tionship between the ptomaïns and the vegetable bases than that which actually exists. But the development of the chemistry of the ptomaïns has shown that those of them which have the most complex molecular structure are more simple in constitution than their nearest relatives among the vegetable alkaloids, and very much more simple than the ester-alkaloids, such as atropin, or the still more complex polynuclear alkaloids, such as morphin.

While the parasitic bacteria probably cause synthetic combinations, as in the generation of the toxins, the function of the saprophytic bacteria, which alone are of interest in this connection, is essentially analytical. It may be considered to be within the limits of possibility that, starting with the complex protein molecule, a substance having the constitution of a vegetable alkaloid might be produced during the series of hydrolytic decompositions caused by the saprophytes. But all observations are against such an hypothesis, no such substance has been found among all of the putrid products which have been obtained. Moreover, the known products of decomposition of the proteins by other means, through the protamins, the hexon bases, the nucleins, the purin bases, the amido acids, and the amins, lead in a direction not tending to the formation of the alkaloids, except in the case of the formation of the pyridic bases by the action of heat. The formation, however, of pyridic and, particularly, of hydropyridic ptomaïns as late products of putrefaction indicates the possibility that the analytical processes of the saprophytes may be followed by the transformation of certain of the acyclic products into heterocyclic compounds, in a manner similar to the conversion of pentamethylene hydrochlorid (cadaverin) into piperidin: $H_2N.(CH_2)_5.NH_2 : HCl = NH_4Cl + C_5H_{11}N$.

No ptomaïn has been discovered which corresponds in all of its characters with a vegetable alkaloid. Two substances alike in all respects are two samples of the same substance, and no vegetable alkaloid is known which is also a product of putrefaction. But there are certain vegetable alkaloids which resemble certain ptomaïns in several of their properties, while differing in others, and, at the same time, exhibit no known well-marked and distinctive chemical reactions. Probably the closest resemblance is that between the so-called cadaveric coniïn and true coniïn. Both are liquid, oily, volatile, intensely alkaline, similar in odor, soluble in water and in petroleum ether, and form precipitates with platinic chlorid, auric chlorid, mercuric chlorid, and several of the general reagents. They differ in that coniïn is actively poisonous, while the ptomaïn has been found to be inert, except in one case in which Otto obtained a poisonous substance, which probably owed its toxicity to the presence of another ptomaïn. The "cadaveric coniïn" is, however, not coniïn (*a*-propyl piperidin) but cadaverin (pentamethylenediamin). Therefore, while it must be admitted that we have no method to separate coniïn from a putrid cadaver, and, in the minute quantity in which it would probably be obtained, distinguish it from cadaverin, or from a mixture of ptomaïns containing cadaverin; it may also be anticipated, the two substances not being identical, that distinguishing characters of sufficient delicacy will be found to exist.

Attempts have been made to find a characterizing reaction common to all ptomaïns, whereby they might be distinguished from the vegetable alkaloids. Among those suggested were the reactions of Brouardel and Boutmy, and of Trotarelli. But no such reaction can exist, because the ptomaïns do not constitute a distinct chemical class, but include among their number representatives of several chemical classes of tolerably diverse character; and for the further reason that, while the great majority of ptomaïns are non-alkaloidal, some are pyridin or hydropyridin derivatives, as are also the alkaloids. As the "general tests" for the alkaloids for the most part form precipitates with ptomaïns, albumins, and nitrogenized bases other than alkaloids, they are only of negative value in the rare cases in which they fail to react, or of confirmatory value by reason of peculiarities in the qualities of the precipitates which they produce with certain alkaloids.

The ptomaïns which are frequently referred to as "strychnin-like" or "morphin-like" are quite as noticeable because of the differences from those alkaloids which they present, as by reason of their resemblances thereto.

The bases obtained by Brieger from the cultures of the tetanus bacillus, while resembling strychnin in the production of tetanic spasms, differ from the alkaloid in not giving the color reaction, in not being bitter, and in crystalline form. Amthor's product was neither bitter nor crystalline, nor did it give the color reaction of strychnin, but an entirely different one. In Ciotto's case the material supposed to have been strychnin appears to have given the color reaction, as Selmi, who differed from Ciotto in his conclusions from the observed facts, concedes this much. But the colors obtained are not described beyond the statement that they were "the colors proper to the reaction of strychnin," and Selmi, in the course of the same paper, says that aspidospermin "behaves with bichromate as does strychnin," while in fact there are marked differences between the color reactions of strychnin and of aspidospermin under like treatment. But Ciotto's substance was not shown to be either crystalline, alkaline, or distinctly bitter, and when administered to frogs in quantity sufficient to kill them it did not cause tetanic spasms. Lombroso and Dupré obtained from the spoiled maize which is regarded as the cause of pellagra a mixture of bases (pellagrozein) which is bitter in taste, causes tetanus in frogs, and is said to give the color reaction of strychnin, but whose reaction only resembles that of strychnin in its initial stage. It also differs from strychnin in its crystalline form, and in that its sulfuric-acid solution assumes a permanent violet color when exposed to vapor of bromin. But pellagra is confined to a comparatively narrow strip of territory (six degrees) in the south of Europe. Moreover it is not proven that the constituents of pellagrozein are bacterial products; certainly they are not cadaveric ptomaïns.

