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Ergota.—Ergot. The sclerotium of *Claviceps purpurea*, replacing the grain of *Secale cereale* Linné (Nat. Ord. *Graminaceæ*). (U. S. P.) *Ergot de seigle*, Fr.; *Mutterkorn*, Ger.

Extractum Ergotæ Fluidum.—Fluid extract of ergot. Dose, 3 ss— $\bar{3}$ j.

Vinum Ergotæ.—Wine of ergot. Dose, 3 j— $\bar{3}$ ss.

Ergotin.—This preparation must not be confounded with a constituent of ergot, supposed to be an active principle. The ergotin of the shops gets its name from "Bonjean's ergotin." It varies very much in strength, owing to faulty modes of preparing it, and is not unfrequently inert. As prepared by Squibb it is entirely soluble in water, and represents the powers of the drug. Ergotin (the aqueous extract) is the most eligible preparation for hypodermatic injection. From one to five grains may be injected at one time. In preparing it for this purpose, the quantity to be injected should be rubbed up with fresh distilled or rain water, and then passed through the filter. It is always better to prepare it whenever required. If it is necessary to preserve the solution, the addition of a little carbolic acid—one grain to four ounces—will usually suffice. The addition of glycerin is not necessary, unless added as a preservative fluid; and is objectionable, because it greatly increases the pain which attends the subcutaneous injection.

COMPOSITION.—Some confusion yet exists in regard to the constituents of ergot, notwithstanding recent advances in our knowledge. An unfortunate nomenclature is in part responsible for the confusion; but the complexity of the subject and the conflicting views of chemists are the chief causes of the present condition of the pharmaceutical knowledge of ergot.

Ergot contains about thirty per cent of a saponifiable, non-drying oil, with which is associated a small quantity of resin and cholesterin. When extract of ergot is treated with an alkali, a peculiar fishy odor is developed, due to *methylamine*, according to some authorities, and *trimethylamine* according to others. Ergot also contains lactic and phosphoric acids and phosphates. The two principles, *ecbolina* and *ergotina*, separated by Wenzell in 1864, are not true alkaloids of ergot, and are said by Dragendorff to be identical. In 1830 a supposed al-

kaloid was obtained by Wiggers, which he named *ergotin*, but this is not the true active principle. Unfortunately, an aqueous extract, prepared by Bonjean, was also named *ergotin*. Köhler has examined the ergotin of Wiggers and that of Bonjean, and finds that they are mixtures: the former containing the ingredients of ergot not soluble in water; the latter, those that are soluble in water. According to Köhler, neither of these so-called ergotins represents the properties of ergot. More recently Dragendorff and Podwissotzky have gone over the chemistry of ergot anew, with different results. They have introduced new terms also, which add to the complications. The most important principles obtained by them are *sclerotic* or *sclerotinic acid*, and *scleromucin*, the former existing in good ergot in the proportion of about four per cent, and the latter, two to three per cent. They have also separated other principles and secondary products, named respectively *sclererythin*, *scleroidin*, *scleroxanthin*, and *sclerocrystallin*. Another alkaloid has lately been discovered by Tanret, to which he has given the name *ergotinine*. This substance seems to be the nearest approximation to a genuine alkaloid of any hitherto proposed. It is a white, crystallizable solid, insoluble in water, and soluble in ether and chloroform. It is alkaline in reaction and has strong basic properties, and combines with acids to form salts. It is an unstable substance, and in the air soon decomposes.

ANTAGONISTS AND INCOMPATIBLES.—The caustic alkalies and the metallic salts are chemically incompatible. Aconite, veratrum viride, tobacco, lobelia, and amyl nitrite (Shafer), antagonize the action of ergot on the circulation.

SYNERGISTS.—Electricity, cold, digitalis, belladonna, are synergistic as regards the vascular system. Savin, gossypium, rue, borax, increase its parturient action.

PHYSIOLOGICAL EFFECTS.—In small medicinal doses ergot does not produce sensible physiological effects. In large doses it causes symptoms referable to the gastro-intestinal canal, and to the cerebro-spinal axis. It is bitter to the taste, and excites more or less heat and dryness of the throat, followed by thirst, stomach-pain, vomiting, intestinal pain, and occasionally purging. These gastro-intestinal symptoms are unquestionably due to the local irritant action of the drug; for, after death, in a few fatal cases which have resulted from its administration, there have been found patches of inflammatory redness in the stomach and intestines.

