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Sincere regards of the Author.

52754/p

AN  
EXPERIMENTAL INQUIRY  
INTO THE  
PHYSIOLOGICAL ACTION OF ERGOT OF RYE.

By SAMUEL WRIGHT, B.A., F.B.S.E., M.S.A.

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of Edinburgh, Honorary Member of the Metaphysical Association of  
Glasgow, and of the Physiological Society of Montpellier.

[Being an abridgement of the Harveian Prize Essay for the Session 1837—38.]

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(From the *Edin. Med. and Surg. Journal*, No. 141.)

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WHETHER ergotted grain were known to the ancients is a matter of doubt. It is said to have been mentioned by Theophrastus, Virgil, Ovid, and Pliny;\* but I think it very probable that they were not acquainted with any other forms of the disease than smut and mildew. The “luxuries segetum” of Theophrastus and Pliny has been supposed to imply ergot, though the evidence in its favour I have never been able clearly to ascertain. We are, however, certain that it has been extensively known during the last two centuries, described as chiefly affecting rye, and recog-

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\* Spicæ quædam binos ordines habent, quædam plures usque ad senos. Grano ipsi aliquot differentiæ, longius, leviusque, aut brevius, aut rotundius, candidius, nigrius, vel cui purpura est.—Plinii, Nat. Hist. lib. 18, c. 18.



nized by various names, according to the languages in which it may have been expressed.

*Germ.* Mutterkorn, Afterkorn, Schwarzkorn, Halmensporn, Aetzroggen, &c.—*Fr.* Seigle ergoté, Bled cornu, Clou de seigle, Mère de seigle, Bled avorté, Bled farouche, Have, or Rachitique, Calcar, Chambucle, Ebrun, Faux seigle, Seigle cornu, or corrompu, Seigle à eperon, or ergotisé, Seigle ivré, Seigle noir, Argot, &c.—*Ital.* Grano allogliato, Segala allogliata.—*Polon.* Paniec. *Russ.* Spornick.—*Angl.* Ergot, Ergotted, Horned, or Spurred Rye.\*—*Lat.* Clavus secalinus, Secalis mater, Ergota, &c. “A Cl. Candolle, qui illud inter fungos computat, vocatur Sclerotium clavus; eandem ob causam a Doct. Münchhausen, Clavaria solida. Doct. Robert, ob vires partum promoventes, illud nuncupat Secale Puerperale, vel Melanophyma secalinum; (nigra in Secali semina.”)

Ergot is a disease to which rye is more liable than any other grain, though Tillet observed it in wheat near Rheims;† and the author of the *Journal Encyclopédique* says that he has repeatedly seen the oat so deteriorated.‡ Nor is it uncommon for barley to become ergotted in Scotland.

This disease has also been noticed in the

Phalaris canariensis	Arundo arenaria
—— aquatica	—— cinnoides
Panicum miliaceum	Elymus arenarius
Phleum pratense	—— Europæus
Poa fluitans	Triticum spelta
Festuca duriuscula	—— junceum
Alopecurus pratensis	—— repens
—— geniculatus	Holcus avenaceus
Aira cristata	—— lanatus
Agrostis stolonifera	Dactylis glomerata §

By Curtis in the *Festuca fluitans*, and by others in the *Avena elatior*,|| and in the family of palms.¶.

\* From its supposed resemblance to the spur of a cock or a horn.

“Deep-rooted mould, and Ergot’s horn uncouth.”—

(Darwin’s Bot. Garden, Canto 4.)

“Denominationis origo facili negotio explicatur: secale enim appellatur, quod vulgo observatur in secali cereali; *cornutum*, figura, quod semina hoc vitio degenerata ad calcaris vel cornu similitudinem accedunt; quoad significationem ergo nihil differunt nomina: secale corniculatum, calcaratum, frumentum, cornutum, et alia, quæ passim reperimus.”—(Rudolph Padiera, Med. Diss. De Secali Cornuto, Cap. i.)

† Dissertation sur la cause qui corrompt et noircit les grains du blé dans les épis, et sur les moyens de prévenir les accidens.—Bordeaux, 1755, 4to.

‡ Journ. Encyclop. Juin 1771. p. 209.

§ Rust’s Magazin für die gesammte Heilkunde, 25, 8.

|| Lond. Med. and Phys. Journ. 1817, Vol. xxxviii. p. 334.

¶ Aymen.—It may be observed, that Tissot states, on the authority of Haller, that the ergot affects only rye, and two or three other alpine plants of the grass kind.—(See Philosophical Transactions for 1765, Vol. lv. p. 110.)



SECTION I.—*Physical Characters of Ergot of Rye.*

Ergot, when ripe, displays itself in the form of a dark-coloured substance,\* which, in the place of sound grain, resides in the glume, exceeding it variously in length, and, if abundant, rendering the ear very conspicuous from the peculiarity of its hue. Some of the grains are composed of sound and diseased portions; the ergotted part, varying from one-third to one-half, is always within the husk.† It is rare to find all the pickles of an ear ergotted, the fewer so corrupted the more luxuriant they are. And conversely, when numerous, they are small in size, sometimes not exceeding the diameter or length of a sound grain.‡ The number of ergots in each ear is usually from four to five, though sometimes there will be ten or twelve. If only two or three be present, the sound grains upon the same ear are observed to be larger than usual; the whole plant is also more vigorous and healthy. But when the ergots are numerous, the grains not actually diseased have a very unhealthy appearance; they look shrunken, and are covered at their superior extremity with a black powder.§

It is chiefly produced upon low lands, more frequently on the borders than in the middle of a field, and generally in hot summers when there is plenty of rain. Spring wheat is also more liable to it than that sown in the winter season.||

Ergot of rye is triangular in form, occasionally round, but oftener angulated, retaining the original longitudinal depression of the sound grain, to which are generally added two or three others, running from one extremity to the opposite. Its length is from six to ten lines; though often much greater. I have seen it eighteen lines in extent; and Aymen says that he has preserved in his herbarium a specimen, the length of which is equal to twenty-six lines. It is from one to three lines in diameter, generally smooth,

\* Tissot says that it is sometimes green.—(*Traité des Nerfs, et de leurs Maladies*, Vol. vi. p. 218.)—When growing it is usually of a deep-green colour, gradually changes to a light pink, and when matured becomes purple, from the action of atmospheric air upon its oil.

† Dissertation by Oliver Prescott, A. M. Read before the Massachusetts Med. Soc. June 2, 1813.

‡ This is only the case with rye. Ergot of wheat, whether sparing or abundant, is always found to be short and thick.

§ Tessier, *Traité des Maladies des Grains*. 8vo, Paris, 1783, p. 421.

|| We hence see the appropriateness of Virgil's allusion.

“Multi ante occasum Maïæ capere: sed illos

Expectata seges vanis elusit aristas.”—*Georg. lib. i.* 225–6.

Columella also remarks—It was an old proverb amongst farmers, that an early sowing often deceives our expectations, but seldom a late one.

The growth of ergot is very rapid when compared with that of the sound grain. Philippart in his “*Traité Organographique et Physiologico-agricole sur l'Ergot, &c. dans le Cereal*,” says that he observed some particular plants of rye whilst passing a certain corn-field, which plants had no appearance of ergot, but in ten or twelve days afterwards they had full-sized ergots on them.



of a violet-brown or brownish-purple colour, and curved towards the extremities, which are commonly tapering. To the naked eye its surface appears uniform, but when viewed through a microscope it is found to be sprinkled over with sparkling white dots, translucent and angular. Sometimes it is entirely covered with a grayish mealy powder, arising from the puncture of an insect, which transfers some portion of the substance of the grain to the surface.

