ful dressing of the vulva with sterile gauze and cotton pads is essential. Voluntary micturition is preferable to catheterization. There is a physiological advantage in placing the child to the breast at regular intervals, as this stimulates the uterus to healthy contraction and favors involution. The patient should not be asked, however, to feed the child from the breasts, unless she is quite able to do so without feeling the drain.

The patient should be allowed partially to sit up in bed after eight or nine days, according to the conditions. To avoid abdominal hernia, it is best not to hurry getting the patient on her feet, the fourth week being usually time enough. An abdominal bandage, or truss, should be worn for a while.

Cœlio-Hysterectomy (the Porro operation).—In 1876 a modification of the classical Cæsarean section was performed by Edward Porro, which consisted in ligation of the uterine and ovarian arteries and removal of the uterus at the cervix, the stump being brought into the abdominal wound and there fixed.

There are two methods of performing this operation: one, the original Porro method, in which the same steps as in the method just described, up to the removal of the child, are taken, after which the ovarian and uterine arteries in the broad ligaments are tied, and the uterus then cut away just above the ligature; and the other known as the Porro-Müller method, in which the abdominal incision is made sufficiently large to permit bringing the uterus out of the abdominal cavity before removing the child, when the latter, if still alive, is removed by opening the uterus; or if the child is dead, or the uterus is dangerously septic, the entire uterus is cut away without opening it.

When the Porro method—removal of the uterine contents with the uterus *in situ*—is employed, great care is necessary to prevent contact of any of the uterine fluids with the abdominal cavity, inasmuch as this operation is generally done in preference to the so-called Sänger operation because the uterus is believed to be septic. It is better, when doing the operation, to ligate the neck of the uterus more tightly than is done in the Sänger operation, as it is most desirable to avoid flowing into the abdominal cavity, while there is no need of preserving uterine tonicity.

In doing this operation there is no necessity for care in making the opening into the uterus, and it is permissible to tear the opening with the hand instead of cutting to the desired size with knife or scissors. This may save some time and lessen hemorrhage. It is also well to draw a pad of sterile gauze down behind the uterus before making the incision into it. This will best prevent the entrance of fluids into the abdominal cavity. After the uterus has been emptied it should be cut away with scissors at about one inch above the line of constriction, the tubes and ovaries being included. The vessels should then be ligated, including those in the stump. The raw surface of the stump is next seared with pure carbolic acid. The abdominal wound is then sutured down to the stump. Knitting needles, or pins six inches or more in length, are passed through the stump, including the ligature, and are protected from cutting into the abdominal wall by pads of gutta-percha or closely folded gauze. The stump is generally well dusted with iodoform and boric-acid powders, though there is a developing tendency to discard iodoform at the present time. The entire wound is then covered with sterile gauze pads and absorbent cotton. These dressings may require removal and fresh ones to be put in their place in two or three days, especially if sepsis develops in the stump.

A modification of this method of treating the stump is known as the subperitoneal method, in which, instead of bringing the stump into the abdominal wound and fixing it there, it is left *in situ*, and a layer of peritoneum from the posterior surface of the lower uterus is dissected free from the uterus before the constrictor is applied, and then closely stitched over the stump to the peritoneum in front. This method requires, in place of the constriction ligature around the neck of the uterus, the application of clamps to the vessels in the broad ligaments; then, after removal of the uterine contents, the peritoneal flaps are dissected loose. The constrictor can then be applied without involving the flaps. This method requires more time than the older one, but is preferable when feasible.

Complete Hysterectomy.—The removal of the entire uterus and cervix is necessary in conditions such as cancer involving the cervix. When this is done, instead of ligaturing the stump the vessels are tied in the broad ligament and the uterus dissected out complete, as in ordinary hysterectomies in gynæcological work.

Indications for Cæsarean Section.—Certain cases of pregnancy are met with in which the physician has the choice of only one method of relief—Cæsarean section.

Tumors and Diseases.—Tumors of the lower segment of the uterus which cannot be removed by vaginal operation, and which are of such size as to prevent dilatation of the cervix sufficient to permit passage of the fœtus, necessitate cœlio-hysterotomy. Fibroids are most frequent in this list. Ovarian tumors impacted in advance of the head, and occupying the pelvic basin to the obstruction of the fœtus; rarely a dislocated and adherent kidney; intestinal displacement; carcinomata of the cervix, rectum, sigmoid flexure, and vagina, and certain obstructive growths following old cases of appendicitis, compose most of the abnormalities necessitating Cæsarean section. Exostoses may also compel the operation. Cicatrices of the vagina may be of sufficient size to compel Cæsarean section. It is not worth while to classify some of these obstructions as "absolute" indicators of Cæsarean section, because every case offers an individual equation, and must be decided by itself.

It may be that slitting the cervix in some cases of tumor, such as myoma, will be less dangerous than Cæsarean section; or a tumor of the ovary prolapsed into the pelvis may be removed with less danger than a Cæsarean section involves. In tumors of the lower uterus the imminent danger of rupture of that organ in cervical dilatation must be given much weight. In cicatrices of the vagina it may seem feasible to cut and dilate them, but they are liable to tear much beyond safe limits in the passage of the fœtus.