The active constituents of ergot diffuse into the blood. What changes, if any, are caused in the composition of the blood, are at present quite unknown. Very characteristic effects are, however, produced in the circulatory system: the action of the heart becomes slower, and an enormous rise takes place in the blood-pressure. This influence on the circulatory system modern research has shown to be

due to the action of ergot on the vaso-motor nervous system ; it increases the action of this system, and causes a contraction of the arterioles.

The dilatation of the pupil which follows is another evidence of this action. Pain in the head (usually frontal), dimness of vision, giddiness, and stupor, are also produced by it. The action of ergot on unstriated muscular fiber is further shown in the contractions of the parturient womb, the arrest of hæmorrhage, and the difficulty of micturition, which follows its medicinal administration. The power of ergot to contract the arterioles has been repeatedly demonstrated in the web of the frog's foot.

The phenomena above described, due to the administration of large medicinal or toxic doses, are known as *acute ergotism*. The peculiar morbid effects of ergot, when used for a long period of time as food (diseased grain), are known as *chronic ergotism*, which exists in two forms, the *convulsive* and *gangrenous*. Generally the convulsive form begins by vertigo, disorders of vision, *tinnitus aurium*, numbness of the fingers and toes, and afterward of the integuments of the body. These symptoms are followed by tetanoid contractions of the fingers, of the forearms on the arms, and of the arms against the chest ; of the toes on the palmar surface of the foot, of the leg on the thigh. The thoracic, abdominal, and diaphragm muscles are also tetanically contracted, and respiration becomes painful and difficult, and attacks occur similar to asthma. The intestinal muscles become affected by cramp, doubtless tetanoid in character, colics ensue, and diarrhœa ; the uterus in pregnant females takes on action, and abortion may result. The pulse is small, action of heart slow, and the surface cold. The appetite is generally ravenous.

The tetanic spasms, at first separated by distinct intervals, become continuous, and opisthotonos or emprostotonos is produced. Anæsthesia (complete) of the surface succeeds to the tetanoid attacks, and gangrene of limited spots may occur. The organs of sense lose their sensibility and taste, hearing and smell are abolished. The pupils are dilated, sometimes unequal, and various disturbances of vision ensue. Epileptiform convulsions may occur in addition to the tetanoid spasms, delirium sets in, and complete insensibility at last supervenes.

As has been shown by Lasègue and Tardieu, the gangrenous and convulsive forms of chronic ergotism are not separated by any well-marked pathological differences. The gangrenous form begins by tingling, numbness, formication, an insupportable sense of fatigue in the members, an earthy hue of the skin, coldness of the surface ; nausea, vomiting, and diarrhœa, with intestinal cramps, then occur ; muscular contractions take place ; an eruption of vesicles filled with a dark ichorous fluid appears on one or more extremities, and gangrene, dry or moist, quickly destroys the toes, the legs, the nose, or other parts.

The phenomena of chronic ergotism are evidently due to two causes—to the dyscrasia which exists in the subjects of this malady, owing to insufficient food and bad hygienic surroundings, and to the action of the ergot of the diseased grain, in diminishing the blood-supply to the cerebro-spinal axis, to the vegetative organs, and to the skin and muscular system.