We find reference in toxicological literature to alleged "morphin-like" ptomaïns in three cases. In the Sonsogno case, in Italy, the substance mistaken for morphin did not give either the Pellagri reaction, the ferric-chlorid reaction, the nitric-acid reaction, or the Erdmann reaction; and it only resembled morphin in that it behaved as a reducing agent toward iodic acid, auric chlorid, and certain other reducible substances. In the Portuguese case of Urbino de Freitas not one of the three most nearly characteristic of the tests for morphin, the Pellagri, the Husemann, and the ferric chlorid was even tried, and the experts erred in asserting the presence of morphin in a cadaver upon the evidence of a not entirely satisfactory Fröhde reaction, the iodic reaction, and the formation of a green color with the Lafon test, the last a reagent whose merits had been insufficiently tested. In the Buchanan case in New York, Vaughan makes the unwarranted assertion that "all the tests obtained by the experts were duplicated with putrefactive products." This alleged duplication was attempted in open court, in the presence of the author, with the following results: The ferric chlorid gave a brilliant grass-green, not a blue color. The Husemann was improperly applied, and failed, as it would have done had morphin been present. The Pellagri was also improperly applied, and failed, as it would have failed with morphin in the manner in which it was used. The Fröhde gave a distinct orange color, passing to yellow, in place of the purple, passing through blue, dirty green, and yellow to pink as it gives with morphin. The nitric acid gave an immediate yellow, but not the orange-red changing to yellow of morphin. The iodic acid gave a faint reaction similar to that obtained with morphin and with many other reducing agents. The six "duplications" therefore consisted of five failures to produce similarity, and one faint resemblance.

Whether a vegetable alkaloid is detectable in cadaveric material or no depends now, as it did before our knowledge of the existence of the ptomaïns was gained, upon the existence or non-existence of a sufficient number of well-marked physical qualities, chemical reactions, or physiological actions of that alkaloid. If such exist, and are not duplicated or interfered with by ptomaïns, the alkaloid may be detected with certainty. If they do not, it cannot be, ptomaïn or no ptomaïn. In the frequently cited case of General Gibbone in Rome, it was shown by Selmi that the substance which was claimed to have been delphinin could not be that alkaloid, because it did not have its physiological action. But this affirmative proof was simply confirmative of the already convincing argument that delphinin has no physical characters and gives no chemical reactions which are sufficiently distinctive to permit of its identification when present in the minute quantity obtainable in such an analysis.

That the presence of ptomaïns may militate against the detection of a vegetable alkaloid, both by interference with its reactions and by similarity of its physiological action, is well shown in the case of atropin. From the viscera of a woman, after nine months' burial, the author obtained a residue (which would have contained atropin had it been present) which caused wide dilatation of the pupil and insensibility to light, persisting for several hours, gave the peculiar crystals with bromin in hydrobromic acid, and reddened phenolphthalein; but did not produce Kratter's crystals, or respond to the Vitali reaction. But portions of the same residue, to which atropin sulfate was added in notable proportion, also failed to give the Vitali reaction.

While, therefore, the presence of ptomaïns may interfere to prevent the detection of certain alkaloids which may be actually present in the materials examined, we know of no instance in which a ptomaïn or mixture of ptomaïns has given reactions which would cause it to be mistaken for an alkaloid possessed of sufficiently distinctive characteristics to permit of its certain identification in the assured absence of all ptomaïns. A survey of the reactions manifested by the reputed "alkaloid-like" ptomaïns shows that their similarities to those of the vegetable alkaloids consist chiefly in resemblances of physiological action, and in their behavior toward "general reagents" and toward iodic acid. We have stated above that the general reagents play only a very secondary rôle in the identification of vegetable alkaloids, and iodic acid is merely a test for reducing agents, which is used for morphin because the reducing action of that alkaloid is one of the characters which differentiates it from most of the other vegetable bases. If we except one veratrin reaction obtained by Brouardel and Boutmy, the somewhat doubtful case of Ciotto mentioned above, and the statements of Vaughan, there is no reference in toxicological literature to a ptomaïn which has given a well-characterized reaction of a vegetable alkaloid.

Rudolph A. Witthaus.

PTYALIN. See *Saliva*.

PTYALISM. See *Mouth, Diseases of*, in THE APPENDIX.

PUBERTY.—DEFINITION.—The term puberty was formerly used to designate the whole period of sexual development, and is still occasionally so used. Jules Voisin[1] refers to the age of puberty as the time between the ages of fourteen and twenty-two years. In general, however, writers now confine the term puberty to the initiatory and formative period of sexual development, while to the entire period of sexual development is applied the broader term adolescence.

