Surely no plainer words could have fallen from the court, and a severer thrust than it has not been made at the medical profession in many a day; and if their pride can be touched, and their sense of honor stimulated, it would seem as though the exciting cause for such emotions and efforts had now been presented.

THE PHYSIOLOGICAL AND THERAPEUTIC RELATIONSHIPS OF ERGOT OF RYE.

By FRANK W. DRAPER, M.D.

(Continued from page 341.)

THERAPEUTICS.—So readily are the therapeutic relationships of this important agent inferred from the study of its physiological action, that the indications for its use need hardly be discussed at length. Indeed, so numerous are the accredited occasions for its practical application, that the recorded different instances in which it has been found efficacious would by themselves fill a volume, exhibiting proofs of the most extraordinary powers, and placing it in the very front rank of therapeutic agents. For example, it is claimed by one author to have, for its destiny, to supersede entirely the use of forceps in obstetric practice; while another advocate of its omnipotence says enthusiastically that were it introduced to general practice, the death of a woman in childbed would never be heard of. (Mitchel on Ergot, p. 78.) Boujean places it at the head of hæmostatic agents, and urges its use in various surgical operations where ligatures are now employed; while for its use in dysentery and in whooping cough, in albuminuria and in asthma, in neuralgia, in gonorrhœa, and in a multitude of other diseases, its advocates are sufficiently numerous to almost warrant its title of universal panacea, and, with a surfeit of virtues, to enable it to partake of the unenviable pretensions of advertised nostrums. In thus passing through the trying ordeal of therapeutic fashion, ergot, in common with all valuable remedies, has been in danger of being sacrificed through the ardor of its friends; but its efficacy is now too well recognized to permit its exposure to any such fear for the future. But from all this apparent diversity and incongruity in its practical applications, it is still possible to deduce a single rule for its general employment, the direct corollary of its physiological action—*whenever it is desirable to stimulate and contract the unstriated muscular fibre, then the use of ergot is indicated.* To the test of this rule its powers as an astrin-

gent, a sedative, a hæmostatic, a parturifacient, in all their seemingly anomalous phases, may be at once referred. The conditions of its action must, of course, be favorable, else, on the one hand, no effect will follow, and we shall say with Madame LaChapelle, "its innocence is its greatest virtue"; or, on the other, its action will be unexpectedly disastrous, and we shall lean to the side which declares that "its introduction into practice has been productive of more harm than good." But between these two extremes is a safe mean wherein its judicious use is the source of indescribable blessing.

It should be remembered, however, that for reasons already referred to, we must not expect a uniform effect on all the parts supposed to be susceptible to the influence of ergot. Nor must it be forgotten that as a necessary result of its general constitutional effect, we must be prepared for symptoms quite unlike those for which the dose was administered, and, it may be, for the time, harmful. Thus it is possible that, in uterine hæmorrhage, our ergot will not only control the flooding, but, at the same time, produce a distressing nausea and alarming depression entirely unlooked for; or, if given to a pregnant female for the relief of myelitis, it may send into the world, "scarce half made up," the ill-fated occupant of the gravid uterus. But if with the beneficent results of the administration of spurred rye we must also expect the undesirable, proper discrimination may still anticipate and avert disasters.

Its earliest as well as its most important use ranks it as the first of parturifacient agents. For nearly three centuries it has been thus employed, and upon its uses, its virtues and its abuses in this direction, have depended the sharp differences of opinion which have sometimes developed to acrimony. The mode of its action and the attendant phenomena have been considered. If in any hands it fails to give good results, the fault is either in the quality of the drug used, or in the unfavorable condition of the patient, either for the time being or through permanent idiosyncrasy. The conditions modifying its action in labor are both mechanical and vital. Thus, an undilatable os tincæ, a narrowed pelvis, a hydrocephalic head, would offer obvious obstacles to a normal labor which ergot could hardly be expected to overcome. And again, the condition of the patient may have become so depressed, from exhaustion or other causes, that ergot would fail to create its proper effects. So clearly has this been