To this general sketch of the actions of ergot, it may be well to add some particulars of its most important physiological properties, and some observations on the actions of the recently discovered active principles. The most conspicuous effect of ergot, and that on which depends its therapeutical applications, is the influence which it exerts over the vascular apparatus. It is an undoubted fact, in respect to which all the investigators agree, that ergot diminishes the number and alters the character of the cardiac pulsations. The frog's heart may be arrested in the diastole by the intravenous injection of a full dose. By Rossbach and Wernich it was observed that a vermicular or peristaltic motion was given to the heart of frogs. The arrest of the heart's action is attributed by Eberty to stimulation of the vagus and a consequent increase of the inhibition. By Rossbach it is referred to an action on the cardiac muscle. It is in a high degree probable, however, that the slowing and depression of the cardiac functions is due to the action of ergot on the cardiac ganglia. To this may be opposed the observation of Willebrand, that the normal or hypertrophied heart so contracts under the action of ergot that the difference in size is appreciable by percussion ! There is no dispute in regard to the contraction of the arteries induced by ergot. It has been observed and measured by Wernich, Briesemann, and Holmes. The notion that ergot causes contraction of the arteries by stimulating the vaso-motor system and its muscular apparatus has long been entertained. An enormous rise in the blood-pressure has been stated to occur by Eberty, Köhler, and H. C. Wood, and their opinion was based on kymographic observations. Holmes, Hermann, and Wernich, on the other hand, maintain that the blood-pressure is actually reduced. Wernich shows that the veins are dilated, and that a great accumulation of blood takes place in them, while, at the same time, the arteries contract, not receiving from the slowly acting heart sufficient blood. The contraction of the arteries is not, therefore, an active contraction, as has been supposed, but a collapse, the result of deficient supply of blood, which has accumulated in the dilated veins. By the theory of vaso-motor stimulation, it was easy to explain the action of ergot on the muscular fiber of the uterus and intestinal canal. If, however, the blood-pressure falls after the administration of considerable doses, as Handelin, Brown-Séguard, and others affirm, and the arterial contraction is not active, how explain the uterine and intestinal action of ergot ? This result is due to arterial anæmia (Wernich, Schlesinger, Mayer,

etc.). It is now clearly established that active movements occur in the muscular fiber of the intestinal canal and uterus by inducing an arterial anæmia. According to this view, then, the active peristalsis and the uterine contractions which follow the exhibition of ergot are the result, not of a direct stimulation of the sympathetic system, but of the diminished cardiac energy, dilatation of the veins, and arterial anæmia.

The action of ergot is not limited to the vascular apparatus. The arterial anæmia which it induces may serve to explain the cerebral effects which follow its free administration in man, but, besides these, the functions of the spinal cord and peripheral nerves undergo changes. In frogs ergot induces paralysis, beginning in the hind extremities, and thence involving all parts, the circulation and respiration being the last to yield. In warm-blooded animals the same effects are produced, and, if the action continues, finally the cardiac and respiratory centers are paralyzed. By Zweifel these central effects are held to be the principal, and all others merely secondary. On the other hand, the depression in the motor and reflex functions of the cord may be explained by the arterial anæmia, which is an undisputed effect of ergot, how much soever the mechanism of its production may be disputed. Indeed, it must be admitted that the actions of ergot are still *sub judice*. The numerous and often diverse views which have been expressed may be in part explained by the character of the preparations. There can be no doubt that the active constituents are unstable, and hence the pharmaceutical products vary, not only in the degree, but decidedly also in the character, of the actions. In Köhler's investigation, in which he compared the ergotin of Wiggers and Bonjean, there were very wide differences between them. The ergotin of Bonjean—an aqueous extract—excites the vaso-motor center in the medulla and the cardiac inhibitory center, and very large doses paralyze the heart, the muscular tissue losing its excitability to galvanism. Wiggers's ergotin has no effect on the vascular apparatus. In these experiments of Köhler, with which Eberty was associated, the power of ergot to increase the blood-pressure is an important point. The attentive reader will observe that in these experiments the heart was paralyzed, and the irritability of its muscular tissue destroyed. Wiggers's ergotin causes cramps of the intestines, and violent inflammation of the gastro-intestinal mucous membrane, effects which never result from Bonjean's. Both kinds of ergotin lower the temperature, and both retard the respiration. Bonjean's ergotin diminishes the irritability of the peripheral motor nerves, and Wiggers's increases it. Both lessen the irritability of the sensory nerves. Köhler concludes that, when it is desired to slow the heart, contract the vessels, diminish reflex actions, and lessen temperature, the ergotin of Bonjean should be used.

The physiological action of sclerotinic acid has been carefully studied by Nikitin in Rossbach's laboratory. He starts out by affirming the identity of action between this principle and ergot. In frogs the reflex excitability of the spinal cord is reduced, then destroyed, but in warm-blooded animals it is reduced only. It does not affect the irritability of the motor nerves, nor the contractility of the muscles, but when brought in contact with sensory nerves, paralyzes them. Sclerotinic acid depresses the action of the heart in frogs, but not in mammals. In toxic doses it lowers the blood-pressure and reduces the temperature. The respiration is slowed, and, when toxic doses are given, the movements of respiration cease before the heart stops. The peristaltic movements are increased in warm-blooded animals, and the uterus, whether gravid or not, is excited to action. Death is due to paralysis of respiration.