The Age of Puberty.—The average age of puberty in the male is 14.3 years; the average age of first menstruation in the female is about 13.7 years. The period differs according to race and climate, and may be hastened by the reading of erotic literature, by suggestion, and by an early participation in social life.

The pubescent period begins in girls at least a year and a half before the first menstruation. This preliminary period is, according to Armand Delpeuch,[2] the time when the child needs the greatest care, for at this time the trunk is relatively the shortest, the thorax relatively the narrowest, and the heart relatively the smallest, and at the same time the child is doing his most rapid growing. The female makes the most rapid growth from twelve to fourteen, and the male from fourteen to seventeen. The pubescent child should, therefore, be guarded against too violent exercise, and yet should be provided with much pure air.

Physical Changes.—A general physical disturbance takes place, shown by the rapid bodily growth, the elongation of the vocal cords, increased pilosity, a change in the size and condition of the reproductive organs, and a profound disturbance of the nervous system. Indeed, muscles, blood-vessels, glands, and all organs share in the general disturbance.

Psychical Changes.—The psychical no less than the physical being is affected by puberty. Marro of Turin[3] says that "puberty exercises a notable influence upon the psychical life, which is manifested, in some instances, by giving to mental symptoms qualities which they did not have before or which they had only to a slight degree, and in others by preparing a way for the invasion of psychoses. Hereditary predisposition is the prominent cause of the affection."

Periodic Phenomena.—The most notable accompaniment of puberty in the female is *menstruation* (which see). In the male there is throughout sexual life and beginning with puberty a periodicity which is probably analogous to that of the female. The seminal vesicles possess glandular walls and retain the secretion of these walls for periods varying from one to four weeks normally.

The retained secretion distends the walls, and through pressure stimulates nerves which pass to the erection centre, which is in turn excited.

By day erotic emotions are easily aroused; at night when the subject sleeps he may experience an erection accompanied by an erotic dream and culminating in an emission ("nocturnal emission"). In this way is the pressure of accumulating vesicular secretion relieved and the subject should pass another period free from sexual impulses. After the period of pubescence is established, the testes of the male form spermatozoa rapidly under sexual excitement and slowly during periods which are free from excitement. In neither case do the spermatozoa pass into the seminal vesicles; they are retained in the testes, the vasa deferentia, and ampullæ. The testes form not only the spermatozoa but a milky fluid in which the spermatozoa float. The secretion of the testes contains a mysterious principle whose reabsorption gives to the male those characteristics which we recognize as distinctive of virility. In the nocturnal emission coming without sexual excitement no spermatozoa are lost; hence these emissions cause no depletion. *J. W. Hall.*

[1] St. Louis Med. Review, October 13th, 1901.
[2] La Presse méd., August 17th, 1898.
[3] St. Louis Med. Review, October 13th, 1901.

PUERPERAL INFECTION.—(Puerperal fever, puerperal sepsis, puerperal septicæmia, childbed fever.)

DEFINITION.—An acute contagious disease of the puerperium characterized by an inflammation of some part of the genital tract, and frequently associated with a variety of systemic manifestations. It is caused by a number of pathogenic and saprophytic micro-organisms.

HISTORY.—The disease has been known from the earliest times. Hippocrates, Galen, Avicenna, and others of the early writers, as well as many in the sixteenth, seventeenth, and eighteenth centuries, have described cases. In the first half of the nineteenth century there were many frightful epidemics of the disease.[1] It was the scourge of the great lying-in hospitals of Europe, and patients were decimated regularly by its ravages. Oliver Wendell Holmes in his essay, "The Contagiousness of Puerperal Fever," published in 1843, logically proved the contagious nature of the disease; and Ignaz Philipp Semmelweiss, who recognized the identity of the disease with wound infection and devised a practical method

of hand disinfection, published, in 1861, his monograph, "Die Etiologie des Begriffs und die Prophylaxis des Kindbettfiebers." He introduced hand disinfection in the great Maternity Hospital in Vienna, and immediately the mortality fell from ten per cent. to about one per cent. The teachings of these classical essays were bitterly opposed, however, and it was not until after Lister had introduced antisepsis in surgery that its importance in obstetrics was generally recognized. The ancients attributed the affection to a retention of the lochia, and this has been the most common explanation until recent times. After the introduction of antiseptic and aseptic methods in obstetrics, there was a marked reduction in the mortality from puerperal infection in hospital practice. At the present time, in the better maternity hospitals, the mortality is a small fraction of one per cent. In private practice, however, cases are frequently seen, especially in the hands of untrained midwives and careless or ignorant physicians.