shown by Dr. Murphy that it may be well to transcribe his own words. "In order," he says, "to excite the action of this or of any other medicine, the nervous system should be capable of conveying the necessary impressions; but when this is not the case, *secale cornutum* cannot stimulate the uterus; nevertheless, if it regain its irritability, or if ergot be given before the uterus has lost its tone, in either case its efficacy is undoubted, and it may be usefully employed. Assuming this explanation as true, ergot of rye may be contrasted with opium. When the nerves of the uterus have lost their natural irritability, and the uterus is in a state of atony, opium is the most efficient excitant to its action, because it then acts on these nerves as a most powerful stimulant; but when that irritability is restored, or if it be only slightly impaired, it acts as a sedative, and may paralyze the uterus. Ergot, on the contrary, is quite inefficient in nervous exhaustion of the uterus, because so far from acting to stimulate in such cases, its effect tends towards sedation, while its specific effect is produced the moment that exhaustion is removed." (Murphy's *Obstetrics*, p. 273.)

The dangers which are said to attend the use of *secale cornutum* in labor are serious and often truly formidable. Rupture of the uterus, puerperal convulsions, irregular uterine contraction, separation of the placenta and violent flooding, prolapse and procidentia, retained placenta, coma and even death; are attributed to its use. Some of these, depending on inevitable and unforeseen conditions, would perhaps follow in spite of the use of any therapeutic agent, or possibly, the more readily, in some cases, were such a remedy avoided; while many if not most of the fatal cases may be fairly attributable to the use of a powerful agent in inexperienced or ignorant hands, regardless of reasonable rules for guidance in such cases.

The indications for the use of ergot in parturition may be considered in two classes of cases—the *ante-puerperal*, including instances in which it may be used before the expulsion of the foetus, to aid in that process; and the *post-puerperal*, comprising conditions favorable to its action after that stage. In the former may be mentioned—
I. Tedious labor. II. Premature labor. III. Normal labor, when it is desirable to hasten the process when the life of the child or of the mother is endangered. The second class contains cases of—I. Puerperal hæmorrhage. II. Retained placenta, depending on uterine inertia. III. Retention within the uterine cavity of clots of blood

and other puerperal matters, such as fragments of placenta or of the membranes.

In tedious labor, which, according to Churchill, is understood to mean parturition in which no manual or instrumental interference is used, but which is prolonged more than twenty-four hours from causes which occasion delay in the first stage, ergot is of use to supply renewed force to a uterus exhausted or too debilitated to overcome the continued resistance. The conditions favorable for its employment are, on the authority of the same writer, "when the pains are feeble and inefficient without especial cause; if the os uteri be soft and dilatable; if there be no obstacle to the natural delivery; if the head or breech present and be sufficiently advanced; and if there be no threatening head symptoms nor excessive general irritability." (Churchill's *Midwifery*, p. 264.) The conservative and rational policy of Dr. Condie would modify these rules, so that ergot should not be used until the os uteri is not only dilatable but is fully dilated, and the other soft parts are in a favorable state of relaxation. This would appear to be the more prudent course, to the end that all necessary safeguards might be established. Desgranges, an enthusiastic advocate of ergot in the last century, recommended its use in hastening tardy dilatation of the neck of the uterus, and cites numerous confirmatory cases. But such employment is manifestly attended with no slight risk to both mother and child, for the incessant, unremitting uterine contractions induced by ergot, especially if no outlet be provided for the escape of the contents of the womb, must necessarily have a deleterious effect, in a mechanical point of view, on the foetus, while the exhaustion to the uterus itself and to the whole maternal system is increased by the ineffectual influence of an extraneous agent, to the degree that convulsions sometimes result.