Sclerotinic acid has been freely prescribed by Von Holst, who finds it possessed of a high degree of activity, but other clinicians have been less successful—thus Kobert, of Halle, finds it can not be substituted for ergot. In my own experiments, I have found it produce effects, but not those of ergot proper. Sclerotinic acid is separated by alcohol, but Handelin, who had investigated this subject under the superior direction of Schmiedeberg, finds that ergot loses none of its activity by being extracted with alcohol. Handelin's experiments, made with an aqueous extract, present some points of interest. He found that small doses cause anæsthesia and impair the power of co-ordination, and large doses paralyze reflex and voluntary motions. As the peripheral nerves are unaffected, the paralysis is centric. Small doses lower the blood-pressure temporarily, and large doses permanently. The pulse is at first quickened, and then declines, becoming more and more slow until the heart is arrested.

The first trials with Tanret's crystallized ergotinine were made by Dr. Molé, who found it as effective in uterine hæmorrhage as ergot. The amount that he administered did not exceed four milligrammes in twenty-four hours. Galippe and Budin have also experimented with ergotinine on frogs, cats, and dogs, and produced many of the effects ascribed to ergot, namely, slowing of the pulse, reduction of temperature, paralysis, and convulsions. Peton, another investigator, has also experimented with ergotinine, the results of the action being contraction of the arteries, restlessness, trembling, diarrhœa, etc.

An examination of the results obtained from the experimental and clinical trials with the so-called principles and alkaloids of ergot demonstrates that in no single one are contained all the powers and properties of the drug. It is also evident that ergot, and those principles possessing its powers most nearly, depress the heart, and lower rather than elevate the tension of the arteries. The contraction of the arteries is not, therefore, an active contraction; and, as the blood accu-

mulates in the veins, there is an anæmia of the cerebro-spinal axis and of the organic muscular fiber. To this condition of things may be referred the phenomena resulting from the exhibition of ergot.

THERAPY.—The only diseases of the intestinal canal to which ergot is applied are *chronic diarrhœa and dysentery*. It is best adapted to those cases in which the chronic succeeds to the acute form, and is not so serviceable in the chronic diarrhœa of warm climates, which has developed slowly, without preliminary acute symptoms. ℞ Ext. ergotæ fluidi, ℥ ijss; tinct. opii deodor., ℥ ss. M. Sig.: *A teaspoonful three times a day.* ℞ Ergotinæ (aq. ex.), ℥ j; ext. nucis vomicæ, gr. v; ext. opii, gr. v. M. Ft. pil. no. xx. Sig.: *One every four or six hours.* This last prescription is highly useful in persistent chronic diarrhœa.

Dr. L. G. Andrew has treated *acute dysentery* successfully with the fluid extract of ergot. Dr. W. C. Dabney, of Virginia, urges the local application of fluid extract of ergot in affections of the mucous membrane characterized by enlarged vessels, as, *conjunctivitis, cervicitis, pharyngitis, etc.*, and by Dr. Eldridge it has been applied to the treatment of *gonorrhœa, acne rosacea, etc.* The theory of its action in these maladies is the artificial anæmia which it induces in the arterial vessels. Inflammation can not go on, because the blood-supply is inadequate. In the local application the fluid extract of ergot is used. In most cases this may be applied directly to the membrane undiluted. The aqueous extract, or *ergotin*, may be utilized for these purposes also; made into a paste more or less thick according to the character of the surface, it may be plastered on the affected part.

Ergot in the form of the fluid extract, with or without nux-vomica, will often arrest the bleeding of *hæmorrhoids*, and cause such a contraction of the vessels in recent cases as that the symptoms may entirely disappear. This treatment is especially serviceable in the hæmorrhoids which succeed to delivery. *Relaxation of the sphincter ani* and *prolapsus of the rectum* may be ameliorated and, when recent, cured by the same means.