In all these various indications the general rule prevails among experienced operators that a controllable operation like Cæsarean section is much safer than severe straining and mashing of tissue involved in drawing a fœtal body through an abnormally obstructed vagina. Incisions of the cervix or of vaginal cicatrices, with blind traction and distention, cannot equal aseptic, clean abdominal incisions and neat suturing of wounds even though the latter be great in extent.

Pelvic Contraction and Large Head.—When a pelvis is too small to allow passage of the head of the fœtus by symphysiotomy, or when craniotomy would be as difficult and dangerous as a Cæsarean section, the indications for the latter operation may be classed as absolute. But it is almost useless to define such conditions by fixed pelvic diameters. A conjugata vera of but two inches would be "absolute," but between two and one-half and three inches it is not possible to classify the indications. The only proper method of determining the dimension indications for Cæsarean section is to learn the relative proportions existing between fœtal head and pelvic calibre; and pelvic measurement is only one-half of the problem.

Contraction of the pelvic canal of sufficient degree to render craniotomy as dangerous as Cæsarean section is one of the rarest abnormalities in obstetrics. The degree of contraction which renders the operation of symphysiotomy out of the question should be determined. This method of delivery occupies a field limited to such degree of disproportion as will permit passage of the fœtal head after section of the pubic joint without necessitating a separation of the pubic bones of more than two and three-fourth inches. A greater separation of these bones involves such risk to the sacro-iliac joints and the vaginal wall and bladder as to condemn the operation. Cæsarean section should be the absolute choice in such cases.

Symphysiotomy should be performed only when the patient is in labor, and the most useful and the safest method of determining how much separation of the pubic bone would be required is direct palpation of the head and pelvic inlet with the hand in the vagina. Approximately indicating by figures the limits, we would state that a conjugata vera of three inches and a fœtal biparietal diameter of from three and one-half to four inches would not cause too great separation of the pubic joint. Wotherspoon delivered a child weighing fifteen and one-half pounds with a separation of nearly five inches; and the patient recovered, but with a torn vagina, urethral fistula, and one-half of an inch separation of the pubic bones. Such cases get beyond the control of the operator, and are not justifiable when foreseen.

The comparative mortality and morbidity of Cæsarean section, induced labor, and symphysiotomy depend, in the answer, upon many variable points. Induced premature labor is safest for the mother and most dangerous for the child in cases requiring delivery before the thirty-second week. Cæsarean section is most dangerous for the mother and safest for the child; symphysiotomy is safer for the mother than Cæsarean section, and somewhat more dangerous than induced premature delivery. It is less dangerous for the child than the latter method, and more so than is Cæsarean section.

The essential operative mortality (that per cent. of fatalities which will follow the surgical work of the best operators in cases taken at the time most favorable, and which must follow present methods of performance in these several ways of delivery) must be the foundation for selection of method.

Induced premature labor for dystocia is essentially always of the above class, as it is performed voluntarily and at the convenience of operator and patient. The mortality is about 4 per cent., but should not be more than 1 per cent. higher than pertains to spontaneous ordinary labors. Its relative safety for the mother is unquestioned.

The mortality for the child is, and always will be, very high.

Twenty-five per cent. of all babies born die within the first year. The death rate within full term for six-months time babies is nearly 90 per cent., at seven months 75 per cent., and at eight months 50 per cent. These figures are higher than those given by French writers, but they aim to include private as well as hospital cases. Induced labor at a period nearer term than eight months would not indicate Cæsarean section as an alternative operation. Efforts have been made by Prochownick and others to keep the fœtal cranial bones soft up to term by diet, and so accomplish delivery without operation. The results obtained justify further effort in this direction.

The essential mortality from symphysiotomy is about 2.5 per cent.; this in the hands of experienced operators and when the method was properly selected. Pinard gives 5 per cent. as the mortality of 160 symphysiotomies done at the Baudelocque Clinic 1892–1899, excluding 7 deaths due to outside causes. The writer has operated 13 times without a death from symphysiotomy. The general fœtal mortality is given as 14.5 per cent.

The essential mortality from the Sänger Cæsarean section can be given only by estimate. Reynolds ("Obstetrics," Vol. II., No. 1), taking the cases of Leopold, Everke, and himself in which the patients were free from sepsis and exhaustion from labor, reports 88 cases with but 2 deaths which occurred some years ago from operative sepsis. In the hands of operators in general we would expect a percentage mortality from selected cases of about 5. For the children it should scarcely exceed the results in normal labors.

The actual mortality from the Sänger operation is from 6 to 8 per cent. in the work of the leading operators. From all sources the actual mortality from Cæsarean section is from 25 to 33 per cent. to-day. From symphysiotomy it is about 10 per cent. The mortality from the Porro operation is necessarily higher than from the Sänger operation, even in the best of hands, inasmuch as the cause of its selection is often the septic condition of the uterus.