The use of spurred rye in premature labor, to hasten or produce it, when such a proceeding is unfortunately necessary, depends on a question scarcely solved even to-day—the power of that remedy to initiate uterine contractions. Rationally and consistently, according to the proposed theory of its physiological action, such an effect is to be looked for. If the theory of its action is true, it should apply to the uterus when unimpregnated, or in the early stages of foetal development, no less than at full time, when normal contractions have already commenced, the difference being only one of degree. Authorities are not

wanting in support of this view. Thus, Churchill, in discussing the method to be used in the induction of premature labor, says of ergot of rye, that "it is now generally believed to have the power of originating uterine contractions, and when it succeeds, it is a very effectual and safe mode of inducing premature labor, because we can preserve to the child the safeguard of the liquor amnii, which is of the greatest importance." (Midwifery, page 308.) Ramsbotham has published cases in which ergot was thus found efficacious, and advocates its use. (*Medical Times and Gazette*, 1854-1856.) So firm was the professional opinion in France that this power to produce abortion resided specially in ergot, that the Royal Academy urged its exclusion from practice. It has been repeatedly noticed that pregnant women exposed to the chronic effects of ergot, show a very decided tendency to abortion at any stage of pregnancy. It is to be remembered that the peculiar action is marked in proportion to the extent of the muscular tissue exposed; and if, in the early stages of pregnancy, we fail to experience the ready and decided effects of ergot which mark its influence in normal labor, much of the difference may be explained in this way. If, moreover, it is not to be wholly relied on as a means for the induction of premature labor, we have in it, at all events, a powerful agent for the supplementing of other means; if, after mechanical appliances have been resorted to, to separate the uterine membranes or to dilate the os tincæ forcibly, it is required to expedite the expulsion of the foetus, ergot seems a ready agent to complete the process.

There are, thirdly, conditions in normal labor, rare and exceptional, when it is desirable to finish the act as soon as practicable. Thus if, at any stage, puerperal convulsions should develop, or if unexpected hæmorrhage should occur, or if some condition of the child should indicate it, we should look for other means than the natural labor pains to hasten the act of parturition. Such an aid we have either in the uterine forceps or in the agent we are studying.

In this discussion of the use of *secale cornutum* in ante-partum cases, one very essential element requires consideration—the effect on the foetus in utero. Authorities are too numerous to be controverted, that spurred rye is dangerous to the life of the child in labor. The symptoms in living children who have been born with the assistance of this remedy are too well marked, and the

appearance in those stillborn are too characteristic to induce any belief other than that they are to be referred, primarily or secondarily, to its unfavorable influence. This deleterious effect on the child, whether it be fatal or whether it produce a less degree of harm, may be explained in three ways:—first, the mechanical action of the continued and uninterrupted ergotic contractions of the uterus on the body of the foetus, must obviously be more or less harmful, compressing the brain, cramping the limbs, and compromising the circulation; secondly, the same incessant tonic contraction, acting at once on the muscular tissue and on the vessels of the uterus, tends directly to impede both the uterine and the foetal circulation, thus allowing no truce to repair exhaustion, and to permit fresh blood to enter the partially emptied vessels; while at a distance from the uterus, the secondary sedative effect on the heart also modifies the normal circulation; thirdly, so long as the foetus is attached by its umbilical cord to the uterus, deriving its nourishment from that source, its susceptible organism must be more or less exposed to the toxic influence of ergot, through the maternal circulation, in common with every other part. Observing the peculiar phenomena in children born alive or still, after the use of spurred rye in labor, and identifying them with the symptoms of acute ergotism, Dr. Beatty has concluded that most of the fatal cases in children in ergotic labor are induced by an exposure of more than two hours to the poisonous effects of ergot through the blood of the mother. In many cases, also, in which the children survived, he has noticed modified ergotism and secondary permanent effects, manifested chiefly through the nervous system, and attributed by him to the same cause. His numerous observations in this direction have therefore led him to establish the rule that ergot should not be given in any case in which the labor will not terminate within two hours, since the probabilities are vastly in favor of a fatal toxicological effect on the foetus, if it be exposed beyond that period.