Ergot is a useful remedy in cases of *enlarged heart* (dilated cavities) *without valvular lesion*. It may be given with digitalis: ℞ Ext. ergotæ fluidi, ℥ ijss; tinct. digitalis, ℥ ss. M. Sig.: *A teaspoonful three times a day.* There is now no longer any doubt as to the value of ergot in *aneurisms*, and especially in internal aneurisms beyond the reach of surgical treatment. In these cases the *methodus medendi* is as follows: ergot slows the action of the heart, and causes such a degree of contraction of the arterioles as to produce a great increase of the blood-pressure, whence it follows that the coagulation of the blood in the aneurismal sac is greatly promoted. It is quite conceivable that, as respects small aneurisms of the peripheral main arterial trunks, ergot may effect a cure in the mode suggested by Langenbeck, viz.,

by direct contraction, under the influence of the ergot, of the unstripped muscular fibers in the affected portion of the vessel. With the use of ergot should be enjoined rest in the recumbent posture, and other measures to favor hyperinosis and the coagulation of the blood in the aneurismal sac.

The recent, more accurate notions, regarding the physiological action of ergot, have led to its employment in various forms of *hæmorrhage*. With suitable means for improving the quality of the blood, ergot is very serviceable in the *hæmorrhagic diathesis*; but it is not to be relied on alone. The special indication for its use in hæmorrhage is a want of tonicity of the vessels. It is used in *epistaxis, hæmoptysis, renal, intestinal, and uterine hæmorrhage*. Large doses of a suitable preparation are necessary; for, if the drug be inert, nothing but disappointment will be experienced from its use, and small doses do not produce sufficient effect. From half a drachm to a drachm of the powdered ergot, or one to two drachms of the fluid extract, given every half-hour or hour, will be necessary in urgent cases. As powdered ergot rapidly loses its activity by keeping, the fluid extract should be used, and only that prescribed which has been carefully made from the fresh drug. Attention to these precautions will insure more uniform results in *hæmorrhage* than have hitherto been obtained. In *hæmoptysis* the fluid extract of ergot may be given with other appropriate remedies; ℞ Ext. ergotæ fluidi, ℥ ij; ext. ipecac. fluidi, tinct. opii deodor., āā ℥ ss. M. Sig.: *A teaspoonful every half-hour or hour.* When the sputa are heavily charged with blood, and there is no defined hæmorrhage, the following may be used: ℞ Ergotinæ (aq. ex.), ℥ j; pulv. ipecac., gr. x; acid. gallic., ℥ j. M. Ft. pil. no. xx. Sig.: *One every hour or two.* In *renal hæmorrhage*, the following is a useful formula and generally very effective: ℞ Ext. ergotæ fluidi, tinct. kramerizæ, āā ℥ ij. M. Sig.: *A teaspoonful every hour or two.* Or, ergotine may be prescribed with gallic acid, as in the prescription above given.

The indication for the use of ergot in *menorrhagia* is the existence of the large, spongy uterus—the condition of things which depends on *subinvolution of the womb*. Menorrhagia, when caused by ovarian excitement, is usually more promptly relieved by bromide of potassium, and *metrorrhagia*, produced by fibroids or fungous granulations, is, in the author's experience, much more decidedly held in check by diluted sulphuric acid than by ergot.

When there is reason to believe that *vertigo, epistaxis, headache, and tinnitus aurium*, are due to *miliary aneurisms* of the intra-cranial arterioles, most favorable results can be produced by the use of ergot. Also, when there is a sluggish and partially obstructed state of the intra-cranial veins, usually due to chronic arteritis, and accompanied by hebetude of mind, giddiness, epistaxis, etc., these symptoms are

made to disappear, and the mental condition is much improved by ergot.

Dr. Crichton Browne, a physician of large experience in these disorders, finds ergot a very useful remedy in certain forms of *mental disease*, for example, "in *recurrent mania, chronic mania with lucid intervals, and in epileptic mania.*" In these mental disorders he assumes the existence of cerebral hyperæmia, and he deduces the curative value of ergot from its power to cause contraction of the vessels.

Migraine, when the attacks are accompanied by suffusion of the face, injected conjunctivæ, and a full pulse—the congestive form—is cured by ergot, and Dr. Kitchen indeed extends its use to almost all kinds of *headache*.

In *epidemic cerebro-spinal meningitis*, ergot is one of the remedies from which the best results are to be expected. In *congestion of the spinal meninges and the cord, and in acute myelitis*, this remedy has probably been more uniformly successful than any other, but it must be given in large doses.

Excellent results have been obtained from the use of ergot in *acute inflammation of the conjunctiva, in blepharitis, and in the phlyctenular ophthalmia* of children.

