size, large mononuclear leucocytes corresponding to myelocytes, and all possible varieties of transitional forms were also present. The bone marrow of this case showed scattered areas of lymphoid marrow, and in both the liver and spleen changes were found suggesting a return to a fœtal mode of blood formation. Numerous nucleated red cells were present in the blood. The remaining lymph glands showed only a fibroid hyperplasia.

Secondary Cachectic Anæmia.—In a large number of cases examined showing a more or less severe cachectic anæmia both marrow- and splenolymph glands showed increased hæmolysis, but no evidences of the formation of red blood cells were present.

Splenic Anæmia.—In a case of splenomegaly with severe anæmia, the patient dying after splenectomy, numerous minute nodes of lymphoid tissue were found scattered throughout the adipose tissue of the mesentery and retroperitoneal region. The majority of these possessed a small arteriole showing a much thickened wall; in some cases the lumen was completely obliterated by the proliferation of the intima. The new tissue blocking the vessel in many cases showed a hyaline change, and the concentric arrangement in some instances bore a strong resemblance to the thymus corpuscles. In some cases the hyaline tissue had undergone calcification. This new formation of lymphoid tissue resembles very much the changes found in the omentum of animals whose spleens had been experimentally removed, and is probably to be interpreted as compensation for the diseased spleen. The splenolymph glands in this case showed also such changes that they resembled splenic tissue, both to the naked eye and on microscopical examination, being regarded at the autopsy as accessory spleens.

Pernicious Anæmia.—In five cases of pernicious anæmia examined the changes in the hæmolymph glands were so constant and so marked that the writer regards them as specific in nature. In the more rapidly progressing forms the number of splenolymph glands is so great that they must be regarded either as new formations or as resting glands become active. In one case over sixty of these glands were removed from the cervical, thoracic, and retroperitoneal regions; and in another over thirty from the retroperitoneal region alone. The glands are enlarged and darker in color, often a chocolate brown. On microscopical examination the central and communicating sinuses are found almost filled with large phagocytes containing red cells and pigment. The processes of hæmolysis are increased to an extraordinary degree, particularly in the rapidly progressing forms. The spleens in these cases showed but little evidences of hæmolysis, while liver and kidneys showed marked hæmosiderosis. No evidences of increased activity on the part of the bone marrow were found; on the contrary, in all of the cases there was marked atrophy of the red marrow associated with osteoporosis and the formation of cystoid cavities filled with liquid fat.

In one case of progressive anæmia extending over three years, characterized by repeated severe attacks of epistaxis, hæmatemesis, and bloody stools, the only pathological changes of importance found on autopsy were in the retroperitoneal lymph glands. These were enormously enlarged, forming an almost continuous double row on each side of the abdominal aorta and diverging below along the brim of the pelvis. Each gland was 3 to 4 cm. in length and 1 to 2 cm. in thickness. They were almost cylindrical, somewhat flattened, and were dark red in color, almost black. On section the blood flowed freely from the greatly dilated veins. On microscopical examination a great hyperplasia of the lymphoid tissue was found, extending beyond the original capsule of the gland into the surrounding fat tissue. The appearances suggested strongly the possibility of a direct conversion of fat into lymphoid tissue. Numerous mononuclear eosinophiles, nucleated red cells, and occasional giant cells were present throughout the reticulum of the lymphoid areas. Mitotic figures were numerous. The presence of blood sinuses proved these glands to be hæmolymph glands of the marrow-lymph type, and the process was interpreted as a compensatory hyperplasia for the bone marrow which was atrophic and cystoid.

Leukæmia.—In a case of mixed leukæmia an enormous hyperplasia of the marrow-lymph glands similar to the above was found. On microscopical examination the blood sinuses were found filled with giant cells which were also scattered throughout the lymphoid areas. Mononuclear eosinophile cells, nucleated red cells, myelocytes, and an almost infinite variety of leucocytes, especially well shown in specimens stained with the tri-acid stain, made up the lymphoid portions. The resemblance to lymphoid marrow was very close, as in the case of fatal anæmia following epistaxis. The other lymph glands showed but slight enlargement due to the increased number of leucocytes present. The bone marrow showed but little lymphoid increase; the spleen was greatly enlarged. The changes in the marrow-lymph glands are to be interpreted in this case also as being evidence of the ability on the part of these glands to take up the blood-forming function of the bone marrow.

Leucocytosis.—In cases of pyæmia showing marked leucocyte increase the hæmolymph glands exhibit evidences of increased activity in the cells of the lymphoid areas, as shown by numerous mitoses. The mononuclear eosinophiles are also increased in number, and nucleated red cells and giant cells may also be found.

Experimental Pathology. — In animals whose spleens have been removed the hæmolymph glands show hyperplasia and evidences of increased hæmolysis. In poisoning with hæmolytic agents such as pyrogallic acid, muscarin, toluylendiamin, etc., these glands show greatly increased hæmolysis, the sinuses being packed with phagocytes containing red cells and pigment.

Summary.—By the above cases it is shown that under pathological conditions of either the spleen or bone marrow, the hæmolymph glands may assume either a hæmolytic or a hæmatopoietic function; and that in all conditions characterized by increased hæmolysis the chief seat of the blood destruction appears to be located in the sinuses of these organs. *Aldred Scott Warthin.*

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HÆMOPERICARDIUM.—Blood in the pericardium is a rare condition and of small clinical interest.