It is firm, hard, and fragile when dry; soft, flexible, and tough when moist; emitting in the former instance, a heavy mawkish smell, in the latter, the odour of mouldiness.

It breaks with a clear transverse fracture, and the newly separated parts have a bright almond-like structure, over which is shed a faint blush of pink. When split longitudinally, little scales or lamellæ are often found, covering oblong cavities, each cavity usually terminating in a *cul de sac*, being rarely continued to the surface. These little canals are branched, and filled with a grayish dust, interspersed with a number of shining granules.

Ergot of rye has a nauseous acrid taste, leaving in the mouth a slight, but disagreeable sensation of warmth.\* When kept in a moist atmosphere, it becomes soft, enlarges slightly, and is extensively preyed upon by insects; the outer covering acquires an intense blackness, and the active property of the drug is gradually impaired and lost. It is said that after having been twice subjected to dampness and dried again, it is no longer punctured by insects, but remains permanently enlarged. If reduced to powder before exposure to moist air, it very readily grows damp, and spoils much sooner than when exposed in the whole state, being in a few days completely covered with animalculæ. Roll sulphur has been suggested as a preservative; but I have never been able to discover the least advantage in its employment. Camphor has also been advised, and with much more propriety, for if intermixed with even powdered ergot, it completely prevents the formation of animalculæ; but the particles become moist, semi-pellucid, and mouldy, the activity of the substance at the same time diminishing. It is, however, best preserved in a warm dry place, after having been wrapped in absorbent paper, and secured in a well-stoppered bottle.

As it is important to distinguish between a good and a bad specimen, it may be observed, that if the ergot be clear and smooth upon the surface, not powdery, of a deep purple colour—neither totally black nor light brown, having a full strong odour, breaking clearly,† exhibiting a pink blush interiorly, unpunctur-

\* Zimmermann, von der Erfahrung, Th. 2, p. 242, and Trommsdorff, Neues Journal der Pharmacie, Bd. 2, St. 1, p. 94, deny that it has any taste.

† It is necessary that the sample should be broken, and perhaps, that it should be tested, for Dr O'Shaughnessy once analysed a specimen of alleged ergot, which



ed by insects, burning with a clear jetting flame, and being of less specific gravity than water, its activity may be trusted.\*

## SECTION II.—*Chemical Characteristics and Composition of Ergot of Rye.*

When moderately heated, ergot becomes light-coloured, loses its natural smell, and acquires the odour of roasted wheat, at the same time greatly diminishing in activity. Flour, which contains as much as one-third of ergot, rises without any difficulty when made into paste, though when baked, the bread is dry and brittle. When ergot alone is made into bread, it does not ferment, remains sad, or heavy, and crumbles when handled.†

When ergot is boiled in water, it forms, if the preparation be concentrated, a deep claret-coloured solution, having the odour of ergot, and embodying its active principle. Continued boiling weakens the medicinal activity of the solution, and will, if sufficiently continued, render it inert. The cuticle does not peel off by maceration, nor can boiling, however protracted, separate it; but its colour is transferred to the interior of the grain, giving it a deep-red tinge. The solution obtained by boiling exhibits a white pellicle upon its surface, when cool, which is the oil of ergot altered by heat and moisture, and in this condition looks like common fatty matter.

An infusion of ergot is thus affected by reagents. Litmus paper indicates the presence of a free acid. Caustic potassa renders it a fawn colour in a few minutes; flakiness succeeds, which terminates in a light brown precipitate.‡ Caustic ammonia gives a bulky precipitate of a light pink colour. Lime-water, a light blue deposit. Carbonates of soda and potassa, no immediate effect, but in a few minutes there is a deposition of a grayish-pink colour. The strong acids afford a yellowish flaky coagulum. Io-

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proved to be nothing more than plaster of Paris artfully coloured. (Lancet, 1830-31. Vol. i. p. 638.) And I have several times observed the ergot to be adulterated with common paste; a fraud, I suspect, of very frequent occurrence, though not of very easy detection; for the process of baking generally modifies the starch, so that it can scarcely be indicated by iodine. The best way of testing it is to powder the suspected sample, and, after moistening with water, to triturate it gently with iodine, when, if a blue colour results, an impurity may be credited. If this process be not satisfactory, the specimen may be digested in ether; if the ergot be genuine, a yellowish oily solution will result; if impure, little change will take place.

\* The lightness of ergot depends upon the presence of its oil, which reduces its weight considerably below that of sound rye: hence the ergotted ears stand upright, those, on the contrary, not diseased, bend down from their greater weight. A measure that holds fourteen pounds of rye, holds only nine pounds of ergot.

† I may here state, that in giving ergotted bread to dogs, they have invariably been less affected by it, than when a similar quantity of ergot has been administered in an uncombined state.

‡ The action of caustic potassa upon an aqueous solution of ergot, prepared without heat, is somewhat different. When first added, it gives the liquid a greenish tinge, and a curdy precipitate falls. If an acid be then dropped in, the precipitate is redissolved, and the original colour restored.



dine darkens its colour merely. Iodide of potassium, no change. Persulphate of iron, no change. Nitrate and acetate of lead form a bulky precipitate of a dirty violet colour, which is slow in falling. Protochloride of tin gives an abundant precipitate of a light-yellow colour. Chloride of gold, a yellowish deposit. Infusion of galls, a brown coagulum, which dissolves on being agitated. Alcohol occasions a slight opacity. Sulphuric ether when agitated with it forms a solution, which, on standing, separates into three strata,—the lowest, consisting of the aqueous solution, the middle one, of oil dissolved in ether, and the upper one, of pure ether.

Alkalized water, when boiled upon ergot, forms a saponaceous solution, in which the greater part of the colouring matter prevails. Alcohol removes the active principle of ergot, with a very small portion of its colouring matter. Ethers, sulphuret of carbon, naphtha, and the essential oils also separate its active principle, but leave the pigment untouched. Water, therefore, pure or alkalized, is the best solvent of the colouring matter.

This colouring matter is capable of being fixed as a dye; for, if wool or silk, prepared by digestion in sulphate of alumina, be dipped into a solution of ergot, it becomes beautifully tinged with a hue, varying from a light pink to a deep violet.\*

*Chemical Composition.*—Ergot of rye has been analysed by Vauquelin, † Bonvoisin, † Pettenkofer, § Winkler, || Keyl, ¶ Robert,\*\* and others.

Vauquelin obtained a pale yellow pigment, soluble in alcohol; a white oil of a sweetish taste; a violet-coloured pigment, insoluble in alcohol; an acid, resembling the phosphoric; and a vegetable-animal matter, which easily putrefied, and afforded a thick oil and ammonia by distillation.

Pettenkofer, in addition to these constituents, obtained a reddish-yellow resin, phosphates, and a little acetic acid.

Winkler found gum, osmazome, salts of soda and ammonia, a modified fecula, in union with colouring matter, a thick, rancid, slightly acrid oil, and a thick reddish fluid, which had a highly disagreeable empyreumatic odour, a nauseous, sweetish, and slightly acrid taste—composed chiefly of resin, extractive, and colouring matter.

\* Vauquelin, *Annales de Chimie et de Physique*, Tom. iii. p. 337.

† Buchner's *Repertor. für die d. Pharmacie*, Th. 3, and *Bulletins de la Soc. Philomatique*, 1817, 58.