The long-continued use of ergotin has achieved remarkable results in *chronic metritis. Uterine fibroids and polypi of the uterus* are greatly benefited in two modes by ergot: uterine action is set up, by which the growth is either compressed or extruded, and the nutrient vessels are so diminished in caliber that atrophy of the morbid growth occurs. The numerous reported instances of success by this treatment, and the author's personal experience of its utility, justify him in urging a trial of this remedy in uterine fibroids and polypi.

In *congestive dysmenorrhœa*, much good may be expected from the use of ergot when the menstrual molimen begins. ℞ Ext. ergotæ fluidi, ʒ vij; tinct. gelsemii, ʒ j; tinct. aconiti rad., gtt. xvj. M. Sig.: *A teaspoonful every two, three, or four hours. Amenorrhœa, when dependent on plethora, has been cured by ergot.*

When *incontinence of urine, nocturnal or diurnal*, is caused by a paretic or paralytic state of the *sphincter vesicæ*, relief may be confidently expected from the use of ergot. The fact that one of the ill results of the administration of ergot in large doses is an inability to void the urine, is an interesting explanation of the *methodus medendi* of ergot in these cases.

Ergot is one of the most satisfactory remedies in the treatment of *spermatorrhœa*. It is not useful when the losses are due simply to plethora. Its curative value is especially exhibited in those cases in which the erections are feeble and infrequent, the intromittent power wanting, and the testes relaxed and deficient in secretory activity.

Paralysis of the bladder, the result of over-distention, and occasion-

ally when due to cerebral or spinal lesion, is greatly benefited or cured by ergot.

Ergot was first employed by Da Costa in the treatment of *diabetes insipidus*, and a number of cases have been cured by Murrell, Saunders, and others. The remedy must be perseveringly used, and in full doses, up to the stomach capacity or evidence of physiological action.

Heitzmann has found ergot extremely useful in *acne rosacea*, and other forms of acne. He uses Squibb's fluid extract of ergot mixed with glycerin and water, giving ʒ ss internally, daily.

ERGOT IN OBSTETRIC PRACTICE.—It is no longer a matter of doubt that ergot promotes uterine contractions; that it originates them without previous effort of the womb, is questionable. The contractions due to ergot differ from the spontaneous, natural contractions, in being less rhythmical and more tetanic. When large doses of ergot are used, a continuous expulsive effort may be produced. Ergot is indicated in labor when there is *uterine inertia*, the first stage being completed, and no obstacle existing at the outlet. If given before dilatation is completed, the perinæum rigid, and the *ostium vaginae* not relaxed, disastrous consequences may ensue, both to mother and child. On the part of the mother, the violent and continuous pains—the resistance in front remaining—may cause a rupture of the womb, or the resistance may be overcome by laceration of the perinæum. On the part of the child, it arrests hæmotosis, partly by direct action on the placental blood, and partly by the continuous compression of the body; but the chief danger is paralysis of the fetal heart.

It is highly approved by obstetricians at the present time to administer a dose of ergot at the conclusion of the second stage of labor, to insure firm uterine contractions. This practice is held to be the more necessary when previous experience justifies the apprehension of troublesome hæmorrhage. When *post-partum hæmorrhage* occurs, it is universally conceded to be the proper thing to administer a full dose of ergot; but at the same time other measures must be resorted to in order to procure firm uterine contractions, on which alone depends the safety of the patient. In these conditions the ergot is usually administered in substance—one scruple to a drachm of coarsely-powdered ergot infused in a cup of hot water, the whole being drunk by the patient. From ʒ j to ʒ j of the fluid extract may be given instead—the official preparation representing a grain of ergot to the minim.

THE HYPODERMATIC INJECTION OF ERGOTIN.—The subcutaneous injection of ergot has become so important a therapeutical resource that it is necessary to treat the subject in a separate division. The solution employed for this purpose is usually as follows: ℞ Ergotinæ (aq. ex.), ʒ j; glycerini, ʒ j; aquæ destil., ʒ vij. M. Sig.: *Eight minims contain one grain of ergotin.* Squibb has prepared "an extract of ergot which is almost entirely soluble in cold water, and rep-

resents good rye ergot in the proportion of one grain of extract for five grains of ergot. Sixty grains of this extract, dissolved in two hundred and fifty minims of water—the solution filtered, and made up to three hundred minims by passing water through the filter to wash it and the residue upon it—makes a solution which represents ergot in the proportion of minim for grain, and is of the same strength as the fluid extract of ergot, but is free from alcohol or other irritant substance." This preparation the author has found to be admirably adapted for subcutaneous administration. When the aqueous extract of ergot of good quality can not be obtained, the fluid extract may be used.