Etiology.—In tuberculous and malignant diseases of the pericardium, just as in similar diseases of the peritoneum, the exudate is usually bloody. By hæmopericardium is meant a hemorrhage into the pericardium. This accident occurs under the following conditions:

(1) As a result of traumatic injury from without, or by foreign bodies penetrating the œsophagus from within.

(2) Such hemorrhages have been found associated with scurvy, purpura, leukæmia, and allied conditions.

(3) From rupture of the heart or a cardiac aneurism.

(4) From rupture of an aneurism of the aorta or pulmonary artery. The first part of the aorta is usually involved and it may be by only a pinhole rupture.

(5) From rupture of smaller vessels, namely, one of the coronary arteries, or of vessels in a new growth.

Anatomical Characters.—The quantity of blood varies much. It is greater when the opening in the aorta is small. When an aneurism bursts into the pericardium the average amount of blood usually found is said to be about seven ounces. When the hemorrhage takes place through a small hole, it may reach twenty-four ounces. A traumatic case has been reported in which over six pints of thin, dark, fluid blood were removed from the pericardium in the course of three hours. The patient recovered. The blood may appear as a soft, red, jelly-like clot. A variable amount of serum may have separated from it.

Clinical History.—The condition may occur suddenly. The associated disease, such as aneurism, may have been previously demonstrated. When the hemorrhage takes place through a large rent, immediate or very rapid death usually occurs, either from the effects of the hemorrhage, or from paralysis of the heart. The fatal event may be preceded by grave cardiac symptoms. When the accumulation takes place gradually the patient may live for some time, complaining of cardiac oppression or pain, dyspnœa, and faintness.

Physical Signs.—These are not likely to be noted in the sudden cases. When the progress is slower there is a more or less rapid increase in the area of cardiac dulness; the apex beat disappears and the heart sounds become weak.

Treatment.—In the majority of cases treatment is limited to the relief of symptoms. Hæmostatics are useless. In the protracted cases cardiac stimulants may prolong life. A few patients recover as a result of aspiration of the pericardial sac. *James Rae Arneill.*

HÆMOPHILIA.—(Synonyms: Hemorrhagic Diathesis or Idiosyncrasy, Hæmorrhaphilia, Hæmatophilia, Hereditary Hemorrhage; Ger., *Hämophilie, Bluterkrankheit, Blutsucht, Blutungssucht;* Fr., *Hémophilie.* Otto, an American physician, gave the name Bleeder [Ger., *Bluter;* Fr., *Homme saignant*] to an individual patient.)

Definition.—An hereditary and congenital disease, characterized by a tendency to frequent, obstinate, and prolonged hemorrhages, external or interstitial, spontaneous or traumatic, associated with swelling of the joints.

History.—Our knowledge of this disease is modern. Its historians have been able to find the records of but few probable cases or families prior to the present century, and even these, with the exception of the cases reported by Hochstetter and Sir W. Fordyce, may all be considered doubtful examples, and Legg cannot admit Banyer's case to be beyond doubt. It was left for American physicians accurately to fix the characteristics of the disease. Otto, E. H. Smith, Hay, the Buel brothers, and Coates, in the early part of the last century, and Hughes, Gould, Harris, Hutchinson, Holton, and Dunn, in the past thirty years, have been the chief contributors to its literature. The early writers first demonstrated its hereditary nature. In the second and third quarters of the last century the Germans were prolific workers. Nasse, Rieken, Schönlein, and others, were of the earlier writers. Wachsmuth's monograph, Lange's statistics, Virchow's complete description in his "Handbuch," the monograph of Grandidier, the most complete published, and the article in "Ziemssen's Handbuch," by Immermann, familiarized modern German physicians with the affection. The exhaustive monograph of Legg is the principal contribution made by any English physician.

Etiology.—Sex and heredity are the most important factors in the etiology of hæmophilia. It occurs with greatest frequency in the male, the ratio having been put as high as eleven males to one female. Females do not usually present typical cases, and danger to life is less in the latter sex.

Hereditary disposition is so essential that its absence in a supposed case is sufficient to negative the diagnosis, although, it is true, it is difficult, often impossible, to trace genealogy among the lower classes. Legg believes all or nearly all cases may be traced to an hereditary origin. It has been suggested that this hereditary tendency is the result of the intermarriage of near relations. The fact that it occurs largely among Germans and Jews favors this argument, for in both classes such marriages are common. A common ancestry for all bleeders has been assumed by some authors.

While the females are not the bleeders of a hæmophilic family, the disposition is transmitted through them. The mother, not a bleeder, will transmit the tendency to her sons. They in turn are not likely to conduct the disease to their children, but the tendency passes through the daughters to the grandson. The females that transmit the tendency are usually in perfect health, although cases have been reported, in rare instances, in which the mother, a bleeder, transmitted it to the children of both sexes. The cases are still more rare in which the father, a bleeder, will pass down the tendency to either the sons or the daughters, respectively. A male non-bleeder, in a hæmophilic family, seldom transmits the disease to his descendants. Transmission through the female line is the rule. It is said that the first-born of a family are less liable to become bleeders. This tendency to bleeding may continue for many generations. The Clitherow family, reported by Legg, have exhibited the tendency for two hundred years. The families of Tenna, Switzerland, trace the disposition through five generations.