‡ Gehlen's *Journ. d. Chimie*, Th. 6. 1806. § Buchner's *Repert.* 3. 65.

|| Rust's *Magazin*. Bd. 25. Hft. 1, p. 47-49.

¶ De Secali Cornuto, etc. *Diss. Ber.* 1823.

\*\* Rust's *Magazin*, Bd. 25, Hft. 1, p. 41, sqq.



Keyl obtained similar results, but was unable to find either hydrocyanic acid or morphia, both of which were said to be present.

Bonvoisin concluded from his experiments, that the constitution of ergot is highly favourable to decomposition; and further imagined, that, by its putrescency, it acted upon the animal body, occasioning a dissolution of its several parts.

Robert inferred from his researches, that the acid which Vauquelin had supposed to be phosphoric, was none other than hydrocyanic, for the liquor obtained by the distillation of ergot readily killed insects, and gave out a strong narcotic odour, which occasioned dizziness. He also imagined that it contained some specific poison, hardly to be detected by chemical means.

Winkler obtained an acid, the certain nature of which he was unable to prove, but he denied the presence of hydrocyanic acid. He also found amyllum, osmazome, saline matter, and chlorophylle; a thick oil, similar to what he had obtained from *Artemisia vulgaris*, and a pigment, analogous to that in the lichen, *Roccella tinctoria*.

According to the researches of Maas, a German chemist, ergot contains no amyllum, but consists for the most part of gluten, a colouring matter, resin, fixed oil, and an alkaline principle, apparently combined with acetic acid. The alkali he believes to be either ammonia or a peculiar alkaloid. He says he could never find a trace of hydrocyanic or phosphoric acid, morphia, or narcotine.\*

The most elaborate analysis yet given is by Wiggers,† whose results are as follow;—

A thick white oil,	35,0006
White fatty matter,	1,0456
Cerine,	0,7578
Fungin,	46,1862
Ergotine,	1,2466
Osmazome,	7,7645
Sugar,	1,5530
Gum extractive and colouring matter,	2,3250
Vegetable albumen,	1,4600
Phosphoric acid and phosphate of potass,	4,4221
Phosphate of lime and traces of iron,	0,2922
Silica,	0,1394

I have read attentively the analysis of Wiggers, which is detailed in the “*Journal De Pharmacie*,” but I must confess that I think many of his supposed constituents are products, and not educts. This appears to me especially the case in reference to

\* Quoted in the *Lancet*, 1829-30, Vol. ii. p. 187.

† *Journal de Pharmacie*, Tom. xviii. 525.



the cerine and sugar, both of which were probably formed by the solutions of ergot standing for some time. When we consider the liability of vegetable solutions to alter by exposure, and the facility with which new substances are produced, we may easily imagine that some of these constituents were formed during the analytical process; and were not originally present in the ergot. The vegetable albumen I have never been able to discover by any of the means usually employed for its detection, and if the analysis of Wiggers be accurate, my own must either be imperfect, or the specimens of ergot which I examined were peculiarly simple in composition. The following is the analytical process which I have adopted.

To determine the nature of the free acid, the character of which was suspected by Vauquelin, and erroneously represented by Mr Battley,\* I prepared a strong infusion of ergot—200 grains to two ounces of water, and submitted it to slow distillation until two-thirds had passed over. The distilled liquid showed no traces whatever of acidity, but the residual portion was more strongly acid than before concentration. Being satisfied from the fixedness of the acid, that it was neither hydrochloric nor hydrocyanic, I proceeded to demonstrate its nature by filtering through charcoal to remove the colouring matter, and then dividing it into two equal parts. To one of them was added a solution of nitrate of silver, when immediately a yellow precipitate fell, which, when moistened with sulphuric acid, and subjected on charcoal to the flame of a blowpipe, tinged it green. The other portion was acidified with strong acetic acid, and acetate of baryta subsequently added.† The solution was then filtered, slowly evaporated to one-half, and exactly neutralized with ammonia.‡ On adding acetate of lead, a copious precipitate was obtained. The precipitate on being fused on the outer flame of the blowpipe, was in distinct crystals on cooling. Another portion, after having had a drop of sulphuric acid added to it, on being exposed to the inner flame on charcoal, tinged it green.

These experiments, which were many times repeated, and with the same results, appear to justify the inference that the free acid contained in ergot of rye is phosphoric acid. The further analysis of ergot I prosecuted in the following manner.

Any proposed quantity of it is to be reduced to a very fine

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\* London Med. Gazette, 1830-31, Vol. vii. p. 681.

† The object here, was to remove any traces of sulphuric acid, and the acetic acid was added to prevent the phosphate of baryta subsiding along with the sulphate; the latter readily precipitating from an acid solution, the former only from a neutral one.

‡ The fluid was concentrated with the intention of removing as much of the acetic acid as possible; for acetate of ammonia is capable of retaining phosphate of baryta in solution.



powder, and acted upon by sulphuric ether in successive additions, until nothing more that is soluble in that menstruum is taken up.\* Each of the ethereal solutions, after separation and evaporation, furnishes a determinate quantity of oily matter, and the whole collectively weighed, give the proportion of that constituent to the ergot used.

The residuary grain is then to be carefully dried, so that all the remaining ether may be expelled, or the next solution will include the colouring matter. When thoroughly dry, it is to be treated with distilled water, until everything soluble in that liquid is removed. The solution thus obtained comprises the mucilage and osmazome.† By evaporating to dryness, and acting upon the residue with strong alcohol, the osmazome is separated and the gum left. The latter is then to be weighed, and its quantity noted, and after evaporating the alcoholic solution to dryness, the proportion of osmazome is similarly defined.

The grain is next to be boiled in two or three successive measures of strong alcohol, and each filtered whilst hot. The solutions, after intermixture and evaporation, give the gluten contained.

The residue is now to be boiled in dilute nitric or hydrochloric acid to dissolve the fungin. This, after the liquid shall have been filtered, may be precipitated in a gelatinous form by the addition of tincture of galls, or an alkali.

The colouring matter next requires to be removed, and its separation is a work equally protracted and difficult. The remaining solid matter of the grain must be boiled in successive portions of *liq. potassæ*, until the whole of the colouring material is ex-

\* It is necessary that the ether be very pure, and that no water be present, or a complex solution will be formed.

The resin spoken of by many, I have never been able to detect; and as this substance is soluble in ether, it should if present, be furnished along with the oil which is taken up by that solvent. None, however, is afforded in this process, or in any of the succeeding ones, and I am disposed to believe that the alleged resin is nothing more than inspissated oil; for a specimen of ergot which I examined after it had been for some time exposed to atmospheric air and warmth, displayed traces of resinous matter, although a sample from the same packet, examined prior to its exposure, gave no such indications.

The fatty matter, cerine? &c. I have never been able to find. They are probably nothing more than oil, modified by warmth and moisture.

† It is remarkable that this substance, which is so essential a constituent of muscle, should be found prevalent in vegetable matter. But ergot is not the only one of the vegetable tribes which contains it. It is found in the *Agaricus campestris* and *Agaricus pseudo-aurantiacus*; in the rhizome of ginger. (Morin, Journ. Pharm. 10, 252, 9, 258.); in dyer's broom, (Cadet Gassicourt, Journ. Pharm. 10, 434); and in the matter secreted by the bractes of the female hop; (Payen et Chevallier, Journ. Chim. Med. ii. 577). I have continued the old term osmazome, though I am aware that such a substance is not recognized by modern chemists; inasmuch as late experiments in organic analysis have resolved it into various primitive constituents. But as the animal matter which forms the basis of osmazome has not yet been clearly described, I have thought it most prudent to retain the original expression.



tracted. But the potash takes up also the fecula,\* which needs a subsequent removal. For this purpose, the potash solutions are to be neutralized with an acid, evaporated to dryness, and acted upon by *liq. ammoniæ*, which has the property of removing the colouring matter in this state, though before it would be unaffected by it. The ammoniacal liquid after evaporation leaves a definable proportion of colouring material.