Etiology.—Puerperal infection is essentially wound infection. As Semmelweiss and others have shown, the *materies contagii* is carried to the parturient woman on the hands of those who have made recent autopsies or dissections, or who have dressed suppurating or inflammatory cases of any kind. With the advance of our knowledge of the causal relation of bacteria to disease in the last fifty years, the infectious nature of the disease has been clearly established. Puerperal infection, however, is not a specific disease, but like wound infection in general may be caused by a variety of micro-organisms. Among these the streptococcus is found most frequently, and is present in nearly all the fatal and most serious cases. The gonococcus comes next in frequency of occurrence, but causes much less serious infections, and few fatal cases have been caused by it alone. The staphylococci, the colon bacillus, and a number of putrefactive anaërobic bacilli are frequently found. Among the rare forms are the gas bacillus (aërogenes capsulatus,[2] Welch), the peumococcus,[3] the diphtheria bacillus[4] (Bumm, Nisot, Williams), and the typhoid bacillus[5] (Williams). In addition to these a number of unidentified aërobic bacilli have been found.

Mixed infections, as the streptococcus with the colon bacillus, the staphylococci with anaërobes, etc., occur more frequently than infections with a single organism.

The recently emptied uterus with its lacerated bleeding surface presents a peculiarly favorable field for the invasion and growth of micro-organisms. The retention of blood clots and fragments of the placenta or membranes favors infection. Incomplete contraction of the uterus with consequent dilatation of the lymphatics and the formation of large thrombi in the venous sinuses is also a factor, for it is along these vessels that infection most readily extends.

Source of Infection.—Bacteria must either be present in the uterus or vagina or be introduced from without. The doctrine of auto-infection has been advanced by a few observers. Albert[6] attributes to a latent microbic endometritis, which does not prevent conception, many cases of abortion and premature labor as well as some cases of puerperal infection.

The normal uterine cavity, however, is generally conceded to be sterile,[7] but there has been a long controversy over the bacterial flora of the vagina. Bacterial examinations of the vaginæ of a large number of pregnant women have led to contradictory results. Döderlein,[8] Winter, and others found pathogenic bacteria in a varying percentage of cases; while Krönig,[9] Menge, and others, found none, with the exception of the gonococcus. Döderlein,[10] made further studies and divided his cases into two classes: (*a*) Those with "normal" acid vaginal secretion in which he found no pathogenic bacteria; and (*b*) those with an "abnormal" weakly acid, neutral, or alkaline secretion, in ten per cent. of which he found streptococci. Later Krönig,[11] with improved technique by which he avoided contamination from the vulva, found no streptococci in either normal or abnormal cases. These results have been confirmed recently by Williams.[12]

The bulk of the evidence is now in favor of the view that infection comes from without in practically all cases. Experiments have shown that the normal vaginal secretion has distinct bactericidal power. Cultures of streptococci and other pathogenic bacteria, introduced into the vagina of a pregnant woman, have been destroyed, and disappear in from twenty-four to forty-eight hours. The gonococcus forms an exception; as far as known, it is the only pyogenic coccus which can live and thrive in the vaginal secretion.

Morbid Anatomy.—Any part of the genital tract may be infected, and accordingly we may have, primarily, puerperal vulvitis, vaginitis, endometritis, metritis, metro-lymphangitis, metro-phlebitis, or salpingitis. Extension of the infection to adjacent structures may give rise to parametritis, peritonitis, oöphoritis, or phlegmasia alba dolens. Further, with any of these conditions varying degrees of toxæmia and bacteriæmia may occur.

Puerperal vulvitis and vaginitis present no characteristics differing materially from those of ordinary infections of lacerated wounds. The so-called diphtheritic forms are usually due to mixed streptococcus infection, although true diphtheritic inflammation has been reported in a few rare cases (Bumm, Nisot, Williams).

Endometritis, or an inflammation of the uterine mucosa, is the most common form of puerperal infection.

It is a help in the study of the lesions to divide the cases into those which are due to the streptococcus, the septic cases, and those which are due to putrefactive bacteria, the putrid cases.

In the pure streptococcus cases the walls of the uterus are comparatively smooth, there is little or no accumulation of necrotic material, and the discharge is correspondingly small in amount and devoid of offensive odor.

In the cases in which putrefactive bacteria (colon and anaërobic bacilli) are present at the same time with the streptococci, and in the simple putrefactive cases the walls are rough, the cavity of the uterus is filled with masses of foul-smelling necrotic material, and the discharge is profuse, offensive, and frequently contains gas bubbles.

Microscopically there is in general a typical inflammatory reaction in the endometrium. The cavity of the uterus is lined by a surface layer of necrotic tissue which is filled with bacteria; beneath this is a layer of leucocytes, the so-called "protective wall" of leucocytes. In the virulent streptococcus cases the necrotic layer is slight or absent, and the protective wall of leucocytes is poorly developed; the streptococci invade the wall of the uterus along the lymphatics or veins, and can be traced to the peritoneum, the parametrium, and the ovary, and, in many cases of peritonitis, parametritis, oöphoritis, and phlegmasia alba dolens, to the veins of the pelvis and of the leg.