From craniotomy there should be in favorable cases no greater mortality than from forceps deliveries. The operation is seldom performed until after the forceps has been tried severely, and the patient been bruised and often infected. In view of the very low death rate of other methods, it should not be the primary selection of method in the hands of experienced and properly prepared obstetricians; but it may often be the most expedient method for the general practitioner, in whose hands most labors occur outside of hospitals.

Given a patient not in labor but requiring induced premature labor, symphysiotomy, or Cæsarean section to secure delivery of a living child, and an obstetrician of equal experience in each method and regularly engaged in doing abdominal surgery, due regard being given to both mother and child, in cases of medium contraction not permitting forceps delivery, symphysiotomy should be selected. With more marked contraction the Sänger Cæsarean section should be preferred. Cases of severe manipulation, with the child in good condition, with probable infection of the uterus present, call for symphysiotomy in preference to the Porro operation. Symphysiotomy is not affected by infection if the writer's subcutaneous method is employed; Cæsarean section is markedly affected. If the child's condition renders delivery alive very problematical, further effort with forceps and then craniotomy may be best. The *a priori* argument in cases complicated by tumors and local diseases is in favor of Cæsarean section. Induced labor is generally decided upon by the patient.

If the physician is not accustomed to abdominal surgery, he should select symphysiotomy in preference to Cæsarean section. If he is not accustomed to any surgical work, he should choose induced premature labor, or perform craniotomy, if he must deliver the patient himself.

The Choice of Method in Cæsarean Section.—The Porro method is not only indicated but required in all cases of suspected existing infection of the uterus. This is the situation in cases in which extensive efforts have been made by others to secure delivery by use of the forceps or by version; when the amnion has been ruptured for hours and most of the fluid drained away; when the cervix is swollen and œdematous, the vagina hot and dry, and the vulva swollen; also when tumors and pathological changes are present in the soft parts which interfere with passage of the fœtus; in rupture of the uterus at sites difficult to suture, or when it seems safer to do a hysterectomy than to suture a jagged wound at any site. It may be indicated in very exhausted conditions of the uterus with hemorrhage present or threatening. It is indicated in certain conditions of the very rare occurrence of combined intra- and extra-uterine pregnancy. It is not indicated as a means of preventing future pregnancy, unless the operator is perfectly satisfied that he can perform it with the same degree of safety that he could a Sänger section.

To a physician of comparative inexperience in abdominal operations the Sänger Cæsarean section is probably an easier and safer method than the Porro hysterectomy.

Edward A. Ayers.

CAFFEINE.—*Theine.* $C_8H_{10}N_4O_2,H_2O$. "A feeble basic, proximate principle, obtained from the dried leaves of *Thea sinensis*, Linn. (nat. ord. *Ternstræmiaceæ*), or from the dried seeds of *Coffea arabica*, Linn. (nat. ord. *Rubiaceæ*), and found also in other plants" (U. S. P.).

"An alkaloid usually obtained from the dried leaves of *Camellia Thea*, Link, or the dried seeds of *Coffea arabica* Linn." (B. P.).

It occurs in fleecy masses of long, flexible, white crystals, permanent on exposure, of a silky lustre, having a bitter taste, and without odor. Soluble in eighty parts of cold water, in two parts of boiling water, and in thirty-three parts of alcohol. It is neutral to test paper. When ignited it is consumed without residue. A notable fea-

ture is the unusually large proportion of nitrogen that it contains.

The only official salt is the citrate, which is very unstable and rapidly deteriorates, the alkaloid separating and remaining uncombined. When mixed with three parts of water, the citrate forms a thick liquid; when more water is gradually added the caffeine is precipitated, but redissolves and forms a clear solution when twenty-four parts of water are added. It is a white powder, without odor; it has a bitter taste and an acid reaction. When burned it chars and leaves a slight ash. It is soluble in thirty-two parts of water.

An effervescing citrate is official in the United States Pharmacopœia and the British Pharmacopœia. The former contains one per cent. of caffeine, that of the British Pharmacopœia contains nearly four per cent.

Caffeine is the characteristic alkaloid of coffee and tea. It was discovered and first prepared, in an impure condition, from coffee, by Runge, in 1820, and shortly after, in a state of greater purity, by Pelletier and Robiquet, and other chemists. In 1827 Oudry separated an alkaloid from tea, which he named *theine*. This, in 1838, was proved by Mulder and C. Jobst to be the same as Runge's caffeine. In 1840 Martius discovered *guaranine* in guarana, and afterward the same observer, and others, proved its identity with the alkaloid of coffee. The same substance was also found, in 1843, by Stenhouse, in the leaves of maté or Paraguay tea, and in 1865, by D. Daniel and by J. Attfield, in the kola nuts (*Sterculia*) of Africa. In all these products it appears, moreover, to be the most important ingredient. As no two of these plants are nearly related to each other, or are even in the same order, caffeine may yet be found to be as widely distributed in the vegetable kingdom as berberine or buxine. It is an interesting fact that all the above substances have been used from a remote time by communities which could have had no communication with each other, for exactly the same purpose, viz., as a stimulating and comforting addition to their daily food; tea by the Chinese, coffee by the Arabs, the kola nuts by the Africans, and maté and guarana by different tribes of South America.