The rules for the administration of ergot are the same as for other agents applied in this way.

In the treatment of *hæmorrhage*, when a prompt effect is desired, the hypodermatic injection is preferable to the stomach administration. In *hæmoptysis*, the injection may be practiced while suitable remedies are administered by the stomach. In *hæmatemesis*, especially if the stomach be irritable, better results may be obtained by subcutaneous use of ergot than by any form of internal medicine. In *post-partum hæmorrhage*, when to await the action of ergot may endanger the life of the mother, the subcutaneous administration should be resorted to. The happy results which have attended this mode of administration in serious cases, demand that the *accoucheur* be provided with the necessary appliances for the hypodermatic injection of ergot in every obstetrical case. This mode of using ergot is not only prompter in results, but is more effective in securing uterine contractions and arrest of hæmorrhage.

The good results which are obtained from the stomach administration of ergot in *subinvolution of the uterus* and in *chronic metritis*, are much more quickly and decisively obtained from the subcutaneous administration. Since the memoir of Hildebrandt appeared, numerous cases of successful treatment of *uterine fibroids* by hypodermatic injection of ergotin have been published. There seems to be no longer any doubt that this agent administered in this way, and less effectively and for a much longer period by the stomach also, has the power to arrest the growth of uterine fibroids, to cause them to atrophy, or to set up such a degree of uterine action as to compel their extrusion as polypi from the uterine cavity. It has, of course, long been known that ergot administered by the stomach may induce such a degree of uterine contraction as to expel a polypus. In those instances in which the hypodermatic injection fails to arrest the growth of a polypus, notable improvement in the amount of the hæmorrhage and of the muco-purulent discharge is, at least, a result of the treatment. The author is enabled to speak from personal observation of the excellent results obtained by this mode of treatment in many cases.

From two to six grains of the aqueous extract of ergot (ergotin) may be injected under the skin in these cases of uterine fibroids on alternate days, or thrice or twice each week. The abdomen is usually preferred as the site of the injection. More or less pain is experienced at the moment of the insertion of the solution, and an indurated spot, which may be more or less sore, will remain for a week or more. Suppuration may result from the injection, but it is not a frequent accident.

The hypodermatic injection is an effective mode of treating *varicocele*. About two grains of the extract in solution is a suitable dose. The needle is inserted so that its point will rest among the dilated veins, but care must be taken not to puncture a vein. Very severe pain follows, and there may be great faintness, but the effects subside in a few hours unless considerable swelling should ensue, which is quite usual. A single injection may cure a very extensive varicocele, and more than two are rarely necessary. *Varicose veins* in other parts, especially of the inferior extremities, have been cured by the same treatment. The following is the mode of proceeding in these cases: the needle is inserted under the skin, in close juxtaposition to the enlarged vein, and the fluid is so injected as to lie alongside of the vein, but not to enter it. The cure which follows in many of these cases has been ascribed to the inflammatory swelling which takes place, but there is, doubtless, besides this effect, a dynamical influence exerted on the vessel-walls.

It has lately been asserted that *deficient erections* and *loss of the capacity for coitus* are not unfrequently due to enlargement of the dorsal vein of the penis, and consequent too rapid emptying of the veins of the erectile tissue. Acting upon this plausible suggestion, the author has practiced the hypodermatic injection of ergotin about the dorsal vein of the penis, and he has had apparently excellent results.

Before closing this article, it may be advisable to recall to the reader's attention the fact that the hypodermatic injection of ergot, or its internal administration in large doses, may cause such tonic contraction of the *sphincter vesicæ* as to render micturition impossible. Careful inquiry and frequent examinations of the hypogastric region should be made during a course of ergot preparations.

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Ustilago.—Ustilago. *Ustilago maydis* Leveillé (Nat. Ord. *Fungi*) grows upon *Zea mays* Linné (Nat. Ord. *Graminaceæ*). (U. S. P.)

Extractum Ustilaginis Maydis Fluidum.—Fluid extract of ustilago. Dose, ℥ x—ʒ j.