In the second general class of cases in which *secale cornutum* is of use in parturition, those, namely, after the birth of the child, the first order, including cases of puerperal hæmorrhage, is by far the most important, and illustrates most fully the beneficial effects of this remedy. The foetal contents of the uterus having been expelled, that organ itself exhausted by its prolonged labor, and incapable, for the present, of spontaneous contraction, the placenta either

wholly detached and lying inertly in the cavity of the womb or only partially separated, and as a consequence, in either case, a steady and most alarming escape of blood, putting the life of the patient in momentary jeopardy; all these conditions constitute a most serious combination, and any agent endowed with power to relieve it is of incalculable value. The indication is to stimulate the relaxed and wearied uterus to renewed action; whatever will do this will close the exposed mouths of the uterine vessels, complete the detachment of the placenta, and expel it, and thus at once effectually control a condition acknowledged to be the most alarming in the experience of the accoucheur. In conformity with the proposed theory of its physiological action, ergot acts in three ways to control the hæmorrhage:—first, the muscular fibres of the uterus are revived to renewed action by the direct stimulant power of the drug, thus necessarily closing the uterine vessels; secondly, the calibre of the vessels themselves is lessened and the flow of blood diminished; and thirdly, the flow of blood is also modified by the general sedative effect on the heart and circulation. All these results being produced in unison, an early and favorable effect is produced. And fortunately, in view of the formidable nature of the accident, the conditions which are to be remembered as favorable to its action are few and obvious. There is now no fœtus to fall a possible victim to ergotism; there is no danger of rupture of the uterus or of any of the concomitant accidents of labor when ergot is used as an adjuvant. The indication is to contract the uterus, and the principal condition for the action of ergot in such an emergency is that the nervous irritability of the patient shall not have become exhausted to such an extent that the medicine would fail to exercise its influence. To this end many excellent authorities are in the habit of administering *secale cornutum* as a prophylactic to flooding, and to women known to be predisposed to post partum hæmorrhage, or in cases even of doubt, they give the requisite dose at the close of the second stage of labor. This practice is generally attended with most satisfactory consequences. The third stage proceeds at once, and the whole labor is terminated without complication.

The indications for the use of ergot in cases included in the second and third classes of post-partum conditions, those in which the placenta, or any detached portion of it, is retained through inertia of the uterus, or in which coagula or fragments of

the membranes remain as foreign bodies, to provoke renewed hæmorrhage by their presence, are so obvious and follow so closely on the conclusions already expressed, that they need no farther elaboration. So, too, the efficacy of spurred rye in expediting the expulsion of other bodies from the cavity of the uterus, besides those attendant on the puerperal state, is manifest. Great reliance is placed upon it in the management of polypi of the uterus, hydatids and other abnormal growths.

That hæmorrhage under other conditions and in other parts of the body than those peculiar to parturition should be, in greater or less degree, amenable to the hæmostatic power of ergot, is readily inferred. The analogy is sufficiently clear and universal. Having a power to act on the inorganic muscular fibre, residing not in any chemical influence, but in its vital action as a special astringent, its utility in certain cases of hæmorrhage is obvious theoretically and is confirmed in practice. Menorrhagia, metrorrhagia, epistaxis, hæmatemesis, hæmoptysis, hæmaturia, rectal hæmorrhage and that depending on cancer, hæmorrhoids or scurvy, the hæmorrhage of dysentery, are thus all susceptible of successful control by ergot, since they are all dependent on an analogous condition or lesion of the capillaries. This result is especially marked, if with the hæmorrhagic symptoms a firm, bounding pulse indicate a sthenic condition of the circulation, since the secondary depressing influence on the general circulation must have a direct tendency to control the escape of blood. This is of general application in idiopathic or in traumatic hæmorrhage from the capillaries, and the cases of its efficacy in all the conditions mentioned are sufficiently multiplied to establish the prestige of ergot in this relation, whether it be administered internally or locally.