For commercial purposes caffeine is prepared exclusively from tea and coffee; the poorer sorts, that is "tea dust" and damaged and inferior grades of either tea or coffee, being used. As the price of both these articles does not depend at all upon their alkaloidal strength, but only upon their appearance and flavor, the cheaper grades often contain considerably more caffeine than the more expensive ones, and, price apart, are better for this purpose.

The percentage of the alkaloid in the several plants varies greatly. It is estimated that tea contains from one to four per cent.; coffee, one to three; maté, one to two; and guarana about five per cent.

Caffeine acts upon the cerebral, medullary, and spinal centres, primarily as a stimulant and later as a depressant. Its action is also directed to the muscular tissue, improving its tone and contractile power, until ultimately it merges into the general depression.

In small doses, from one to three grains, it produces a sense of well-being, and a feeling of increased strength and vigor. The cerebral functions become more active, the respirations are deeper, the heart beats more forcibly, and the arterial tension is increased. The heart at first participates in the general stimulation, and there is an increase in its frequency and a more rapid pulse. This, however, is transitory, as the inhibitory centres are soon influenced by the stimulation and produce a slowing of the heart's action, which, with the more forcible contraction of the muscular walls, constitutes its most desirable effect. The urine is increased, both the quantity and the contained solids being greater. Tissue change is accelerated, and the body temperature rises. This beneficial action continues for some days, after which the continued use is liable to give rise to signs of cardiac irritation and excessive vascular tension. There may be a rapid, hard pulse, a feeling of constriction in the chest, dyspnœa, and labored action of the heart.

In larger doses, from gr. v. to gr. viij. or x., the symptoms of over-stimulation are developed early, and if the drug is continued, the depression follows rapidly and may become very marked. In addition to the cardiac and respiratory distress, there are insomnia, vertigo, tinnitus aurium, flashes of light, mental distress, and delirium. As the depressant action replaces the stimulation, the inhibitory control of the heart is lost and there follows a rapid, feeble heart beat, which gradually increases until contractions cease. The respirations also become shallow, and there follows a condition of asphyxia and collapse, death being due to respiratory failure. Caffeine is an irritant to the gastric mucous membrane, and its continued use produces heat and burning at the epigastrium, with nausea, which may terminate in pain and severe irritation of the stomach and intestines.

Caffeine was formerly considered only as a cardiac stimulant and administered freely, with very little thought of any subsequent depression. Later experience has shown that this secondary action is of the greatest importance, and although often unrecognized, it is a frequent cause of serious depression, and possibly of death. Cases of acute poisoning are rare, and in healthy adults the quantity necessary to cause death would be very great, but in diseased states its action is much accentuated. In valvular disease and in conditions in which the heart is being overtaxed, even ordinary doses may be attended by very serious consequences. The danger is not only from large doses, but also from the continued use of moderate doses.

Attention has also been directed to an unfavorable condition that may arise during its administration, prior to any depressant action. This is an over-stimulation and irritation of the cardiac ganglia that may terminate in a spasmodic contraction of the heart and death. The following are given as instances of death from this cause. In a case of pneumonia, death occurred suddenly, when the patient was taking caffeine, three grains three times a day. A woman with chronic parenchymatous nephritis, anasarca, and double pleural effusion had taken small doses for some time previous to a sudden fatal syncope. In a third case death took place suddenly, the patient being a young girl who had acquired the habit of taking frequent doses of gr. iv. or v. In all these cases a post-mortem examination was made and the heart found firmly contracted, death being due to a condition described as a "tetanus of the heart muscle."

Caffeine is employed as a cardiac and general stimulant, as a diuretic, and for the relief of headaches and neuralgia pains. Its value as a stimulant is well recognized, and its rapid action makes it of value in cases of sudden weakness and threatened syncope. In addition to its value in threatened heart failure, it is most useful in chronic valvular disease, to counteract a failing compensation. It, however, must always be given cautiously when the heart is feeble and dilated, or in any form of heart disease in which the walls are diseased. In arteriosclerosis it is also contraindicated, as it adds to the already high arterial tension.

The diuretic action of caffeine is always to be depended upon, and is that for which it proves of greatest service. It is in a measure due to the increased arterial pressure, but caffeine also exercises a direct action upon the renal secreting tissue. It is particularly indicated in the dropsy of cardiac disease, and resembles digitalis in its action. It acts more rapidly, but has not the same power to strengthen the heart and increase the blood pressure. For this reason its effects are often better when preceded by digitalis, or when the two are combined. When there is kidney disease it must be given with care, as the stimulation of the renal tissue may aggravate the local trouble. In dropsy due to hepatic disease, its action is very uncertain.