Infected emboli from thrombosed veins may be carried to distant organs and there set up secondary septic inflammations, or they may cause a general systemic infection.

In the milder streptococcus and staphylococcus infections the inflammation may be limited to the endometrium, with little or no invasion of the protective wall of leucocytes, and the general symptoms may be due largely, as in the simple putrefactive cases, to absorption of toxins.

In the simple putrefactive infections the necrotic layer and the protective wall of leucocytes are well developed, and the bacteria are confined to the necrotic layer.

In the mixed infections of streptococcus with putrefactive bacteria we may have a more or less composite picture of the conditions above described.

Since the discovery of the gas bacillus (aërogenes capsulatus) by Welch, in 1891, it has been found in a number of puerperal infections. These include cases of emphysema of the fœtus, puerperal endometritis, physometra, emphysema of the uterine wall, and puerperal gas sepsis. Many of the patients recovered. The fatal cases were characterized by an extraordinarily rapid development, post mortem, of gas in the tissues and blood channels of the fœtus and mother. It seems probable that most of the fatal cases of air embolism previously reported were cases of gas-bacillus infection.

Symptoms.—Cases differ greatly in their character according to the variety and virulence of the micro-organisms, the site of the primary infection, and the degree of extension of the disease. As has been noted, the infection usually takes the form of an endometritis.

In general, the symptoms are those of a wound infection with more or less toxæmia. A chill, fever, general malaise, rapid weak pulse, restlessness, and headache are most frequent.

The patient will have done well during the first few days of the puerperium, and then on the third or fourth day she will have headache and malaise, followed by a chill and a rapid rise of temperature to 103° F. or higher. In the simple cases there is but one chill, while the fever remains high for some days and then subsides. The lower abdomen is tender on pressure. The uterus also manifests increased tenderness, and is larger and more "doughy" in consistency than normal. The character of the lochia is changed. There is apt to be constipation and the urine is scanty and highly colored.

Clinically, the cases may be divided into the septic and the putrid forms. The well-known variation in the virulence of cultures of the streptococcus explains the not infrequent mild cases due to streptococcus infection.

The severer streptococcus cases are characterized by rapid onset, often with early delirium, or great mental prostration and apathy, although some show a remarkable absence of mental symptoms. With the invasion of the lymphatics and blood-vessels come the symptoms of general septicæmia, recurring chills, and high, irregular temperature; in such cases death usually follows within a week.

In the milder septic cases, if the infection is limited to the endometrium, the initial chill and rise of temperature are followed by a gradual decrease of the fever. The lochia are purulent but not profuse, and they are devoid of marked odor. The general symptoms subside after the uterus is washed out, and recovery usually follows, but a condition of subacute or chronic endometritis may persist for a long time.

If the infection is not limited to the endometrium, but extends along the lymphatics, it may give rise to abscess formation in the walls of the uterus, in the broad ligament, in the retroperitoneal tissues, or in the inguinal region; or it may extend to the peritoneum and set up a local or a general peritonitis. The latter is usually fatal. Again, there may be a direct extension of the infection to the Fallopian tubes with development of salpingitis or an abscess. Such extensions are accompanied by chills and a fresh access of fever. The abscess may rupture into the bladder, the rectum, through the skin in the inguinal region, or into the peritoneal cavity. If the abscess is drained satisfactorily the symptoms rapidly subside and recovery follows. Rarely an abscess may undergo gradual resorption.

Extension of the infection along the thrombosed veins of the uterus may give rise to pyæmia. In such cases the initial chill may be delayed, the temperature does not remain constantly high, but instead there is a typical hectic fever with alternating chill, fever, and remissions. The symptoms vary according to the number and size of the infected emboli, the organs to which they are carried, and the virulence of the micro-organisms. These emboli frequently give rise to an often fatal bronchopneumonia, or less frequently to destructive inflammations in various joints. In a few cases the thrombosis extends to the femoral veins and causes phlegmasia alba dolens. This usually occurs in the second week and is characterized by severe pain and swelling of the leg, with fever. The pain and swelling may persist for a long time, but uncomplicated cases end in recovery. The symptoms of thrombosis of the femoral vein may be the first evidence of an infection, the primary inflammation in the uterus having been so slight as to escape notice.

Putrid endometritis differs somewhat in its symptoms and course from the septic forms. The onset is usually on the third or fourth day, and the initial chill and rise of temperature may be as marked or even higher than in the septic cases, but the general condition is not so serious. The main difference is in the character of the lochia, which in the putrid form are profuse, offensive, and frequently have a frothy appearance owing to the presence of large numbers of gas bubbles. The cases improve rapidly after the masses of necrotic material have been removed and the uterus has been washed out. Nearly all of the putrid cases terminate in recovery.

