tuberculous lymph node which in breaking down has perforated the trachea or bronchus; submersion as in drowning, or conditions in which the mouth and nose alone become submerged below the level of the fluid, as in some cases of death of the new-born, or of intoxicated or unconscious persons.

(For information in regard to the various forms of poisoning by carbonic acid gas, see the article entitled *Carbon, Hydrides and Oxides of*.)

Asphyxia may be caused by inhalation of irrespirable gases such as chlorine, bromine, iodine, nitrous acid, sulphurous acid, and sulphureted hydrogen. In these cases death is usually caused immediately by the shutting off of oxygen. There have been cases in which death has occurred, some time after such exposure, from broncho-pneumonia. In regard to sulphureted hydrogen, it has been thought that it forms a compound with hæmoglobin. If the gas is passed through blood the latter becomes dirty greenish in color and shows a spectrum somewhat like that of oxyhæmoglobin, but with an absorption band in the red. The blood, in cases of death by asphyxia from sulphureted hydrogen, does not show this spectrum. In animals killed by exposure to sulphureted hydrogen much less gas is required (one-tenth to one-half per cent.)