Caffeine has not proved of much value in the treatment of headaches. In many forms of neuralgia and migraine, in the debilitated and nervous, it may prove of service, but this is due to the improved tone of the nervous system, and not to any anodyne or analgesic property.

In administering caffeine, the citrate is frequently selected on account of its greater solubility. When used it should have been carefully preserved, and it must be given in powder, or dissolved immediately before use, as it rapidly decomposes when in solution. The citrate is one-half the strength of the pure alkaloid, and gr. x.–xv. during the day is the average dose. When an immediate effect is required, it may be administered subcutaneously. A product that is much employed is the double salt of caffeine, with soda and salicylic, benzoic, or cinnamic acid. It is very soluble and unirritating, and furnishes the best solution for hypodermic use. It is about one-half the strength of the citrate. These salts were proposed as the best means of obtaining the diuretic action of caffeine, but later experiments seem to indicate that these combinations are not so serviceable as were expected. It has been found that the presence of soda and salicylic acid has a tendency to reduce blood pressure and to lessen the secretion of urine. This, it is thought, must influence unfavorably the caffeine when it is thus combined with other drugs. The compound salts, however, are very highly thought of and are becoming more frequently employed. The following formulæ for their preparation are official in the Paris Codex: (1) Caffeine, 4; sodium salicylate, 3; distilled water to 10 parts. (2) Caffeine, 2.5; sodium benzoate, 3; distilled water to 10 parts. *Beaumont Small.*

CAISSON DISEASE.—This term has inappropriately been applied to the whole group of accidents which result from working in compressed air. As Snell aptly says, the name of a disease should indicate some characteristic symptom or some etiological factor. This is manifestly not the case in the present instance. The caisson itself has nothing whatever to do with causing the disease which bears its name. As indicated above, *compressed air* is the causative factor and should be the term substituted for *caisson*. *Compressed air illness*, then, will include all this class of accidents under discussion.

In laying the foundations of bridge piers or abutments under water, various means are resorted to for displacing the water and building a solid basis; one of these methods is by means of caissons. The caisson, or caissoon, is made of different patterns, but the one with which we have to do in the study of caisson disease is like a large inverted cylindrical box supplied with apparatus for condensing air to such a degree as to expel and keep out the water, thus enabling men to work in it. When the in-rushing water cannot be removed by pumping, other means must be resorted to. The method now in vogue is the use of an air-tight diaphragm at some point in the cylinder. The workmen and material used are passed through a small space or ante-room called the "air lock," with which the diaphragm is provided. This chamber is furnished with two air-tight doors, an inner and an outer, both of which open toward the compressed air. When the men have entered this air lock, the outer door is closed and compressed air is gradually admitted by means of cocks until the air in the lock is of the same density as that in the caisson; then the door of admission to the latter is opened. In returning, the process is reversed, the air in the lock being gradually rarefied.

If the fact be borne in mind that the body has about sixteen square feet of surface, and that ordinary atmospheric pressure is about fifteen pounds to the square inch of surface, it may readily be understood that an increase of atmospheric pressure will have some effect on the conditions of the interior of the body. The blood is driven, by reason of this external pressure, from the surface into the bones, cranium, spinal canal, and other parts of the body. If this change of location of the blood be effected too rapidly, or if too much force be applied, the results may be dangerous.

A number of factors must be considered as entering into the production of this disease, in the enumeration of which Snell's order has been followed. Primarily, there is the high atmospheric pressure. As would naturally be expected, the extent of the illness varies in proportion to the degree of this pressure. The length of time of exposure is also an important factor, the longer the period the more severe the symptoms. Ventilation has such an important influence on the degree of this illness that Snell has formulated the following law: "The amount of illness varies inversely with the amount of fresh air supplied to the compressed air chamber." Too rapid decompression should be avoided. Minor etiological factors are: fulness of habit, age, organic disease, alcoholism, severe exertion after decompression, and unfamiliarity with the work, all of which, with the exception of organic disease, militate unfavorably for the patient. As those with organic disease are generally rejected, observations concerning its effect on this disease are not at hand. One sufferer with emphysema, who came under the notice of Snell, was always in better health when working in compressed air. Temperature and hygrometric conditions of the air lock seem to bear no relation to the illness.

In an essay on "The Effects of High Atmospheric Pressure, Including the Caisson Disease," Dr. Andrew H. Smith, of New York, describes the symptoms induced by entering highly compressed air. These, with a few additions, are: (1) Ringing in the ears and impairment of hearing; (2) increased frequency of respiration; (3) increase in the pulse rate to 120, with subsequent fall to the normal; the pulse is reduced in volume, and there are pallor and sallowness of the skin; (4) the temperature of the body, an hour and a half after entering the caisson, is elevated about one degree, but when the atmosphere within the caisson is warmer than the external air, the body heat may rise as high as 101° F.; (5) the skin is covered with perspiration, but this is because of the saturation of the surrounding atmosphere, and not from any increase in the amount of the secretion; (6) increase of appetite; (7) dysphagia at times; (8) fatigue; (9) increase of urine of about normal specific gravity (probably because of diminished evaporation from the skin). No albumin is present.