One peculiarity of bleeder families that has been noted is the marked intellectual power of the individuals; another, the great fertility of the families. Although they have many children, few reach adult age, as the number is much lessened by death from hemorrhages in early life, the mortality at that period being very great.

The disposition to bleed, Grandidier believes, may gradually be lost in a family. He has himself seen one such example, and another has been reported by Legg.

It was noted above that among Germans hæmophilia is common. In fact, some think it a disease peculiar to the Anglo-Germanic races. Dunn's analysis of 219 families shows its distribution about as follows: Germany, 94; Great Britain, 52; North America, 23; France, 22; Prussia and Poland, 10; Switzerland, 9; and the remainder in other European countries. The condition is rarely found in the negro, as has been pointed out recently by Steiner (Johns Hopkins Hosp. Reports, 1900) who reports one case and refers to one other decribed by Hadlock.

Hæmophilia spares no social class, though cases are reported more frequently from the middle and lower classes. Its presence or absence is not influenced by geographical position, and the nature of the food is also without effect on it.

While it has been asserted of many cases of hæmophilia that they arose spontaneously, yet nothing is known of the circumstances contributing to their origin. Legg rightly criticises the case of Mutzenbecher, in which the disease was reported to have arisen *de novo*. A mother, suckling her child, received a great fright, after which the child nursed. Shortly afterward symptoms of hæmophilia developed. Two other sons, also bleeders, were subsequently born, a fact which renders very probable the hereditary transmission in this case.

The circumstances, aside from traumatism, influencing the occurrence of hemorrhage, or which may be the predisposing or exciting causes of the accident, in a person belonging to a hæmophilic family, are the age, the constitution, and the temperament of the individual; the time of day, the season of the year, and the climate. Hemorrhages have not appeared for the first time after the twenty-second year; it is rare for them to appear after the twelfth year, and in the larger number of instances the first attack occurred before the fifth year. Its most usual appearance is about the end of the first year. Hemorrhage from the umbilicus, after sloughing of the cord, is very rare.

Bleeders are always in good health except that they suffer from anæmia. They often have blue eyes, light hair, a thin skin, and prominent veins.

Instances are recorded in which the hemorrhages occurred most frequently at night. The winter season and a cold, damp climate favor attacks of hemorrhage.

Those who consider the disease to be an infectious condition have scanty evidence to support their view. Bacteriological examinations have been entirely negative,

and the manifestations of the disease cannot be explained by the theory of infection.

Symptoms.—The occurrence of frequent, obstinate, and prolonged hemorrhages, spontaneous or traumatic, with their sequelæ, and the joint manifestations, are the essential symptoms.

Legg makes three degrees of hæmophilia: in the first form, the most typical and severe, there is a tendency to every kind of hemorrhage, spontaneous or traumatic, interstitial or superficial. The joint swellings are also marked. In the second form, spontaneous hemorrhages only are present, with rheumatic pains. In the third degree spontaneous ecchymoses alone are observed. The first degree is most often seen in men, the second in women, and the third in members of bleeders' families.

External Hemorrhages.—These are usually capillary. Even a traumatic hemorrhage is of that nature. In one case (Blagden's) a vessel which had been ligated soon gave way on account of the thinness of its coats. One of the cases reported by Dunn had an ulcer in the nostril, from which the spontaneous hemorrhages would spring.

Spontaneous hemorrhages are often preceded by prodromal manifestations. These are usually the symptoms of plethora or nervous symptoms. In children great cheerfulness and liveliness, attacks of crying, morbid fears, and even convulsions, have been noticed. In adults, a good temper, with great restlessness and sensitive emotions, are seen. Pain is often complained of in the locality in which the hemorrhage is about to occur. These prodromal symptoms disappear after the hemorrhage sets in.

The seat of the hemorrhage in the spontaneous form varies with the age—in childhood, the nose and mouth are the most frequent localities; in adult life, in addition to these situations, the stomach, the bowels, the urethra, the lungs, the female generative organs, etc.*

Of interest, in regard to local origin, is the case observed by D. Hayes Agnew (quoted by Osler), in which hemorrhage occurred from cuts and bruises above the neck, but never from those below.

The frequency of occurrence of spontaneous hemorrhages varies. They may occur daily, or at intervals of days or weeks. Resal (Legg) points out two forms of spontaneous hemorrhages. In one they are small in quantity, but frequently repeated, occur without prodromal signs, and always from the same mucous surface. In the other form there are prodromes, the hemorrhage is excessive, and does not usually cease spontaneously. Just as it is impossible to estimate the usual frequency of occurrence, so it is difficult to calculate the length of time the hemorrhages may continue. It is variable, from a moment to weeks, the latter with varying intermissions. Epistaxis is the most fatal of all forms of spontaneous hemorrhages; it has proved fatal in twenty-four hours.