The fecula is purified from the potash salt by continued washings with distilled water, and after having been dried, is to be added to the portion not taken up by the *liq. potassæ*, and carefully weighed.

To determine the proportion of earthy and saline matters, 100 of ergot are to be completely burned in a covered platinum crucible, and the residue tested in the usual way. It has scarcely ever exceeded three grains, one of which has usually been silica, and the other two, phosphates of soda and lime.

My analysis has furnished me with the following constituents and their proportions.

Thick white oil,	-	-	-	31.00 grains.
Osmazome,	-	-	-	5.50
Mucilage,	-	-	-	9.00
Gluten,	-	-	-	7.00
Fungin,	-	-	-	11.40
Colouring matter,	-	-	-	3.50
Fecula,	-	-	-	26.00
Salts,	-	-	-	3.10
Loss,	-	-	-	3.50

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100.00 grains.

Ergot appears to differ from sound rye, chiefly in the presence of oil, osmazome, and fungin.† I am inclined to consider the formation of the oil as in some degree dependent upon an altered condition of the farina, arising from some peculiar change which we cannot express, but which, in the absence of a better term, may be denominated fermentation. It may seem extraordinary that so remarkable a substance should be thus produced; but the fact of its formation is demonstrated by its presence, and when we remember that “unconscious particles of matter take their stations, and severally range themselves in an order so as to become collectively plants or animals,” we can easily conceive it possible for a change so

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\* I use the word fecula for want of a better term, for, as before stated, this substance, unlike starch, does not give a blue colour with iodine, nor is it soluble in dilute nitric acid.

† Rye, according to the analysis of Einhof, gives albumen, 3.27; gluten, 9.48; mucilage, 11.19; amidine, 61.09; saccharine matter, 3.27; woody fibre, 6.38; loss, 5.42, (Dict. de Mat. Med. Tome vi. p. 278.)



apparently intricate and complicated as this, under certain disposing circumstances, readily to ensue.

### SECTION III.—*Natural History of Ergot of Rye.*

An explanation of the manner in which ergot is formed has been very extensively and variously attempted. Some theories have undoubtedly a greater share of probability than others, but, from the uncertainty and difficulty of experiment, it is a subject which will probably ever remain open to discussion. Lentinus\* says, “scarabaceum solstitialem clavi genitorem eapropter habendum censuit, quod pluviosa anni tempestate greges ejus spicas oppugnent seminumque recentium succos imbibant, quo facto inebriati, quasi decidant et e seminum plagis scaturiat humor lacteus, qui aëre inspissatus et nigrescens, secale cornutum fingat.”

Schreber† supposes the ergot to be formed by an insect, from having seen little cavities in its substance, containing insects and worms.

De Geer‡ and Ginnani§ favour the opinion of the insect origin of ergot, and compare its formation to that of gall-nuts. Duhamel and Ray entertain the same idea.

Parmentier thought that the disease originated in the covering of the grain; and M. de Buffon|| regarded ergot as an assemblage of animalculæ, having a similitude to eels.

De Münchausen¶ added ergot to the list of fungi, supposing it to hold a place intermediate between the species “clavaria and lycoperdon,” wherefore “solidam clavariam appellavit.”

Decandolle\*\* considers it to be intimately allied to the fungi, and gives it the name of “sclerotium clavus.”

Tessier†† and Zuckert‡‡ attribute its generation to the combined inimical action of the air, soil, and sun.

Roessig§§ supposes it to arise from a disordered condition of the whole internal structure of the plant.

\* Neues Hanöv. Magazin, 1804, i. p. 1.

† Oeconomische Schriften, Th. 12. p. 481, u. Th. 14, p. 362.

‡ Abhandl. d. Schwed. Acad. d. Wissenschaft. Th. 6.

§ Delle Malattie del Grano in erba. Vesaro, 1759.

|| Histoire Nat. Tome ii. and Sup. Tomé iv.

¶ Krumitz. Encyclop. Th. xcix. p. 289.

\*\* Flore Francaise par Lamark et Decandolle. Paris, 1805–1816, Tome vi.

Fries is also of opinion that it is a fungus, and more lately the question has been very ably treated by Mr Queckett, who proposes that it shall be considered as a new genus, with the title *Ergotata*, which will belong to the sub-order Coniomycetes of Fries, and to its division Mucedines. (Annals of Natural History, March 1839.)

†† Memoire sur la Maladie du Seigle, appelleé ergot. Paris, 1779. Traite des Maladies des Grains. Paris, 1783.

‡‡ Allgem. Abhandl. von d. Nahrungsmitt. Berl. 1775, p. 98.

§§ Abhandlung uber das Mutterkorn. Leipz. 1786.



Hube \* imagines it to be dependent upon too small a quantity, and an undue spissitude of the juices of the plant.

Aymen † mentions as the occasional cause of ergot, the intermission of fecundation, or the coition of the sexual parts intercepted.

Robert, ‡ supposing it to be produced by an impure state of the atmosphere, says its origin may be traced to the deformity of the seed, whereby the disease (finally) hangs upon a disturbance of the harmony of organization, and on the disproportion of nutriment.

The opinion of Robert respecting the formation of ergot is supported by the experiments of Willdenow, who proved that it may be artificially produced, by planting rye, during a wet and hot season, in a rich and moist soil, where it can be well watered.—“The causes, then, of this disease are chiefly to be found in heat, humid air, rich, moist soil, low situation, absence of winds, and an abundance of nutritive juices, badly assimilated. These conditions so change the vital process, that the plant is unable to produce a sound grain. More fruitful juices being received, they fill the vessels, distend them, and destroy their contractility. The power of averting and resisting injuries is lost; thickness and siziness of the humours of secretion come on, the function also dies, and innutrition supervenes. It hence happens that a plant, the reproductive power of which has been so disturbed, is unable to mature its seeds—*pro semine tuber, pro normali mixtione dyscrasiam exhibeat*. These things considered, Robert places the disease which he supposes to be the cause of ergot, in an aberration of the formative tendency of vegetables, and in an alienation of lymphatic plasticity.” (Rudolph Padiera, *Diss. de Secali Cornuto*, p. 15–16.)

It will be perceived that the causes to which Willdenow ascribes the formation of ergot, are somewhat resembling those to which Theophrastus imputes the production of rust and mildew. §

Schnieder attributed the generation of ergot, not to the humid state of the air, but to a viscous sweetish substance, which penetrates with the dew into the grain, and occasions in it a sort of

\* *Der Landwirth*, Th. 4. p. 493.

† *Sur les Maladies des Blés*. *Memoires de Mathematique et de Physique*, Tome iii. et iv.

‡ *Rust's Magazin*. Bd. 25. Hft. 1. p. 19. sqq.