The pathological effects mentioned are: (1) Rupture of the drum membrane and inflammation of the middle ear; (2) epistaxis or hæmoptysis; (3) itching of the skin; (4) neuralgic pains, which may come gradually or suddenly, in the extremities or in any part of the body; when in the lower extremities, they are commonly known as "bends"; (5) epigastric pain and vomiting; (6) paralysis, both sensory and motor, most frequently of the lower limbs, but, notwithstanding the paralysis of sensation, the pains continue; (7) the cerebral symptoms are: headache, dizziness, double vision, incoherence of speech, and sometimes unconsciousness. These symptoms are usually temporary. "Death occurs only in cases which are severe from the first, and are marked by symptoms of serous or sanguineous effusion about the brain or cord." "The constant lesion in fatal cases of caisson disease is congestion of the brain or spinal cord." "It is the *removal* of the pressure, and not the pressure itself, that is the immediate cause of the seizure," which occurs usually at the time when the victims are coming from under the pressure, or even some hours subsequently. The blood is driven by the atmospheric pressure from the surface into the bones and bony spaces, skull, and spinal canal, the vessels of which parts become dilated, and when the external pressure is removed, they do not readily contract to their normal size. Lloyd believes the lesion to be destructive or necrotic, due to the deprivation of blood. Congestion of various organs has been observed. Areas of softening in the brain and cord have been described.

According to Lloyd, the exact pathology of this disease is not perfectly clear, and, indeed, as Smith believes, it may vary in different cases. Several theories have been advanced: congestion followed by blood stasis; lowered vascular tone; revulsive anæmia; extreme destruction of body tissues not followed by proper elimination; excess of oxygen.

Much can be done to prevent caisson disease. Due precautions should be taken for the thorough ventilation of the air chamber, as this is one of the most important

prophylactic measures. Care and experience will often admit of the engineering work being carried on at a much higher level than would ordinarily be thought possible. The length of time which the workman spends in the compressed air should be intelligently regulated—much depending on the degree of pressure. The "locking-out" process must be attended to most carefully. The workmen ought to be taught how to care for themselves. The following points should be emphasized: the method of inflating the ears; hygienic precautions while in the chamber; rest, and a warm drink, preferably coffee or beef tea, after decompression, together with a change to warm clothing. The chamber should be lighted by electricity.

As to curative treatment, the remedy that Smith proposes for this condition is ergot, with morphine as required to relieve pain. Recompression affords the greatest relief to the pains if the patient is seen soon after their onset. Liniments are approved by some, but discarded by others. Bandaging is often efficacious to relieve pains in the extremities. Salicylate of soda has been used. Inhalation of oxygen has been suggested in view of the theory of retained carbonic acid gas. Electricity has not met with much success. Complications must receive the ordinary treatment indicated in such cases. When vertigo is obstinate and persistent, tonics seem to afford the greatest relief.

Charles E. Hackley.
Emma E. Walker.

CAJEPUT, OIL OF.—*Oleum Cajeputi.* A volatile oil distilled from the leaves of *Cajeputia Leucadendron* (L.) Rusby (fam. *Myrtaceæ*). This species is a rather small, fragrant tree, with irregularly growing slender branches, and a thick, soft, exfoliating bark. The leaves are bright, smooth, narrow, entire, pointed at each end, parallel nerved, and often oblique or curved; they are twisted upon their petioles so as to stand with vertical surfaces, like phyllodia. The tree is a native of numerous islands in the Indian archipelago, especially of Borneo, Celebes, and Amboyna. It is also extensively found, if a broad view is taken of the species, in Australia and on the mainland of Asia. Most of the oil is obtained from Celebes, and exported by way of Javan or Indian ports.

Oil of cajeput is extracted on the spot from the fresh leaves, which are first softened by maceration in water, and then subjected to distillation in rude copper stills. It is filled into once-used wine and beer or other European bottles for exportation. It was first introduced into Europe in the early part of the eighteenth century.

It is a pale green, transparent, mobile fluid, with a fragrant mint or camphor-like odor, and bitterish aromatic taste. It has the usual physical properties of the essential oils. It is very similar to its near relative, oil of eucalyptus, containing the same constituent, cineol, along with terpineol and other bodies. Specific gravity of the oil, about 0.926. The green tint is generally ascribed to some compound of copper received from the still, or introduced into the oil intentionally. The color may be separated by several methods of rectification, and the oil obtained clear and white.