Traumatic hemorrhages are due to blows, cuts, scratches, etc. Even after the most trivial operation the hemorrhage may be fatal. The amount of bleeding from a wound varies in bleeders from time to time—at one time scarcely any hemorrhage will be observed; at another, with the same wound, the bleeding can scarcely be checked. So, too, families appear to differ as to the extent of injury they can suffer with impunity. In one family venesection can be performed; in another the application of blisters would be dangerous (Legg). A superficial lacerated wound is thought to be more serious than a deep, clean-cut one. The healing of a wound may occur with or without suppuration; a profuse bleeding, when it occurs, will prevent healing by first intention.

The amount of blood lost by either form of hemorrhage is sometimes enormous. The famous case of Coates lost half a gallon in twenty-four hours, and three gallons in ten days. Thore's case (Legg), that of a boy aged five, lost nearly a pound from a small wound.

The result of these repeated hemorrhages is a profound, and often fatal, anæmia. Digestive troubles also often develop afterward, and in some cases a depraved appetite has been observed (Buel's).

Severe palpitations, dyspnœa, vertigo, syncope, and other evidences of anæmia may be observed. Enlargement of the heart and systolic murmurs at the base and in the vessels of the neck may be detected. The urine after a hemorrhage frequently contains albumin. Fever has been observed, but is not constant.

Ecchymoses and Petechiæ, Interstitial Hemorrhages.—They may be spontaneous or traumatic. The spontaneous varieties may occur without external bleedings, or may precede a hemorrhage. They are seen in early childhood. They are similar in appearance to purpura, and are seated chiefly on the trunk and limbs. They vary from a pin's head to a quarter of a dollar in size, are tender on pressure, and on disappearing pass through the same changes that an ordinary traumatic ecchymosis does, and exhibit the same play of colors. The traumatic ecchymoses are larger than the spontaneous; they may cause death by hemorrhage into the connective tissue. Blood tumors—hæmatomas—may follow the slightest blow. They may become as large as a child's head and are of a bluish-black color. By some authors it is thought they may arise spontaneously.

Joint Affections.—Legg believes that the joint affections are sometimes due to traumatism. In other instances the origin is not understood, the exciting causes being exposure to cold or dampness, and variations in temperature, particularly in the spring and autumn. The larger joints, chiefly the knee-joint, are the ones affected. They become painful, hot, much swollen, soft, and boggy. Often the affection develops suddenly. Marked constitutional symptoms, as fever, anorexia, and general pains, attend the attack. The pain is increased by motion. The duration of the affection varies from a few days to many months. It may change from joint to joint, or the swelling may alternate with a hemorrhage. Once affected, the patient is liable on the slightest provocation to have a recurrence of the disease. Repeated attacks may lead to destructive lesions in the joints, with crippling and deformity.

Persons affected with hæmophilia often suffer from general rheumatic pains, which vary in degree with atmospheric changes.

It is said that some bleeder families are very sensitive to cold and dampness, and that bleeders are very susceptible to the action of mercury. They are not differently affected by various diseases than are non-bleeders. "They appear more liable to acute affections within the chest" (Legg). Rheumatism and scrofula are said to occur frequently; gout is very rare. Gangrene is especially liable to occur after traumatic hemorrhage.

Morbid Anatomy.—The *blood* is usually normal. After a profuse hemorrhage or a series of small ones, it partakes of the nature of the blood of anæmia. Under these circumstances the white corpuscles have been found in excess, the red in smaller numbers, and the hæmoglobin reduced, *i.e.*, the natural result of hemorrhage. The fibrin is apparently not greatly diminished. The salts are said to be increased. Recent studies indicate an actually decreased coagulability of the blood.

There are no characteristic anatomical changes. Blagden called attention to the thinness and transparency of the vessels. One observer found the large vessels smaller than normal; another, an increase in the size of the superficial, in proportion to the central vessels (Immermann). Wilson thought that the arteries resembled the veins. Fatty degeneration of the heart has been found. Kidd observed proliferation of the endothelial cells in small arteries and veins, and "hydropic degeneration" of the muscular fibres. Klein, Ackland, and other observers fail to confirm these studies. The joints, when involved, are the seat of blood extravasation; not only the cavity but the tissues around are infiltrated. Bowlby has shown that the changes in the articular structures cannot be attributed to the mere effusion of blood. As in arthritis deformans, the cartilaginous covering of the articular ends becomes fibrillated, and in the parts most exposed to friction may be eroded and inflamed. There is also the same tendency to the formation of ecchondroses which in time may become osteophytes. Unlike arthritis deformans, fibrous adhesions may form, resulting in limitation of motion.

Pathology.—This is obscure. While a congenital fragility of the vessels is said to exist, it has never been proven. It has been observed that bleeders always suffer from prodromic symptoms, which are due to an increase in the volume of the blood. Hence, variability in the volume has been invoked as causal. Disturbed innervation, diminishing from time to time vascular tone, is thought by many to be the pathological factor. It is merely an hypothesis, as have been all suggestions thus far put forward regarding the pathology of hæmophilia. As suggested by Eichhorst, it may be possible that the changes in the blood are of a chemical nature, not to be discovered by our present methods.