§ “*ἐρυσίβη δὲ σῆψις τίς ἐστι τοῦ ἐφισταμένου ὑγροῦ· διὸ πολὺ μὲν ὕσαντος, οὐ γίνεται καταπλύνεται γάρ· ἐὰν δὲ ψεκάδες ἢ καὶ δρόσοι πλείους γένωνται, καὶ ὁ ἥλιος ἐπιλάβῃ καὶ ἄπνοια, τότε σήπεται· διὸ καὶ ἐν τοῖς ἔυπνοις καὶ μετεώροις ἥτιον ἐν δὲ τοῖς κοίλοις καὶ δροσοβόλοις μᾶλλον καὶ πανσελήνοις δὲ μᾶλλον ὅτι συνεργεῖ καὶ ἡ τῆς σελήνης θερμότης· καὶ ὅλως ὁ ἀῆρ ὑγρότερος.*”

Theophrast. *De Causis Plant.* Lib. iv. cap. 15.



fermentation. He carefully observed its production, and discovered that, on the first and second day, the sweet matter was only adherent to the beard of the ear; on the third it descended into the husks; on the fourth it inclined a little further, and on the fifth it began to corrode the lateral parts, the bottom of the husk, and the grain itself. During other days, Schnieder saw the nourishing juice ferment with this matter, and produce a fungous substance which destroyed the grain of the rye. The seed was yet too small and too soft to resist the impression of this substance, which at last became more solid, dried up, and blackened.\*

Tillet's theory of the origin of ergot, though highly improbable, is exceedingly interesting. He discovered that many ergots contained a worm, though not visible to the naked eye, yet which he believed to have sprung up and nourished itself there. He enclosed in a glass goblet, covered with parchment, a score of these ergots, in which he had observed some small insects. They increased in size, and consumed nearly the whole of the ergot. Four of these changed themselves into beautiful butterflies, the wings, legs, and *antennæ* of which were in some places covered with white spots, and in others with spots of a rich musk colour. The butterflies were of a small kind, and such as Tillet fancied he had seen on the surface of a tub of water which was exposed to the sun, and kept for watering a garden. From this discovery he drew the inference, that butterflies of the same species have inserted into these grains of rye, the eggs from which the caterpillars have subsequently arisen: and these grains, changed into ergot by some derangement in their organization, have served to nourish these caterpillars when converted into butterflies, and that they in their turn have become the cause of many ergots when labouring for the preservation of their young. Nevertheless, he says that he has found many ergots in which he could discover no trace of insects. Here he imagines that the caterpillars perished by some accident during the formation of the ergot.†

Read, a physician in the Military Hospital at Metz, says, that he has established by experiment, the inferences previously drawn by Tillet. He thinks that the butterfly piercing the grain at the time of its development, that is, while the interior is yet soft and immature, excites there a sort of fermentation by the fluid which it deposits. This opinion has also been maintained by Fontana,‡ and supported by General Field, who imitated the action of the flies, by puncturing the sound grains, whilst soft and pulpy, with a needle, and obtained similar results. But he remarks, "under a good microscope I occasionally examined the ergot, and also the

\* Renauldin, Dict. des Sciences Med. art. Ergot. † Ibid.

‡ Fontana, Lettre sur l'Ergot, Journ. de Phys. 7. 42.



grains of rye in every stage of decay, but was not able to discover in either the eggs or larvæ of any insect. I therefore conclude, that the puncture of the fly is for the purpose of extracting its food from the rye, and not for the deposition of its eggs.\*

Wiggers adopts the theory of Decandolle respecting the formation of ergot, for he discovered that the white dust which is sprinkled over the surface of the spurs, will, if applied to the roots of a sound plant, generate the disease.†

On the contrary, Hertwig, a German physician, has concluded from a series of careful experiments, that the disease is incommunicable by contact. He surrounded the ear when in flower, with the powder of spurred rye, without in any degree affecting the healthiness of the plant or its grain.‡

My own experiments correspond in their results with those of Hertwig. I have sown rye in conjunction with ergot, both in powder and in substance, without the process of germination being either retarded or modified, or anything but a natural and healthy maturation resulting. I have regularly watered rye, from the sowing of the seed to its period of ripening, with a solution of ergot, but without producing a trace of the disease. Nor does the direct application of the powder of ergot to the ears of rye seem in any way to affect them. Indeed, a solution of ergot does not appear to have any influence upon vegetables. I have watered turnips, stocks, slips of currant trees, &c. for weeks together, without injuring them in the least.

Should the experiments of Wiggers be correct, they will materially tend to establish the theory which he suggests; but on comparing the small quantity of fungin, a harmless substance, with the prevalence of oil in the ergot, the presence of which requires a different explanation, I cannot help concluding that the hypotheses which ascribe the formation of this excrescence to atmospheric warmth and moisture, are the most accordant with circumstances, and the least liable to objection. Tessier has also rendered this idea more probable, by showing from careful and elaborate investigation, that the district of Sologne, which is more exuberant in the production of ergot than any other place, is thus peculiarly adapted to its production. And it is well known that nothing so soon produces ergot as a storm of rain falling upon rye situate in a hot latitude, and in a moist rich soil.§ Further, the grains are sometimes found to be only partially ergotted, one-half being

\* Annals of Philosophy, N. S. Vol. xi. p. 14.

† Inquisitio in Secale Cornutum, &c. Commentatio præmio regio ornata. Gottingæ, 1831.

‡ Lorinser, Beob. und Vers. über die Wirkung des Mutterkorns, 1824. Quoted in Robert's paper, 28.

§ Duncan's Med. Com. Vol. ix. p. 78.



sound and the other half diseased, which is a circumstance of insuperable objection and denial to the theory of fungous growth. And Virey has found remains of stigmata upon grains infected with the spur, and has proved that the genus *Sclerotium*, in which Decandolle places ergot, has a character widely different from it.\* The ergot has also a form like that of rye, and its longitudinal furrow is scarcely ever wanting; a fact which, coupled with the shining appearance of its interior, renders very nugatory the hypothesis of its being a fungus.

This is perhaps the fittest place for notifying that a minute excrescence has been described as situated at one extremity of the ergot, to which its active properties have been referred. Lèveillé, a French physician, published in 1827, a pamphlet in which he described it minutely. I do not think it a subject which is worth discussing; for were his opinions correct, the samples of ergot which reach us, entirely free as they are from this appendage, ought to be equally free from activity. I think there can be little doubt that the body which he denominates *Sphacelaria segetum* is a stigma altered by disease.†

#### SECTION IV.—*Toxicological History of Ergot of Rye.*

*Spasmodic Ergotism.*—According to the *Abrégé Chronologique* of Mezeray, the historian, the earliest mention we have of ergot is by Sigebert de Gremlour, who wrote upon it in 1096.‡ Others say that its first description was in 1596 by Wendelin-Thalius, a German physician, suggested by an epidemic which it caused in the kingdom of Hesse in that year, and respecting which a treatise was published in the following year in German. In this work, the epidemic is represented as characterized—1. by a peculiar stupidity of the patients, which continued until death; 2. those who escaped death had habitual ill-health, particularly in the months of January and February; 3. the disease was contagious; 4. the bodies rapidly decomposed; 5. the disease was not confined to the human species, for animals were affected, and their chief symptom was lethargy.

The same disease prevailed in Voightland during the years 1648, 1649, and 1675.

\* Lond. Med. and Phys. Journ. 1817. Vol. xxxviii. 334.

† See Experiment 10th.

‡ See Hildanus, Obs. 69. cent. 2. N. C. Dec. 3. Ann. 4. Obs. 234, &c. Miscel. Nat. Cur. Cent. 5. Obs. 82, and Hoffmann, Vol. i. Part, 2, Cap. 9.

|| In the "*Recueil des Historien des Gaules, et de la France*," Tom. xiii. p. 258, is the following passage, extracted from the works of Sigebert.—"1089. Anus pestilens maxime in occidentali parte Lotharingiæ, ubi multi sacro igne interiora consumente computrescentes, exesis membris instar carbonum nigrescentibus, aut miserabiliter moriuntur, aut manibus, ac pedibus putrefactis truncati, miserabiliore vitæ reservantur, multi vero nervorum contractione distorti tormentantur."