Action and Use.—Cajeput has the stimulating properties of camphor and the essential oils in general, and stands between the most irritant of them, like oil of turpentine, and the milder mint oils. It is more extensively used in the Indies and Eastern islands than here—in some places being given for nearly everything, but is particularly popular for colics, diarrhœas, and even cholera, as well as for chronic rheumatism, chronic vesical catarrh, etc. Here it is not often given internally, but has no doubt some value in non-inflammatory intestinal disturbances, where an aromatic stimulant and antispasmodic is needed, being in these cases very much like camphor, and like this may be very suitably combined with opium. Externally it is a mild rubefacient, and a good ingredient for stimulating liniments in chronic rheumatism, old sprains, etc.; it may be also useful for psoriasis, scaly eczema, etc., and is a fairly efficient parasiticide. As a stimulant diuretic in chronic vesical catarrh it is as good as most others of its class. Cajeput is the basis of numerous toothache and earache drops. It is often adulterated. Dose, from 1 to 5 dgm. (ɱij. to viij.) dissolved in spirit, suspended in mucilage or syrup, or on a lump of sugar. There are twenty or thirty drops to the gram.

W. P. Bolles.

CALABAR BEAN. — Physostigma. *Ordeal Bean, Chop-nut.* "The seed of *Physostigma venenosum* Balfour (fam. *Leguminosæ*)" (U. S. P.). This plant is a large, climbing, perennial vine, with trifolioiate leaves and the general appearance of an enormous bean vine. The stem is woody below and often as large as the wrist. The showy purple flowers are nearly as large as those of the sweet-pea, and hang in loose racemes. The large pods contain two or three seeds each. The "beans" are very hard, oblong, slightly curved or kidney-shaped, from 2 to 3 cm. in length, and about 1.5 cm. broad (.75 to 1.25 in., by .5 in.), and covered with a roughish but shining chocolate-brown or brownish-red testa. A broad, shallow, black groove or furrow extends along the convex border and around one end of the seed; it contains the raphe. The kernel is exalbuminous and consists mostly of the two large, white, brittle cotyledons, whose faces are concave and enclose an air space which enables the entire seeds to float upon water, although when broken the fragments are denser than water. The taste and odor of the seeds are simply bean-like, and give no suggestion of the deadly poison which they contain.

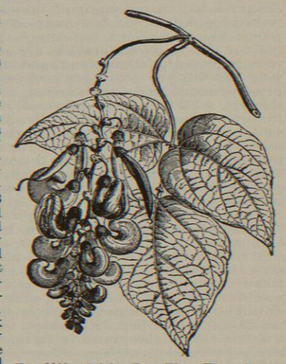

Fig. 1068.—Calabar Bean Vine; Flowering Branch, Reduced. (Baillon.)

The plant grows about the mouths of the Old Calabar and Niger rivers in tropical West Africa. It has been transplanted to India, Brazil, and other places, where it flourishes. Physostigma is an ingredient of the poisonous mixture which persons accused of witchcraft or crime are compelled by the savage chiefs of these African tribes to take as an ordeal or punishment. The draught is usually rapidly fatal, unless vomiting occurs. It was first known in England about 1840 as a curiosity and poison, but not much employed in medicine until Fraser, of Edinburgh, about 1863, discovered its specific power of contracting the pupil, since when it has been in rather frequent use by oculists and in occasional use in internal medicine. Besides forty-eight per cent. of starch and about twenty of albuminoid matters, with a little oil and gum (substances which are contained as well in the common bean, and which are entirely inert), the drug in question contains three alkaloids, with *physosterin*, a fatty or cholesterin-like substance, which occurs in the Calabar bean in common with other leguminous seeds, and which is inert.

Fig. 1069.—Calabar Bean, Two-Fifths Natural Size.

Physostigmine or *eserine* is the principal alkaloid. *Calabarine* is apparently a derivative of the former, while eseridine can be converted into physostigmine. The action of physostigmine dominates that of the drug, especially as that of eseridine is very similar. Calabarine acts antagonistically to the others, but is in such small amount as not greatly to modify the drug's action. The action of Calabar bean will therefore be discussed under *Physostigmine.*

Except in the form of the alkaloid, calabar bean is but little used. It has been rather thoroughly experimented with for its depressing action upon the nerve centres in various diseases involving central excitability, and especially in tetanus; but the results cannot be regarded as encouraging. Some benefit has resulted from its use in checking the paralysis of insanity, and it often does good as an intestinal laxative. We have an official extract, the dose of which is .006 to .03 gm. (gr. $\frac{1}{10}$ to $\frac{1}{2}$), and a fifteen-per-cent. tincture, the dose of which is .6 to 2 c.c. (ɱx. to xxx.).

Physostigmine or *Eserine* ($C_{15}H_{20}N_2O_2$). The chemistry of this alkaloid, and its relations to the bodies associated with it, are but imperfectly known. Formerly, the two names were believed to represent two alkaloids, but it was subsequently ascertained that one was merely an impure form of the other. It is almost always used in the form of its salts. The pure alkaloid occurs in the form of colorless crystals which are soluble in both alcohol and water, slowly in the latter. They are very hygroscopic and quickly lose their characters if exposed to dampness or light. Of the numerous salts, the most important are the hydrochloride, sulphate, and salicylate, the two last being official. The sulphate $(C_{15}H_{21}N_2O_2)_2$.H_2SO_4, a white or whitish crystalline powder, which is the salt most used, is very soluble in both water and alcohol. The salicylate, $C_{15}H_{21}N_2O_2.C_7H_6O_3$, in white crystals, is less soluble, namely, in one hundred and fifty parts of water or twelve parts of alcohol. The hydrochloride, $C_{15}H_{21}N_3O_2HCl$, is soluble in water.