Diagnosis.—Many cases of a hemorrhagic diathesis occur, the exact nature of which it is difficult to determine. Especially is it so with this diathesis in women. If, however, there is no history of heredity, if the hemorrhages did not occur in early life, prior to twelve years, and if she should not transmit it to her sons, it is not likely to be a case of hæmophilia. The hereditary predisposition, the spontaneous and traumatic hemorrhages setting in early in life, and the joint symptoms, are conclusive evidence of the nature of a case. Cases arise, no doubt, in which heredity cannot be determined, and which may yet be the founders of a stock of bleeders. One of the writer's cases is possibly of this class. Since the age of five months spontaneous bleedings, often to syncope, have occurred; since puberty (the patient is now twenty-two years of age) plethoric prodromes have preceded the attacks. The patient undertook to learn carpentering, but had to give it up on account of traumatic hemorrhages. Extractions of teeth have caused serious hemorrhages. Annually the patient is afflicted with severe joint symptoms, rheumatic in character.

Umbilical hemorrhage in the new-born is not due, or but rarely, to hæmophilia, but is usually the result of liver disease or syphilis. The hemorrhagic conditions of the new-born, probably infectious in character, referred to as *transitory hæmophilia, spontaneous hemorrhage, or infectious hæmophilia of the new-born*, can be distinguished from true hæmophilia by their transitory character, the occurrence of spontaneous hemorrhages in different parts of the body, their acute course, their self-limited character, the early appearance of symptoms, and the frequency of umbilical hemorrhage, jaundice, and high fever. Purpura, simplex and hæmorrhagica, scurvy, peliosis rheumatica, toxic and septic purpura, must be excluded.

Prognosis.—The first bleeding is rarely fatal. The younger the patient, the more grave the prognosis. Hæmophilia is more serious in boys than in girls, and more so in the delicate than in the strong. With advancing years the prognosis improves. Often, especially if the patient suffer from joint complication, the tendency to hemorrhage may disappear for a number of years. Long-continued oozing is a serious form of hemorrhage. The bleeding after the extraction of a tooth is very serious, as is also the hemorrhage from lacerated and contused wounds. Face injuries are also serious.

Treatment.—If a person suffering from hæmophilia present the symptoms indicative of an attack of hemorrhage, an active purgative should be administered and the patient put on low diet without stimulants. Often an attack is averted thereby. Otto advised the sulphate of soda; Fordyce, the sulphate of magnesia. Venesection has been resorted to under similar circumstances. If a spontaneous hemorrhage occur, opinions differ, whether to check it or not is advisable. Wachsmuth, Legg, Frish, and others claim that apoplectic symptoms or grave dyspnœa may arise if it is checked. The latter author advocates venesection. It is certain, if the hemorrhage is not too profuse, a bleeder always feels better after it. When it is decided to check the hemorrhage the method of treatment depends largely on the seat of the bleeding, and is similar to the plan adopted in the traumatic varieties if it arise from external parts. Internal remedies are more frequently required in the spontaneous form, but are used in both. Ergot or ergotin, the latter by mouth or hypodermatically, hamamelis, gallic acid, opium, alum, turpentine, and preparations of iron, have been used with benefit. Legg recommends the tincture of the perchloride of iron, thirty to forty minim doses every two hours, together with a purge if there is no intestinal hemorrhage. Transfusion may be resorted to when external and internal remedies are used without avail.

The principles that govern the treatment of any traumatic hemorrhage apply in a case of hæmophilia. A few of the usual methods must be modified as follows: Ligation of the artery should never be performed; the actual cautery should be used as a last resort only; care in exercising pressure should be used on account of the possibility of ecchymoses and sloughing taking place; plugging of the nares should only follow failures to control bleeding by other means. The wound should be cleansed, rest secured, compression used, the artery pressed upon if possible, cold, and especially ice, or very hot water applied to the bleeding parts, and finally, styptics, as the astringent salts of iron, preferably Monsel's solution, the nitrate of silver, alum, and other well-known astringents should be tried. The famous styptic of Pancoast is a clean and most efficient application. Gelatin in five-per-cent. solution may be used. A hemorrhage from the extraction of teeth may be controlled by means indicated above, by replacing the tooth in its socket, by taking a plaster-of-Paris cast of the jaw, by retaining the jaw in position by a roller bandage, or finally by the cautery.

Recently the physiological principles of coagulation have been applied to the treatment of hemorrhage. A. E. Wright recommends the local use of a solution of fibrin ferment in an aqueous calcium-chloride solution. Schmidt and von Manteuffel have controlled a hemorrhage after tooth extraction by application of Schmidt's zymoplastic substance after cocainization. For the epistaxis Wright also recommends the inhalation of carbon dioxide through the nostrils.

Traumatic hemorrhage must be prevented by avoiding all surgical operations on a person affected with hæmophilia, unless life is in peril, and by preventing him from engaging in any occupation in which he is liable to receive an injury. A tooth should not be extracted under any circumstance.

In the interval between the hemorrhages the patient should use a generous but non-stimulating regimen, should live in the fresh air, should avoid exposure to cold and dampness, and should be free from all excitement. Iron and cod-liver oil should be used, unless plethora should ensue. The prolonged use of the Rock Bridge alum water, of Virginia, has been of service in some cases, in reducing the frequency of hemorrhages.

Surgical principles must be invoked in the treatment of the joint affections. Residence in a damp locality, or exposure to cold and dampness is particularly likely to cause and aggravate these complications. If they are obstinate, a warm, dry climate must be sought.