In 1693, it raged extensively in the Black Forest, and some severe cases of it are described by Wepfer.\*

The Ephemerides Curiosor. Naturæ, Dec. 3d, report, that, in 1698, many persons in the Cantons of Germany were the subjects of transient intoxication, pains in the head, continued nausea, and considerable tumefaction of the face, all of which symptoms were regarded as the consequence of eating bread that contained ergotted rye.

In the years 1702, 1716, and 1717, this disease caused by bad rye, which contained nearly one-third of ergot, almost devastated Freybourg, and overran many of the Cantons of Lusatia, Saxony, and Sweden. The villages situate on marshy land were more unfortunate than others, and the cities were least visited by the disease. According to Videlius, the patients were attacked with spasms and convulsions, accompanied with violent pains, which were said to equal those of luxation, and to be similar in their type. These pains were intermittent, sometimes having intervals of two or three days, during which period the patients were capable of following their usual employment. After the cessation of the paroxysms, there generally came on a voracious appetite; in other instances the patients became lethargic, and when recovering from such state, gave respectively signs of stupidity, intoxication, and extreme lassitude, after which the fit subsided for a time. But there generally remained vertigo, *tinnitus aurium*, *nebulae oculorum*, rigidity of the members, and excessive feebleness. The dissections showed extravasation of blood in the chest, and traces of inflammation in the lungs. The heart presented a remarkable flaccidity, the ventricles were usually empty, and "the blood-vessels seemed only to carry bile." The liver and spleen were commonly studded with gangrenous spots.

In 1722, Silesia, in 1723, the environs of Berlin, and in 1736, Wirtemberg in Bohemia, sustained the disastrous effects of ergotism. The symptoms of the first epidemic have been ably described by M. Vater,† and those of the last, with equal precision by J. A. Scrinc,‡ who alone saw 500 individuals the subjects of its virulence. He describes the disease as commencing with a disagreeable sensation in the feet, a tingling or itching; a violent cardialgia then came on; and the disease ascended to the hands and the head. The pains in a short time subsided, the head became heavy, and vertigo prevailed,—the eyes appearing to have a thick mist before them. The patient then complained of extreme heat, which was attended with diaphoresis. The fingers and

\* De Affect. Capitis, Obs. 109, p. 482.

† Dissertatio de Morbo Spasmodico. Siles. Wirtemberg, 1723.

‡ Satyr. Medicor. Siles. Specim. 3.



hands were so spasmodically contracted, that no ordinary force could straighten them, and the pain was described as equalling that of luxation. Some of the patients became totally blind, and others had double vision. The memory also failed, the conversation was wild and unintelligible, and the movements staggering and awkward. Some became maniacal, some melancholic, and others comatose. The disease was usually accompanied with opisthotonos, and an abundance of saliva tinged with blood, or coloured greenish-yellow, poured from the mouth. The tongue was frequently so much swollen as to impede articulation. The greater part of those who had epileptic fits died, and such as experienced sensations of coldness and rigidity in the limbs, consequent upon the subsidence of the itching, had less distension of the hands and feet. "This iliad of affections" was followed by excessive hunger, many had an insatiable appetite, and very few evinced any aversion to food. One had buboes in the neck, which discharged yellow purulent matter, accompanied with violent burning pains. Another had spots on his feet resembling the stings of fleas, and which remained during eight weeks. Some had the face extensively covered with these spots. The pulse, without one exception, was the same as in health. The disease continued for two, four, eight, and sometimes even for twelve weeks, with occasional intervals of repose. Of the 500 patients coming under the notice of Scrine, 300 infants perished, considering as such, all under five years of age.

G. H. Burghard gives the following description of a convulsive epidemic which raged in the Canton of Silesia. \* The patients were the subjects of excessive spasms, which convulsed the extremities, and the head, eyes, and lips in particular, attended with an aberration of reason which no medicines could restore. Rarely had the patients any remission until the third week, and the disease generally continued for two or three months with those who took no medicine, and who were not guarded in their manner of living. Those who had continued fever, and in whom profuse perspiration following the spasms prevailed, were most readily cured. Those who died, showed, previously to dissolution, a sort of paralysis, which degenerated into apoplexy. Females were more severely affected than men, and especially so during the period of menstruation. This being over, they complained of little except great debility, until the return of the menses, when the symptoms were much aggravated. Such as were fortunate enough to recover, laboured for some time under excessive debility, particularly of the joints, stiffness, and even immobility of the limbs, enfeebled intellect, &c.

In 1741, this disease raged in Germany. J. M. F. Müller gave

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\* *Satyræ Medic. Specim.*



a very elaborate description of it, in a dissertation which was discussed at Frankfort on the Oder. \* This epidemic presented symptoms very closely allied to those described by Scrine.

In 1756, M. Blohm of Altona gave a description of a similar epidemic, but without saying where it prevailed.†

*Gangrenous Ergotism.*—In 1630, the dry gangrene appeared in many parts of France, often producing very fatal effects. This epidemic Dr Thuillier attributed to the incautious use of ergot of rye.

In 1650, 1660, and 1664, it prevailed in Guyenne and Sologne districts, and, during the last year especially, at Montargis, of which a report has been given by M. Perault.‡ From his account, it appears, that, whilst travelling in Sologne, he had found, from the physicians and surgeons, that the rye was sometimes so corrupted, as to form a highly injurious bread, the use of which had brought on dry gangrene, followed by the loss of the limb, and without inflammation or fever. The Academy having learnt some years afterwards that similar accidents had happened at Montargis, requested Dodart, in 1674, to investigate the circumstances. It seemed from the report of this physician, that the use of ergotted bread had occasioned vertigos, malignant fevers, heaviness, and gangrene of the extremities. The last symptom was preceded by numbness of the legs, which members afterwards became painful, and swelled slightly, but did not evince any direct signs of inflammation. The skin, on the contrary, was cold and livid. The gangrene commenced in the centre of the member, and did not attack the cutaneous tissue until a long time afterwards, and they were consequently obliged to cut through the skin to discover the progress of the disease. Dodart further observed, that the poor only were the particular subjects of this distressing malady, and that the ergot occasioned it more certainly when new, than after having been kept for some time.

In 1695, John Conrad Brun or Brunner, saw in Augsburg a female whose fingers were withered, blackened, and sphacelated from having eaten bread containing ergot of rye. The surgeon who presented this female to Brunner, assured him that the patients in the environs were attacked with resembling symptoms, which were violent in proportion to the newness of the bread. He added, that some time before, he had amputated a foot which was gangrenous from the use of ergotted bread.

In 1709, a gangrenous epidemic prevailed in the Departments of Orleans and Blesse. Noel, surgeon at the Hotel Dieu, had to treat above fifty cases, incident to adults and infants. In one

\* Dissertatio de morbo epidemico, convuls. contagiis. experte. Franc. ad Oder. 1742.

† De Affectu Spasmod. vago Maligno. Erford, 1756.

‡ Journ. des Sav. 1676.



case only were the fingers attacked, in every other, the disease began in the toes, and, extending gradually, sometimes reached the top of the thigh.