There are even authorities for giving to *secale cornutum* a still higher place as a hæmostatic agent. In 1843, the Royal Academy of Sciences in France reported, through its Secretary, that "ergotine is the most powerful remedy which medical science possesses to control arterial or venous hæmorrhage"; and three years later, the Royal Academy of Turin concluded that "ergot was a hæmostatic agent especially appropriate to arrest arterial hæmorrhage, even in great vessels, without occluding them." Without claiming for spurred rye that it will entirely supersede the use of the ligature in surgery, M. Bonjean urges its local, external use in many

cases in which ligation would generally be resorted to, involving inconvenient if not grave operative complications. He even goes farther, and cites cases in which, under the effects of ergot of rye as a surgical dressing, by means of tampons or otherwise, lacerated wounds of considerable extent have healed "with very little suppuration or inflammation, and sometimes even by the first intention," owing, as he believes, to the depressing influence on the adjacent parts. (On Ergotism, p. 12 et seq.)

These results, although stated with emphatic directness, and supported by well authenticated authority, and moreover confirmed by cases of remarkable cure, have hardly given to ergot, in our time, an important place among surgical therapeutic agents for the arrest of hæmorrhage, or for other indications, and appear to need still further proof.

Among the more indirect and anomalous indications for the use of spurred rye, most of them substantiated by trustworthy cases, many of them founded on empirical experience, and all of them probably dependent on the secondary effects of the drug, acting through the circulation to modify the nutrition of the diseased parts, may be mentioned the various affections of the mucous membranes, such as bronchitis, leucorrhœa, diarrhœa and gonorrhœa in their chronic stages. Gubler, in common with other writers, urges its utility in alleviation of either the passive or the inflammatory congestion of the unimpregnated uterus, in incontinence of urine on account of deficient tonicity of the sphincter of the bladder, in spermatorrhœa under similar conditions, and in calculus of the bladder to aid in the expulsion of the fragments. And at a still greater distance from the more obvious conditions subject to the proposed theory of its action, and indeed in some degree savoring of homœopathic inconsistency, may be mentioned the use of ergot in puerperal convulsions (Gendrin, Baylis's Commentaries, p. 448); in the puerperal after-pains (Beatty, op. cit.); and in intermittent fever (Pereira, Mat. Med. p. 82). Others recommend its use in whooping-cough (*Edin. Med. and Surg. Jour.*, vol. ix. p. 56) and in amenorrhœa (Giacomini, op. cit. p. 330). It is difficult to account for the action of ergot in these cases on any uniform principle, if we accept at the outset the fact of its efficacy.

In more manifest accord with the theory of action proposed may be noted the general application of secale cornutum in all inflammatory states (Hartshorne, Essentials

of Pract. Medicine, p. 90). Illustrative of this, we may cite the observations of Parola, who found it useful in the first stage of pneumonia and in diarrhœa and peritonitis.

Finally, it remains to allude to a class of cases in which the efficacy of ergot depends on its continued stimulant action on the muscular elements of the vessels supplying the nutrition of the spinal cord. In 1831 Barbier first employed spurred rye in paraplegia, complicated with retention of urine, and with good success. (*Rev. Med.* xiii. p. 332.) Subsequent similar results were attained by various observers, and on various theories. It was reserved, however, for Prof. Brown-Séquard to elucidate its action and to propound rules which should govern its employment. Having demonstrated experimentally that ergot in common with belladonna had the power of diminishing the congestion of the spinal cord, he reasonably applied those remedies to cases of paraplegia depending on myelitis or on simple congestion; the attendant hyperæmia being the requisite indication, in contradistinction to the condition in white or non-inflammatory softening. He establishes it as a rule of universal application, that ergot is to be used in paraplegia only in cases in which the symptoms of irritation indicate some inflammatory change in the cord or its membranes; and among these symptoms he enumerates altered sensations of heat and cold, continued cramps of the abdominal or thoracic muscles at the upper limit of the inflammation, giving a feeling as of a tight band around the body, referred sensations of formication, of pricking or of heat and cold, and general muscular spasms. He thus draws a marked distinction between cases in which ergot is useful by temporarily modifying the nutrition of the cord, and other conditions in which such a proceeding would result in positive harm by still farther compromising the supply of blood, already too greatly diminished (*Lancet*, Dec., 1860, p. 605). To all states, then, of the spinal cord, in which congestion is a present symptom, ergot is applicable; and in support of this, abundant clinical evidence is adduced demonstrating its efficacy in such cases.