Diagnosis.—Typical cases give no difficulty in diagnosis. In distinguishing between the septic and the putrid forms of endometritis the changes in the lochia are important. The profuse malodorous discharge and the roughened surface of the uterine mucosa are very distinctive in the putrid types; while a smooth uterine surface with scanty purulent discharge and high fever suggests a streptococcus infection.

In the mixed streptococcus cases, however, the uterine wall may be rough and the discharge profuse and offensive. Here the value of a bacteriological examination of the uterine lochia is particularly evident.

Fever, during the puerperium, may be due to diseases other than puerperal infection. Angina, acute pulmonary affections, influenza, acute inflammatory conditions of the breasts, typhoid fever, and malaria occasionally occur.

Some cases of puerperal infection are undoubtedly diagnosed as malaria. But we are not justified in attributing the fever to malaria unless we find the plasmodium in the blood, and even then we cannot exclude puerperal infection until we have proved that the uterine lochia are sterile.

"We might say that every rise in temperature in the puerperium should be regarded as due to puerperal infection, unless we can clearly demonstrate some other infection to be its cause" (Williams).

Fever due to auto-infection from the intestinal tract is promptly reduced by the effective action of a strong laxative. Certain mental disturbances, such as emotional excitement, fright, or grief, may be attended with a sudden rise of temperature, which falls to normal in a few hours.

The absorption of sterile exudates and blood clots is usually associated with a rise of temperature often to 100°, but rarely above 101° F., and this rise occurs in the first thirty-six hours.

Prophylaxis.—Puerperal infection is wound infection. Therefore in order to avoid infection scrupulous care, according to the principles of surgical technique, must be taken from the beginning of labor to the end of the puerperium.

Vaginal examinations in the last days of pregnancy should be made with antiseptic precautions. During and after labor they should be reduced to a minimum. Preliminary antiseptic douches in normal cases are to be avoided, since they decidedly decrease the bactericidal power and resistance of the vagina and its secretion. The use of the ordinary douche and the making of a vaginal examination by the nurse should be prohibited. If the vagina is known to contain pathogenic bacteria, the obstetrician himself should cleanse it with the utmost care; but such conditions should be corrected, if possible, long before the onset of labor.

Since the hands are the chief carriers of infection, they should receive careful attention. The following is one of the most satisfactory methods of hand disinfection:

1. Scrub the hands and forearms up to the elbows with a sterile brush, green soap, and hot water for three minutes, paying especial attention to the finger nails and palmar surfaces of the fingers—change the water at least once.

2. Trim the finger nails with a sterile knife or scissors, and clean the finger nails with a nail cleaner.

3. Repeat the washing for five minutes by the clock, using a fresh brush.

4. Rinse in fresh water.

5. Soak hands in a hot saturated solution of potassium permanganate until they are of a deep mahogany color.

6. Decolorize completely in a hot saturated solution of oxalic acid.

7. Soak forearms and hands in a 1 to 1,000 solution of bichloride of mercury for three minutes by the clock, or until the patient is ready for examination.

It should not be forgotten that sterile hands may be contaminated readily at the bedside.

The patient also should be carefully prepared. At the onset of labor she should be bathed and given a rectal enema. The external genitals frequently harbor streptococci and various pathogenic and putrefactive bacteria. They should be carefully washed, before each vaginal examination, first with soap and hot water, and then with a 1 to 2,000 solution of bichloride of mercury; afterward they should be protected, with a towel soaked in the bichloride, until the physician is ready to make his examination.

During the second stage an antiseptic towel should be kept over the vulva and sterile sheets and towels should be arranged in such a manner as to prevent contamination.

In operative procedures rubber gloves may be worn to give added protection. They should be thoroughly boiled and then drawn over the sterilized hands.

Perineal tears offer ready entrance to bacteria and should be repaired. The sutures may be placed during the third stage and tied after the expulsion of the placenta.

Operations for the repair of lacerations of the cervix greatly increase the chance for infection, and should not be done unless imperatively demanded for the control of hemorrhage.

After the birth of the placenta the patient should be cleaned and the vulva covered with an ample sterile dressing, which is held in place by a T-bandage.

Ergot may be used to secure better contraction of the uterus, but should not be given until the placenta has been expelled.

During the puerperium the external genitals should be kept clean by frequent irrigation with a 1 to 4,000 solution of bichloride, and the vulval pads frequently renewed. Vaginal douches should be used only in exceptional cases, and then with the utmost regard for surgical cleanliness. Infections have been caused by the careless use of the vaginal douche, even in the later stages of the purperium.

Treatment.—General treatment alone often gives the best results in the severe streptococcus cases. Strychnine, gr. $\frac{1}{30}$, may be given every two hours with half an ounce of whiskey every hour, but the quantity should be reduced promptly when the pulse shows improvement. The patient should be kept on the verge of strychnine poisoning and a state of drunkenness, if necessary. Mild cases require little medicine. The bowels should be kept open and good food given in all cases.