In this epoch it was discovered that the internal use of ergotted bread had horribly mutilated a peasant at Blois, the particulars of whose case are described by M. de Fontenelle in the following terms. A peasant was attacked most severely. Gangrene caused first the separation of all the toes of one foot ; then those of the other ; next both legs and both thighs were successively detached, leaving only bones. At the time of writing the account, the cavities of the iliac bones began to be filled with good fleshy granulations.\*

Noel declares that, in the year 1709, the rye of Sologne contained nearly one-third of ergot ; that, as soon as the inhabitants of the country had eaten of this unwholesome bread, they became inebriated, and this was followed by gangrene ; but in Beauce, where there was little or no ergot, these accidents were not common.

In the same year, (1709), from the excessive coldness of the season, this malady, ascribed to an intermixture of ergot with the bread, raged in the canton of Lucerne, and reappeared in 1715 and 1716 at the same time as in the cantons of Zurich and Berne. Of this epidemic, Langius has given the following description ;—“ It began with excessive lassitude, unaccompanied by any febrile action. Soon, the cold attacked the extremities, which became painful and rigid, as they are after a long immersion in cold water : the wrinkles were so marked, that even the veins could not be distinguished ; benumbed, and almost insensible, the limbs were with difficulty moved. They were internally tortured with acute pain, increased either by the heat of a room or of a bed, and which did not subside until the patient had been long exposed to a low temperature. These pains extended by degrees to the hands, arms, and shoulders ; and from the feet to the legs and thighs, until the parts affected became dry, sphacelated, and attacked. Some victims of this plague found in their gloves or stockings, one or two of the digital phalanges separated by gangrene. Throughout the progress of the disease, the other organs of the body were in a healthy condition, except, that, as the pain increased, the patients experienced slight febrile heat, afterwards a copious sweat, which extended from the top of the head to the pit of the stomach, and lastly, a disturbed sleep, agitated by frightful dreams, particularly after warm food. This affection, tortured with equal severity all its victims ; but those with whose food ergot had been sparingly mixed, were only affected with a feeling of weight in the head, and drowsiness, to which often succeeded transient intoxication.”

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\* Hist. de l'Acad. Roy. 1710, 81.



Du Hamel, on the authority of Mulcaille, in the *Memoires de l'Academie Royale des Sciences*, année 1748, has described a fatal epidemic which in 1747 raged in Sologne, destroying the greater number of its inhabitants.

Salerne, a physician at Orleans, and Corresponding Member of the *Academie Royale des Sciences de Paris*, gave also, in 1748, to that Academy, an interesting memoir on the diseases produced by ergotted rye.\* From his report it appears, that about the middle of August, in the year preceding, he commenced treating in the Hotel Dieu, patients threatened, or attacked with gangrene, more than two-thirds of whom were men. A child, ten years old, lost both its thighs, which were detached from their articulations without any hemorrhage. Its brother lost the leg and thigh of one side, and the leg of the other. Both died in twenty-eight days from the commencement of the disease. In every case, amputation rather accelerated than retarded dissolution. Of more than 120 patients, operated on or not, but 4 or 5 escaped. During the time that he gave his memoir, he had three or four cases in which the feet fell off, yet the appetites of the sufferers were not diminished. He saw one man, about forty-five years old, who, eighteen years before, lost the left hand and wrist; he had a large, hard, and tense belly, his right hand was numbed, but he had a creeping sensation in it. Most of his symptoms were relieved, except the numbness, but he returned to the hospital shortly afterwards, his disease being aggravated. Salerne observed that most of the patients were dull and stupid, scarcely able to describe or to define their sufferings; the skin was generally yellow; the face and the conjunctiva being more decidedly tinged than the other parts: the belly was hard, tense, and stretched; emaciation rapidly came on, nevertheless the alvine and urinary evacuations were regular and copious, the latter being natural, the former coherent and imperfectly digested, until within three or four weeks of death, when diarrhœa supervened, not unfrequently accompanied with colic pains; the appetite was usually good, and the sleep natural; the pulse was hard, but often imperceptible, although the vessels appeared swollen and distended, and the blood, whether emitted from a large or a small orifice, was slimy in its consistence, and tardy in its escape.

In 1749, there prevailed in Bethune, a disease very closely resembling gangrenous ergotism, and which had every appearance of having originated from the same cause.

In August 1764, the dry gangrene made destructive ravages in the environs of Arras and Douai. The disease, according to the report of Read, † was announced by sharp lancinating pains in the

\* *Mem. de Mathemat, et de Phys.* Tome ii. 55. † *Traité du Seigle Ergote.* 82.



extremities, little swelling or local inflammation being present, but general fever commonly prevailing. This first stage lasted from ten to fifteen days. In the second period, which continued during eight or ten days, the pains commonly ceased, and the extremities became numbed; the limbs were then greatly reduced in temperature, but were not relieved by the application of external warmth. The third stage manifested itself by the developement of blisters, quickly succeeded by gangrene of the toes, which made rapid progress, extending over the whole surface of the foot, stretching to the leg, and sometimes even reaching the middle of the thigh. During the third period, the feet, legs, and hands detached themselves from their articulations, and the pulse was generally small and hard. Read saw two children, twelve months after their attack, begging at Valenciennes; the youngest had lost one leg and both feet, the other had lost only a leg. Two eminent physicians, Larsé and Taranget, commissioned by the state of Artois to institute means best calculated to prevent the spread of the disease, ascribed its entire origination to the use of bread contaminated with ergot.

Dr Vetillart, who, in 1770, published a work upon the treatment of gangrenous ergotism, gives the following example of its virulence.

A poor man of Noyen in Maine, seeing a farmer sifting his rye, begged permission to carry away the refuse to make bread of it. The farmer represented to him that this bread might be detrimental to him; but necessity prevailed over fear. The poor man ground these siftings, consisting mostly of ergot, and made bread of the flour. In the course of one month this unfortunate person, his wife, and two children perished wretchedly. A third at the breast; and which had eaten panado of this flour, escaped death, but it was deaf, dumb, and deprived of two legs.

MM. Model,\* Schlégel,† and Parmentier,‡ having stated their disbelief in the noxious properties of ergot, and especially in its tendency to produce gangrene, Tessier submitted a second paper to the Société Roy. de Med., Tome ii. 587; experimentally illustrative of his previous views, and confirmatory of the popular belief in the injurious effects of this diseased grain.§ These experiments were instituted to answer the sceptical inquiries of the age in which he lived, though more than a century antecedently.

\* Recreat. Chim.

† Journ. Encyclop. Juin 1771.

‡ Addit. Aux récréat. Chim. du Model.

§ His experiments are in favour of the notion, that ergot is actually destructive of animal life; and that gangrene in various external organs is consequent upon its protracted use. His views upon spasmodic and gangrenous ergotism are amply confirmed by M. Hoffman, (Path. gener., part 2, cap. 9.)



Dr Thuillier affirmed that he had given ergot to many animals, all of which perished from its effects.\* But the memoir which Dr Salerne presented to the Academy in 1748 is perhaps equal to any one written prior or subsequent to it. This physician intermixed some ergot with appropriate food, intending to feed with it a young pig, which was lively, and in good health. As he refused on the first day to take his food, they were compelled to make him swallow it with a spoon; but at the end of five days he took it readily, so that during one month he swallowed daily three pints of the mash. At the commencement of the trial, he thrived perceptibly, but so soon as they took away the bran, only with the intention of giving him more barley, in which there was one-third of ergot, he ceased to grow. At least his belly only augmented, which eventually became large and hard. At the end of five days his legs began to redden and inflame, exuding a greenish fluid of a disagreeable odour, which grew rapidly worse. The parts under the belly blackened, the tail and ears dropped, but the alvine and urinary dejections were ordinary in quantity and natural in kind. After having eaten in the space of a month, two bushels of rye, (Orleans measure,) containing one-third of ergot, he was put upon pure bran, in the form of a tepid mash; but this change of food failed to re-establish him; the poison had accomplished its effect, and although the animal at first appeared a little better, he was evidently the subject of pain and uneasiness; his walk was unsteady and tottering, and the powers of life gradually declined, until their final termination in death. On opening the body, part of the mesentery, the jejunum, and especially the ileum, were found inflamed. The acute margin of the liver presented two large dark-coloured spots. Under the throat, and in the legs, were some unhealthy open tumours, from which exuded a reddish puriform discharge. There was no gangrene of the feet.