The marriage of the daughters of a family of bleeders should be prohibited. In this way only can the advance

* The following statistics are interesting, mainly from Grandidier, also quoted by Legg, and by Osler. Spontaneous Hemorrhages—localities and frequency: From the nose, 169 times; the mouth, 43; stomach, 15; bowels, 36; urethra, 16; lungs, 17; cerebral hemorrhage, 2; swollen place on scalp, 4; tongue, 4; finger-tips, 4; ear, 5; eyelids, 2; tear papilla, 3; female generative organs, 10; ulcer of skin, 2; navel (long healed), 2. Fatal hemorrhages have occurred from the following wounds: Blow on head, 11 times; slight scratches on skin or abrasion of dermis; laceration of frænum of the lip; slight cut in a duel wound, bite of the tongue (7 cases); fall on the mouth; blow on the nose; blow of a stone on the finger; cut in paring the nails; fall on the head with meningeal hemorrhage (2 cases, brothers); and rupture of the hymen on the wedding night.

Deaths after operations: Cutting of frænum linguæ, 1; leeching, 5; venesection, 4; blister, 2; extraction of tooth, 12; circumcision, 8; cutting umbilical cord, 4; vaccination, 2; fistula, stone, ligature of carotid, of radial, of ulnar, of femoral arteries, amputation of arm and of thigh, 1 each; phimosis, 2.

of the disease be checked. If the brothers are marked subjects of the disease their marriage should be prevented.

J. H. Musser.
R. M. Pearce.

HÆMOPTYSIS.—Etymologically considered, the word hæmoptysis signifies the expectoration of blood, without regard to its source or quantity. Practically, however, the term has come to indicate the expectoration of pure, or of almost pure blood, emanating from the respiratory organs, viz., from the larynx, trachea, bronchi, or lungs. The expectoration of rusty, prune juice, or greenish sputa, in pneumonia; of blood-streaked sputa in bronchitis; of jelly-like masses, as in cancer; or of chocolate-colored material in hepatic abscess, does not, therefore, properly constitute an example of hæmoptysis in the ordinary acceptation of the word. The term is, however, applied by some authors to the expectoration of blood in sufficient quantities to be microscopically discovered, even if the sputa containing it be largely composed of other constituents.[1] The spitting of blood which, having been extravasated at points more or less remote from the respiratory organs, and having reached the pharynx, has gravitated into the air passages (as in hæmatemesis, and in buccal, œsophageal, or nasal hemorrhages), may be designated as pseudo-hæmoptysis or spurious hæmoptysis. The expectoration of blood follows bronchorrhagia and pneumorrhagia in so large a proportion of cases that only hæmoptysis due to these causes will be considered in this place, the reader being referred, for information regarding laryngeal and tracheal hemorrhages, which are comparatively rare, to the articles in this HANDBOOK treating of diseases of the larynx and trachea. An absolute discrimination between bronchial and pulmonary hemorrhage being very difficult, and of slight importance from a therapeutical standpoint, will not be insisted on in the present article. Furthermore, as the etiology and pathology of hæmoptysis are fully discussed under other headings (the various diseases of the heart, lungs, bronchi, larynx, etc.), it seems best to omit, in the present article, all discussion of this part of our subject.

SYMPTOMATOLOGY.—The clinical history of hæmoptysis embraces: I. Prodromal Symptoms; II. Actual Symptoms, or those of the attack, and III. Consecutive Symptoms, or sequelæ.

I. *Prodromal Symptoms.*—Premonitory symptoms are often absent in hæmoptysis, particularly if it be due to traumatic causes, to the rupture of an aneurism, or to incipient phthisis.[2] Under these circumstances the hemorrhage occurs either without an evident exciting cause, while the patient is quiescent, or it is precipitated by some physical effort, such as lifting, riding, running, or dancing. Subjective precursory phenomena generally precede hæmoptysis from active or passive congestion, and in cases of recurrent hæmoptysis. The most noteworthy premonitory symptoms are cold extremities, accelerated pulse, vertigo, cephalalgia, epistaxis, thoracic oppression, constriction, distention or warmth, a dry hacking cough, vague general discomfort, slight dyspnœa, and cardiac palpitation. An objective prodromal symptom is cerebral congestion, accompanied by flushing of the face, throbbing of the carotids, and augmented rapidity and force of the pulse. Important suggestions relative to the possible occurrence of hæmoptysis may be derived from the previous history, particularly if this includes evidences of phthisis, of cardiac disease, or of one of the dyscrasiæ. Prodromes may be observed several days before a pulmonary hemorrhage, recurring at irregular intervals before the attack, or they may directly precede the hæmoptysis.