Antistreptococcus serum has given very unsatisfactory results. Laboratory experiments have shown that serum prepared from a given culture is protective for that particular culture and no other. Recent reports by Labusquière.[13] Savor, Blumberg, and Scharfe show results of doubtful or no value.

The cases of true diphtheritic infection reported by Bumm, Nisot, and Williams showed rapid improvement and recovery following the use of diphtheria antitoxin.

Salt-solution enemata every six hours, given through the long rectal tube, are often of value in relieving symptoms and promoting diuresis. The subcutaneous injection of sterile decinormal salt solution has been of apparent benefit in some cases. Tincture of ferric chloride in large doses is of value.

Local treatment in the streptococcus cases should be limited to douches, preferably of hot sterile decinormal salt solution. These may be repeated every six hours if necessary. Dilute bichloride douches, 1 to 10,000, immediately followed by the salt solution, may be used. But antiseptic douches are dangerous and should be used with great care. Forty cases of death from bichloride poisoning have been reported.

Clots and fragments of the placenta may be removed with the finger or the dull curette. Curetting on the whole is dangerous, especially if streptococci are present, for by it we may break down the protective wall of leucocytes and expose fresh areas to infection, the very thing we wish to avoid.

Hysterectomy has been advocated for severe cases, but the results reported by Rochard, Bazy, Terrier, and Tuffier, with a mortality of from thirty-three to one hundred per cent., hardly justify a resort to the operation. Leopold[14] and Fehling do not favor it. As they show, to be of value it must be done early, before the infection has extended through the uterine wall. But at present we have no means of determining in which cases the infection will extend, and in which it will remain limited to the uterus. Ricard has collected eight hundred and fifty-one cases with fever at 102.2° F. and higher, showing a mortality of thirteen per cent. under general treatment.

Abscesses and dense areas of cellulitis in the parametrium should be opened through the vagina or through the abdominal wall.

Putrefactive cases with abundant foul discharge are greatly helped by cleaning out the masses of necrotic material with the finger or curette, and following this by a large douche of salt solution, the douche to be repeated every six hours. *Otto G. Ramsay.*

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PULLER SPRINGS. — Madison County, Montana. Post-Office.—Puller Springs. Hotel.

This resort is reached by a good wagon-road, and has semi-weekly mails. The location is in a beautiful valley, having an elevation of 5,530 feet above the sea-level. The springs are two in number, the temperature of the water being 95° F. for the larger and 105° F. for the smaller spring. No analysis. The waters have been found beneficial in rheumatism and allied disorders. The beautiful location of these springs, coupled with the potential therapeutic properties of the water, will undoubtedly bring them into extensive use as the State becomes more thickly settled. *James K. Crook.*

PULSATILLA.—U. S. *Pasque Flowers.* The dried herb of *Anemone Pulsatilla* L. and *A. pratensis* L. (fam. *Ranunculaceæ*), collected soon after flowering, carefully preserved and kept not longer than one year. Both are low, hairy herbs and among the earliest and most beloved of spring flowers. For medicinal purposes the plant should be dried in the shade and stored in a cool and dry place. The drug is thus described: Silky-villous; leaves radical, long-petioled, the petioles usually purplish, the blades twice or thrice deeply three-parted or pinnately cleft, the lobes linear and acute; flowers long-peduncled, subtended by an involucre of three pinnately parted sessile leaves; calyx of (usually six) large, dull purple, hairy sepals; petals obsolete; stamens numerous; pistils several, becoming in fruit long, plumose-tailed akenes; inodorous and very acrid.

Constituents.—Pulsatilla yields upon distillation with water a very pungent, volatile, oil-like principle, from which ether or chloroform extracts a peculiar camphor, which has been called *Anemone camphor*, and which possesses the acridity of the oil to such a degree that it is capable of blistering the skin. This camphor is divisible into anemonin and iso-anemonic acid. The former is a colorless, crystalline, neutral substance, of but little taste when cold, but intensely pungent when melted. It is but slightly soluble in cold alcohol, ether, or water, more so in those liquids when hot, and is readily soluble in chloroform. *Iso-anemonic acid* is a white, amorphous, insoluble substance, without odor, taste, or medicinal property.