Action.—The physiological action of eserine is powerful and characteristic, and has been very extensively studied. Except in large poisonous doses, its chief action is upon the secretion and involuntary muscular movements, through the cells and fibres, or their nerve endings, or both. The secretions of the entire alimentary system, excepting perhaps the bile, are markedly increased, in which particular a close similarity to pilocarpine has been noted. The perspiration and tears share in this increase. At the same time, the activity of the gastric and intestinal muscles is greatly augmented also. The effect upon the stomach may be such as to cause vomiting, especially by large doses, poisoning being thus avoided. More or less nausea is frequent. If vomiting does not occur, then purgation may, owing to a similar effect upon the intestinal muscles, combined with the increased secretion. Looseness of the bowels is an ordinary symptom. Uterine contractions may be induced. Coincident with these effects, and evidently of the same general nature, is the contraction of the pupil and ciliary muscle. In all these directions, the drug is directly antagonistic to atropine, and one drug can be used to counteract the other, to a great extent. Strychnine, while directly antagonistic to physostigmine in its central effects, strangely enough produces, through the spinal centres, many symptoms similar to those produced by the latter through peripheral action. In the voluntary muscular system, there is increased irritability of the fibre, and apparently stimulation of the nerve endings also. This produces muscular twitchings among the most prominent of the early symptoms of poisoning. It is apparently due to bronchial spasm that respiration is slightly interfered with. This interference acts as a respiratory stimulant, and the respirations are early increased both in number and force. At the same time there is a marked rise of blood pressure, though this is quite irregular. The heart is continuously and powerfully slowed from the start, due apparently to direct action upon it, but the beat is strong. There is the widest disagreement as to whether primary central stimulation occurs and is partly responsible for these symptoms. Whatever may be the primary central effect, depression of the motor centres is early and powerful. If the dose has been large, and is not vomited, paralysis may be very sudden. There may then be almost no preliminary symptoms, or the muscular twitchings may amount almost to convulsions. With increasing cardiac slowness, weakness and reduced blood pressure supervene; but this effect is not so marked as respiratory depression, which is the immediate cause of death.

Uses.—Physostigmine salts have been used, as already stated, for the same purposes as Calabar bean, in doses of .001 to .003 gm. (gr. $\frac{1}{60}$ to $\frac{1}{20}$). Their chief use, however, is for instillation into the eye, in solution of one-per-cent. strength or weaker. The effect is to produce, at the end of a half-hour, a very powerful contraction of the pupil, which lasts for ten or twelve hours, and markedly to decrease intraocular tension, after a brief increase. It thus becomes of service in overcoming the interference with vision induced by the use of atropine. Efforts have been made, with some success, to destroy iritic adhesions by its use.

Pseudo-physostigmine is an alkaloid having apparently the same composition and properties; it is derived from cali-nuts or false Calabar beans, the botanical origin of which is doubtful.

Henry H. Rusby.

CALAMUS. SWEETFLAG.—The rhizome of *Acorus Calamus* L. (fam. *Araceæ*). An endogenous perennial with a thick, fleshy, long and branched horizontal root-stock, and a few very long and narrow (.5 to 1 m.) linear equitant leaves. The flowering scape is also long and flattened, like one of the leaves, and bears at its apex a straight, solid, fleshy, cylindrical spadix from 5 to 10 cm. long. Flowers perfect, small, crowded. A long, leaf-like bract or "spathe" (Bentley and Trimen) arises at the junction of the spadix and scape, and, proceeding in a straight line, looks like a continuation of the scape, while the really terminal spadix is diverted to an angle with the axis, and appears to be lateral. Sweetflag is indigenous in parts of Asia, as Asia Minor, India, etc., and in some parts of Europe and North America, but has been so extensively spread and naturalized by human intervention that it is found in nearly the whole north temperate zone. It grows either in the water or in swampy and shady places, and is very variable in size.

Fig. 1070.—Rhizoma of Acorus Calamus, Showing Cicatrices of Adventitious Roots. (Baillon.)

All parts of the plant are slightly aromatic, the leaves least so, but for medicinal use the rhizome only is employed. It should be gathered in the autumn or spring, washed, cleaned, and dried. In Germany it is generally peeled or scraped before drying; but while the appearance is improved by this process, the strength and quality are deteriorated, and this is not authorized by our

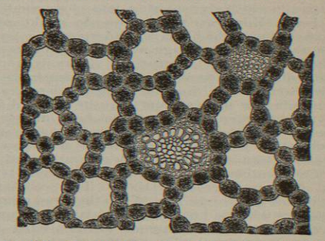

Fig. 1071.—Transverse Section of the Same. (Baillon.)