II. *Actual Symptoms, or those of the Attack.*—In an ordinary case of hæmoptysis, whether inaugurated by premonitory symptoms or not, the patient experiences a sensation such as might be referred to the trickling of a warm liquid beneath the sternum, perceives a saline, sweetish taste, and, on clearing his throat, expectorates blood without effort. Cough, attended by characteristic large, moist, tracheal and bronchial râles, now begins, or may have preceded the first bloody expectoration, and each paroxysm of coughing leads to the expulsion of a variable quantity of blood, which is generally fluid, arterial in color, of alkaline reaction, frothy from the admixture of air, and often mingled with mucus or muco-pus. If the quantity of blood be small, and its expulsion gradual, it is often venous, or even black in color, and more or less completely coagulated. Coagula emanating from the lung are usually of low specific gravity, on account of the air bubbles which they contain. Blood casts of the bronchi may be expectorated. The quantity of blood rejected varies within wide limits. In some cases only a few drachms are expectorated; in others, particularly in hæmoptysis from ruptured aneurisms, from phthisical or other cavities and in pneumorrhagia, several pounds may be rejected. If the blood is so abundant that it fails to find a ready exit through the buccal cavity, which rarely happens, it flows in an almost uninterrupted current from both nose and mouth, quickly producing syncope, or even convulsions and death. A certain quantity of blood is often swallowed, giving rise to hæmatemesis or to melæna. The uninterrupted duration of hæmoptysis is very variable, ranging from a few minutes to several days. A single attack sometimes occurs, but hæmoptysis is generally recurrent. The intervals between successive attacks vary from a few hours or days to months or years. Eichhorst affirms that malarial hæmoptysis recurs periodically at the time when a febrile paroxysm should be expected. A similar periodicity may obtain in amenorrhœal hæmoptysis. Hæmoptysis manifests a strong tendency to self-limitation, but it may, in exceptional cases, especially when dependent upon phthisis or on hæmophilia, recur so often as to cause death by exhaustion. Only in rare instances does the spitting of blood prove immediately fatal from rapid asthenia, or from asphyxia due to obstruction of the air passages.

The first sight of blood, especially in an initial hæmoptysis, engenders characteristic excitement and terror on the patient's part; but when a few safely surmounted paroxysms have demonstrated their comparative innocuousness, his mental equilibrium is often little disturbed by the onset of a new hemorrhage. In cases of moderate hæmoptysis the constitutional symptoms, aside from mental perturbation, betrayed by an anxious expression and by gentle tremor, are at first those of slight shock, *i.e.*, pallor, faintness or nausea, chilliness, and enfeeblement of the pulse. These symptoms are succeeded by congestion of the face and by augmented force and frequency of the heart's action, which phenomena gradually disappear after the cessation of the hemorrhage. In cases of more copious hæmoptysis the facial congestion gives place to returning pallor, the pulse becomes irregular and compressible, the respiration suspirious, the surface clammy, and the mind apathetic. Restlessness, tinnitus aurium, urgent thirst, falling temperature, nausea, muscæ volitantes, dimness of vision, increasing asthenia, transient syncope, and convulsive twitchings are symptoms which complete the clinical picture. In the worst cases of hæmoptysis the phenomena just enumerated appear in rapid succession, and death results either from syncope or from suffocation, due to obstruction of the air passages by fluid and coagulated blood. Hæmoptysis from hemorrhagic infarction generally ensues forty-eight hours, or even later, after the occurrence of pulmonary embolism, which, if the embolus be of septic character, is frequently announced by a chill. For the symptoms peculiar to hemorrhagic infarction, *vide* the article on *Lung, Infarction of the.* Hæmoptysis from the other predisposing and exciting causes described under the caption *Etiology*, as cancer, aneurisms, abscess, and gangrene, will, of course, be accompanied by the symptoms peculiar to these diseases. That pulmonary or bronchial hemorrhage and hæmoptysis are not convertible terms is shown by the fact that hemorrhages from the lungs sometimes occur without giving rise either to the prodromal or to the actual symptoms of hæmoptysis. These symptoms may be absent either if the

quantity of extravasated blood be insignificant and undergo reabsorption, or if it be so large as to preclude the possibility of its expectoration by causing sudden death.

The *physical signs*, aside from those due to the diseases causing hæmoptysis, are usually unimportant. If the attack be slight, there may be no physical signs, or moist râles may show the presence of blood in the alveoli, bronchioles, and bronchi. No additional signs will be discovered, unless considerable consolidation has been produced by the accumulation of blood in the air passages and the interstitial pulmonary tissues, when dulness, and, provided that the bronchi be unobstructed, broncho-vesicular or bronchial respiration and increased vocal fremitus may be found. If the bronchi are completely or considerably obstructed, there will be diminution or absence of respiratory and of vocal signs.

TREATMENT.—The indications for the treatment of hæmoptysis are: first, the arrest of an actual attack; second, the prevention of its recurrence by treatment of the causative affections; and finally, the relief of its consecutive symptoms.