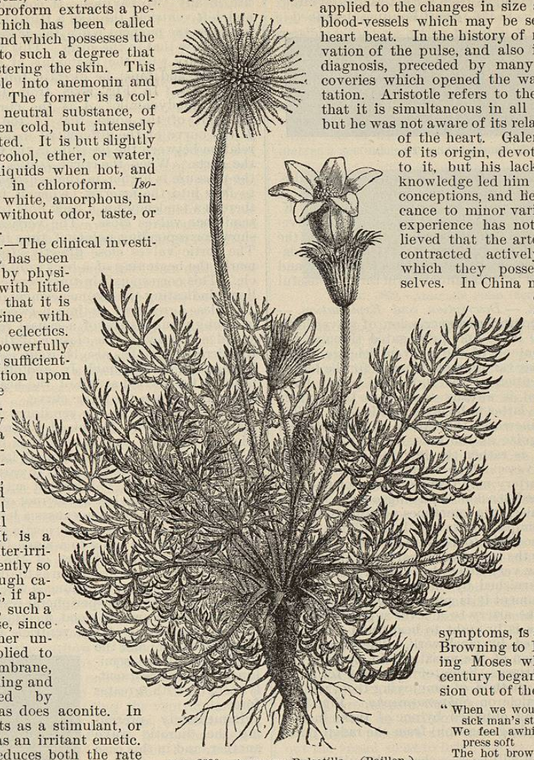

Fig. 3896.—Anemone Pulsatilla. (Baillon.)

Action and Use.—The clinical investigation of pulsatilla has been greatly neglected by physicians, apparently with little better reason than that it is a favorite medicine with homœopaths and eclectics. That it possesses powerfully active properties is sufficiently proven by its action upon the skin and the mucous membrane. Its action is fairly well described in a general way by saying that it resembles that of aconite, but its special field of usefulness is well worthy of careful determination. It is a fairly active counter-irritant, and is frequently so employed. Although capable of blistering, if applied with friction, such a use of it is not wise, since the blister is rather uncontrollable. Applied to the mucous membrane, it produces a burning and tingling, followed by numbness, much as does aconite. In the stomach it acts as a stimulant, or in larger amount as an irritant emetic. Systemically, it reduces both the rate and the force of the heart and of the respiration. It is therefore an antiphlogistic, and is somewhat used as a respiratory sedative. Among the homœopaths and eclectics its sedative action is largely utilized in the treatment of inflammatory conditions of the genitals, although it is also a favorite emmenagogue.

There is no official preparation. The powdered drug may be given in doses of 0.06–0.3 gm. (gr. i.–v.) or the fluid extract in an equal number of minims. The tincture is probably more used than all other of its preparations combined. It is commonly made of twenty-per-cent. strength, and the dose is 0.5–1 c.c. (ɱviij.–xv.). The extract is used in doses of one-half to two grains and anemonin in doses of one-fifth to one-half a grain.

Allied Drugs.—*Anemone nemorosa* L., the common wind-flower, and various other anemones, have a similar composition to that of pulsatilla, and are similarly used. Various species of *Ranunculus* or buttercup, and of *Clematis* or virgin's bower, also exhibit resemblances in the same direction, as does Hepatica or liver-leaf. All these pertain to the family *Ranunculaceæ*. *Henry H. Rusby.*

PULSE, THE.—Introductory and Historical.—The pulse, literally a beating or throbbing, may be broadly defined as periodic movements caused by the rhythmic action of the heart. The term is commonly applied to the changes in size and tension of the blood-vessels which may be seen or felt at each heart beat. In the history of medicine the observation of the pulse, and also its employment in diagnosis, preceded by many centuries the discoveries which opened the way for its interpretation. Aristotle refers to the pulse, and states that it is simultaneous in all parts of the body; but he was not aware of its relation to the activity of the heart. Galen, equally ignorant of its origin, devoted much attention to it, but his lack of physiological knowledge led him to form many false conceptions, and he attached a significance to minor variations which later experience has not justified. He believed that the arteries expanded and contracted actively by some force which they possessed within themselves. In China medical science, like other things, has changed little in thousands of years. The native physicians there have very crude ideas of both anatomy and physiology, and yet they describe and even graphically depict the pulse in great detail. They imagine they find indications in it of the exact seat no less than the nature of nearly every disease.

A more reasonable claim, where the indications given are better supported by other symptoms, is ascribed by the poet Browning to Paracelsus, that erring Moses who in the sixteenth century began to lead the profession out of the Egypt of tradition.

> "When we would thoroughly know the sick man's state
> We feel awhile the fluttering pulse, press soft
> The hot brow, look upon the languid eyes
> And thence divine the rest."

The foundation for the scientific study of the pulse was laid by William Harvey, who discovered and described the circulation early in the seventeenth century. Among his conclusions we find that "the heart is the organ of propulsion for the blood" and that "the pulsation of the arteries is nothing else than the impulse of the blood within them." In 1707 Sir John Floyer states a little more definitely: "The pulse is that sensible motion which is given to the artery by the blood which the heart injects into it." Still fuller is the account given in Haller's "Elements of Physiology," published in 1760: "The arteries are, in a living person, always full of blood, since the jet or stream that starts from an artery is not interrupted by alternate stops, while the heart rests or relaxes itself, but it flows on in a continued thread. . . . Since, therefore, a new wave or column of blood is sent into the arteries already full, although it bears but a small proportion to the whole mass contained in the arterial system throughout the body, . . . yet by its immediate contact with the precedent wave or column, which