COMPOSITION.—No proper investigation has yet been made of the chemical constitution of ustilago. Some of the ingredients found in ergot have been detected, as *secaline* so called, and *trimethylamine*; but the latter is regarded by others as a decomposition product and not existing preformed. Besides other substances, Parsons has separated an acid, which he regards as similar to the *sclerotic acid* of Dragen-dorff, and a substance soluble in ether but not in alcohol.

PHYSIOLOGICAL ACTIONS.—Ustilago has been made the subject of physiological investigation by Mr. (now Dr.) Ripley C. Hoffman, of Iowa, in the laboratory of experimental therapeutics of Jefferson Medical College, under the supervision of the author. The research embraced cold- and warm-blooded animals. The preparation used was the fluid extract, made by John Wyeth and Brother, of Philadelphia, and it proved to be quite active. Both in cold- and warm-blooded animals, ustilago acts as a spinal excitant, causing convulsions of a tonic character. It also heightens sensibility and the reflex function, so that the least irritation of the skin induces general tonic convulsions of the tetanic or strychnic character. Frequent irritation and repeated convulsions rapidly exhaust the animal. On the other hand, quiet, darkness, and relief from all irritation, diminish the severity of the convulsions, and prolong life, if not prevent a fatal result. Death may ensue in a convulsion by tetanus of the respiratory muscles. Muscular tremors, general, occur in warm-blooded animals, and muscular weakness (paresis) appears in the intervals between the convulsions. The irritability of the motor nerves, and toward the end, of the sensory nerves also, declines, but is not entirely lost, and the contractility of the muscles lessens somewhat. That the convulsions are spinal, is a fact proved by destroying the cord in a frog, before admin-

istering the medicament, when no muscular action of any kind takes place. Section of the medulla or decapitation does not prevent the occurrence of the convulsions.

Ustilago slows the heart, and by numerous control experiments this action was shown to be due to stimulation of the pneumogastric and its terminal ganglia. It dilates the pupil, and affects the acuteness of vision for near objects.

We have no exact data in regard to the action of this agent on the uterine system. An impregnated cat, dying by a merely lethal dose slowly, did not abort; but it is said that pregnant cows and bitches, after eating ustilago, have dropped their young.

The modes of dying are two: in the tetanus; by exhaustion. In the former, the respiration is arrested, violent tonic extension of the voluntary muscles takes place, the head being drawn back, the toes incurved. In the latter, there is gradually increasing paresis between the convulsions, and slowing of the heart's action. The difference is largely due to the dose and rapidity of administration. A lethal dose for a rabbit weighing 25 ounces seems to be one drachm of the fluid extract.

THERAPY.—If Dr. Hoffman's study of the action of the fluid extract be confirmed by others, ustilago must occupy an important position as a remedy, possessing as it apparently does the powers of nux-vomica and of ergot combined. It is indicated in the several groups of cases to the treatment of which these remedies are now applied.

Digitalis.—The leaves of *Digitalis purpurea* Linné (Nat. Ord. *Scrophulariaceæ*), from plants of the second year's growth. (U. S. P.) *Feuilles de digitale*, Fr.; *Fingerhutblätter*, Ger.

Abstractum Digitalis.—Abstract of digitalis. Dose, gr. ss—gr. j.

Infusum Digitalis.—Infusion of digitalis contains 3 parts each of digitalis and cinnamon, infused in boiling water; after two hours maceration is strained; then 15 parts of alcohol added, and finally sufficient water to make up to 200 parts. Dose, ʒ ij—ʒ ss.

Extractum Digitalis Fluidum.—Fluid extract of digitalis. Dose, ℥ j—℥ iij.

Extractum Digitalis.—Extract of digitalis. Dose, gr. ss—grs. ij.

Tinctura Digitalis.—Tincture of digitalis. Dose, ℥ v—ʒ j.

COMPOSITION.—Digitalis contains an active principle, *digitaline*. This exists in the amorphous and crystalline form. The amorphous form—the digitaline of Homolle and Quévenne—possesses considerable activity, and, according to some authorities, is quite equal to the crystalline in strength. The crystalline digitaline (Nativelle's digitaline), physiological investigations have shown, is really an active principle which represents all of the powers of the drug. This occurs in needle-shaped crystals, and has an extremely bitter taste.