Energetic therapeutical measures are not indicated in mild attacks of hæmoptysis. Inasmuch as local depletion exerts a beneficial effect upon pulmonary congestion, which is the cause of most slight hemorrhages, it is advisable not to interfere with nature's efforts for the relief of excessive intravascular tension, but to second them by measures tending to the accomplishment of the same end. Whether, therefore, the congestion be active or passive, perfect quiescence, in a semi-recumbent position, should be strictly enjoined upon the patient. The statement that hæmoptysis is useful in relieving pulmonary congestion, and that its occurrence, given the usual pre-existing congestion, is desirable, should be confidently made, and is usually effective in quieting the patient's apprehensions. The sick-room must be kept cool, well ventilated, and free from all persons whose demeanor would tend to excite misgivings in the patient's mind. The bed-coverings are to be so light as not to compress the chest. The patient should be frequently reminded persistently to restrain his desire to cough. Mild revulsive measures, such as the application of mustard leaves, or of dry cups, to the exposed parts of the chest, and of stimulating pediluvia, are in order, as is derivation by means of a gentle saline purgative. If the pulmonary hyperæmia be active, cardiac sedatives may be employed, one of the best being the tincture of aconite, in two-drop doses, every twenty minutes, until a reduction in the force and frequency of the pulse, or tingling in the throat and finger-tips is observed. Should the hyperæmia be passive, as in uncompensated heart lesions, the tincture of digitalis, in ten-drop doses, should be administered, every hour, for the purpose of strengthening the heart's action. In cases of more profuse or protracted hæmoptysis the same rules regarding the patient's position and surroundings should be rigidly enforced, and more potent therapeutical measures adopted. If the hemorrhage be occasioned by excessive active hyperæmia, the patient being strong and plethoric, or by so great passive congestion as to threaten cardiac paralysis, venesection, to eight or ten ounces, affords prompt relief. This treatment is particularly adapted to the initial hæmoptysis of tuberculosis, and to pulmonary hemorrhage from rarefaction of the atmosphere, from the inhalation of irritating substances, and from violent physical exertions.

If the patient will not submit to the operation of phlebotomy, active congestion may be measurably controlled by a brisk saline purgative, by emetic doses of ipecac, as recommended by Trousseau and Graves, and recently advocated by Massina and Peter, but which must be avoided in hæmoptysis from cavities because of its tendency to prevent closure of bleeding vessels, or by the following therapeutic agents, which are useful in all varieties of profuse pulmonary hemorrhage. The most potent of these is cold, which is best applied by means of an ice-bag, of moderate weight, placed over the primary bronchi, or on that part of the chest to which the detection of râles points as the probable seat of hemorrhage. Small pieces of ice should be constantly dissolved in the mouth and swallowed. The best form of nourishment is cold milk, taken in quantities of eight ounces, at intervals of two or three hours. Physical examinations should be studiously avoided, as calculated to increase and to excite hæmoptysis, and as affording no important results. Ligation of the extremities, which is sometimes a very efficient hæmostatic measure, acts by retaining the venous blood in the limbs, while the arterial current is not arrested; but it must be cautiously employed, lest syncope or venous thrombosis be induced. These untoward results may be prevented by the simultaneous ligation of only two members, by leaving the ligatures in place for only a few minutes, consecutively, and by removing them so soon as hæmoptysis ceases. Ligation must, naturally, be undertaken only under the physician's immediate direction and supervision. Ergot is probably the most efficient hæmostatic remedy. It may be exhibited in the form of the fluid extract, in doses of one or two drachms, diluted with an ounce of water, every half-hour or hour, until the hemorrhage ceases or a decided diminution in the force and frequency of the pulse is observed. Should the stomach prove rebellious, half an ounce of the fluid extract, diluted with an equal quantity of lukewarm water, may be given by rectum, and repeated every hour until the physiological effects are produced. If it is desirable that the action of the drug be very speedily exerted, half a drachm of the fluid extract, or three grains of ergotin, dissolved in equal parts glycerin and water, should be subcutaneously administered, every half-hour, until the desired result is obtained. One grain of opium, or one-fourth grain of the sulphate of morphine, preferably in fluid form, must be immediately administered for the purpose of checking cough, and of inducing mental and physical quietude. The opiate should be repeated in doses of half the size mentioned, every two hours, until hemorrhage ceases or the physiological effects of the medicine are obtained. The most speedy and satisfactory method of administering the narcotic is by hypodermatic injection of the sulphate of morphine, particularly if simple emesis or hæmatemesis coexist with the hæmoptysis. Opiates are contraindicated when fatal accumulation of blood in the air passages is threatened. At such times expectoration should be encouraged and facilitated. Many authorities recommend that several teaspoonfuls of dry common salt be administered, if no other remedy be at hand, largely for the desirable moral effect resulting from medication in general, and partly on account of the unexplained but well-attested restraining effect of salt upon hæmoptysis. Inhalations of astringents, preferably of Monsel's solution, or of the *liquor ferri sesquichloridi*, diluted twenty-five times with water, and administered in the form of spray generated by an atomizer, are sometimes useful. The acetate of lead in two-grain doses, or gallic acid in twenty-grain doses, every three hours, is often administered internally, although the question of their value is still debatable. Bartholow extols the virtues of turpentine in hæmoptysis dependent upon hæmophilia and purpura.[3] It may be exhibited by mouth, in twenty-drop doses, in emulsion, or on sugar, or its vapor may be inhaled, for one-quarter hour, at intervals of two hours.

After-Treatment.—The objects of the after-treatment are the prevention of a recurrence of hæmoptysis, and the relief of its consecutive symptoms. The former indication is best fulfilled by the removal of predisposing morbid conditions, and by the avoidance of exciting causes. Many of the diseases predisposing to hæmoptysis, although, unfortunately, not amenable to curative measures, may be favorably influenced by judicious treatment. Pernicious malarial fever, of the hemorrhagic type, may be controlled by quinine and by other antiperiodics. Vicarious amenorrhœal hæmoptysis is to be combated by means tending to excite the normal menstrual flow, and scorbutic pulmonary hemorrhage by good food and vegetable acids. In cases of puerperal or marantic venous thrombosis, the utmost quietude should be enjoined, in