The dose of ergot for fulfilling these therapeutic indications is either simple or continued; the former applicable to cases in which it is liable to produce marked and immediate effects without repetition of the administration, and the latter to those in which continued action is sought. The obstetrical indications illustrate the one, and the conditions in myelitis, the other. In

obstetric practice, the infusion of the crude drug, freshly powdered, is preferred, greater certainty of action being secured. The formula of Dr. Beatty directs the infusion of two scruples of ergot in four fluid ounces of boiling water, and of this one half is administered at a dose. The fluid-extract is also largely used, each minim representing one grain of the drug. For the continued action the standard dose is five grains. The ergotine of Bonjean, much used in France, is given in doses of from one to three grains.

This study of the psychological and therapeutical relationships of ergot is not intended as a complete or exhaustive review of its characteristic powers. The object has been to present, in a brief way, a *résumé* of the latest views, by the best authorities, concerning a remedial agent whose legitimate use has placed it in the first order of importance in the materia medica, establishing for it a position which all the evils, attending its abuse, can hardly compromise.

Medical and Surgical Journal.

BOSTON: THURSDAY, JUNE 17, 1869.

WE have alluded, in a former number of this JOURNAL, to the experiments of Cohnheim upon the *white* corpuscles of the blood, and to the doubts thrown upon their accuracy by Balogh. We now give extracts from a translation by S. Nickles, M.D., in the *Western Journal of Medicine*, of a paper by Cohnheim on Congestion, with especial reference to the behavior of the *red* globules. These extracts we follow with an abstract from the French, which speaks for itself.

"Cohnheim publishes (*Virch. Arch.*, xli. p. 227) an investigation on venous congestion, which is closely related with his researches on inflammation and suppuration. The object of the inquiry was to ascertain why, in passive hyperæmia, a plasmatic fluid (*œdema*) transudes very copiously, while, on the contrary, lymphatic elements (*phlegmon*) find egress in but limited amount.

"Cohnheim selected for his observations the web of frogs which had been treated with curara poison, and in which, by means

of a simple and suitable contrivance for regulating the firmness of a ligature, he could absolutely control the circulation of the femoral vein. He found that soon after the ligation of the crural vein, the movement of the blood in all the vessels of the web became *pulsative* and *rhythmical*, while, at the same time, the *rapidity* of the *current gradually diminished*, so that, finally, one gets the impression of a resting mass pressed onward only at intervals, by the pulse-move. The cause of this phenomenon is, that the resistance in the veins and capillaries has become so great from the sudden closure of the crural vein, that it can be overcome only by the systole. *Edematous infiltration* of the web begins very early, while the *axial character of the current disappears* in the arteries and veins, and soon, with but *moderate dilatation*, all the vessels become *densely filled with blood corpuscles*, of which the red ones are so placed in the capillaries that not the edge but the surface is struck by the current. The accumulation of the red corpuscles increases gradually to such a degree that their outlines seem to blend with one another, and a few minutes later the capillary vessel presents a homogeneous, red, immovable cylinder, which soon changes its color from a light yellowish or greenish red to a bluish red, the color of venous blood. Without any marked alteration in the interior of the capillaries, one may now observe on their outward periphery the protrusion of *small red, rounded elevations*, which form lateral offshoots, not unlike little mulberries, and their collapse and change into ordinary red blood corpuscles. If the ligature of the femoral vein is now removed, the normal conditions are soon reestablished, the red corpuscles, one by one, becoming separated in the direction of the veins from the apparently homogeneous cylinders. Of course the red masses already exuded into the tissues are not affected by this restorative process, whereas, the intracapillary part of cells about passing through the walls, is lashed by the current of blood until it is torn off and carried away."

"That, on the contrary, the red corpuscles do indeed pass through the *unbroken wall of the vessel*; that, in other words, really a *hæmorrhage per diapedesin* and not *per rhexin* presents itself, is shown by the circumstance that as soon as the circulation again becomes free and the pressure upon the capillaries remits, not a single corpuscle follows those already exuded."