This physician learned from a lady, whose charitableness was often exercised in attendance upon those who were suffering from the diseases consequent upon eating ergotted bread, that the dogs to which she had given some of this bread the day before, would not leave the yard, and that two days afterwards, a couple of them were found dead. The others would also have died had the poisonous food been continued, the ill effects of which ceased only after many days use of good and nutritious diet. This lady further asserted, that the ears and feet of a pig had fallen off, from eating twenty-four bushels of barley, which had a notable intermixture of ergot.

Dr Read fed during five days a pig three months old, with er-

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\* Journ. des. Savans pour l'année 1676.



got mixed in his mash. The animal did not go out of the sty, his eyes were suffused with tears, and an acrid serous humour poured from his ears. On the 17th day, dry gangrene had attacked the left ear, which fell off on the day following, and on the 19th the animal died. Upon examination, the abdominal viscera were found in a swollen state, and a gangrenous spot, an inch in diameter, was discovered upon the liver. This physician further states that he made a strong decoction of ergotted rye, which he mixed with an equal quantity of syrup, and that flies died in two or three minutes after tasting it. \*

Spurred Indian corn is said to produce similar diseases to those occasioned by spurred rye.—Christison on Poisons, p. 836, 3d edition.†

Though the authors, who have respectively detailed the diseases consequent upon the alimentary use of ergot, have ably illustrated the natural, statistical, and medical history of the substance, so as not to require me to dwell longer on these heads, yet it is somewhat incumbent upon me, in connecting together these interesting and valuable records, to determine, if possible, their verity of character, to divest the narratives of any admixture of exaggeration, and to give upon the pages of a work amenable to the judicature of established science, results as satisfactory as common experiment and inference can supply. Notwithstanding that most of the diseases regarded as the effects of ergot have been so proved, I am decidedly of opinion, that in numerous instances these diseases have had origins widely different and distinct. In many of the provinces where spasms and gangrene have prevailed, ergot has been sparingly, and in others, not at all produced. In some instances, the season of the year in which these diseases have prevailed, renders it extremely improbable that ergot, admitting its use, could have retained sufficient activity to qualify the virulence which history and tradition have ascribed to it; and in others, the very sparing employment of bread supposed to contain it, would require to produce such notable effects, even a greater degree of activity on the part of the drug, than its toxico-

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\* I have repeated this experiment scores of times, but have not in one instance found any deadly consequences. I think Dr Read must have been a very fortunate experimenter.

† *Gallinæ quæ illud Maïs peladero comedunt, sæpissime ova gignunt testis orbatæ. Primo intuitu difficile est intellectu, inquit Roulin, qua ratione illa nutrimenti species effectum exserere possit in formationem carbonatis calcis, quo vulgo ovum est incrustatum;—attamen ex eo satis bene res mihi videtur explicanda, si statuamus, triticum illud cornutum hoc in casu excitare partum præcoccem et intempestivum; verbo, illud contractionibus eo ducere organa ovis producendis destinata, ut ovum ab ovario separent antequam illi occasio fuerit et tempus, terrestri involucro se obtegendi. (Specimen Medicum Inaugurale, de Secali Cornuto, auctore G. Ter. Horst., p. 19-20.)*



logical history will authorize us in effecting. As a proof of the difficulty experienced in determining the etiology of dry gangrene, we repeatedly see it confounded with other diseases, widely different in their cause, but having a remarkable similitude in their appearance, viz. the "*mal des ardens*," and the "*ignis sacer*," called also, "*feu sacré*," "*feu St Antonie*," and "*feu d'enfer*"—both modifications of erysipelas, but commonly having a gangrenous termination. The latter appears to have been first observed in Paris in 947. It is said to have attacked all parts of the body, destroying the patient with the most torturing and afflicting pains. About the year 1000, this disease prevailed in Lorrain. It was characterized by a sense of burning heat, the affected parts subsequently becoming gangrenous.

Sigebert de Gremlour states, that, in 1089, the *feu sacré* ravaged the eastern part of Lorrain. In some instances the limbs dropped off, in others, the patients suffered only from contractions of such parts. In the epidemic of Dauphiné in 1089, its visitancy gave rise to the formation of the order of Saint Anthony; and tradition states, that one of the sufferers lived several days with his head and trunk only remaining, all the limbs having separated.

Again, we are not justified in concluding that the diseases, when they occurred in those instances where ergotted rye was used, were solely in consequence of the deleterious impression of the grain itself. The bread was poor, and sometimes almost innutritive, hardly, indeed, calculated to sustain the physical energies of the peasantry, compelled to subsist upon such crude and unwholesome aliment. And when we consider the fearful train of diseases which defective nourishment induces, we need not hesitate to infer, that, in many instances, the supposed ergotism was occasioned, as M. Gassoud observes, by the people "in order to avoid actual famine, being compelled to live upon a sort of bread made of the meal of acorns, of grape stones, of the roots of fern, and other such crude and innutritious substances."

To prove the succession of pestilence to famine it is scarcely necessary to quote the apothegm, "*pestis post famem*." The records of history furnish proofs which abundantly substantiate the notion.

"He that abideth in this city shall die by the sword, and by the *famine*, and by the *pestilence*."\*

In the year of Rome 300, a fearful pestilence was the melancholy effect of previous famine.†

About the year 407 or 408, near the close of the reign of Arcadius, a plague, consequent upon famine, is said to have prevailed in every quarter. Nicephorus, in his description, affirms that al-

\* Jeremiah, ch. xxi. v. 9.

† Livy, lib. iii. 32.



most all Europe perished. "Pasa de oieto e Europe"—and very considerably of Asia and Africa.

In 590, the severest drought ever known visited Italy, lasting from January to September. A famine was the result, and a deadly plague succeeded. Of this pestilence died Pope Pelagius.\*

In 987, an unfavourable season caused a sad dearth in the harvest. The subsequent scarcity of provisions caused a multitude of diseases—malignant fevers prevailed, and the cattle died of fluxes.†

In 1084, there was a famine, which was succeeded by a severe pestilence. The latter destroyed the whole of the army of the Emperor Henry at Rome. In the following year, the defective crops in England caused a great mortality amongst cattle.

The epidemic of 1596, which is by one party regarded as the sole offspring of ergotted rye, is, by a very high authority also declared to have been caused by famine.‡

In the year 1600, pestilence raged in almost every part of Europe. Many of the symptoms were precisely those of ergotism. The patients were senseless, the hair fell off, livid spots appeared, and the limbs mortified. But we have no mention of ergot.§

In the description given by Gregorius Horstius of the epidemic febrile disease, accompanied by spasmodic convulsive symptoms, in which, or in epileptic fits, the patients died, no allusion whatever is made to ergot. Bad bread is simply notified amongst other sorts of crude and unwholesome diet. "Causas hujus affectus quoad attinet, ex ægrotantium relatione scire licet, quoad externa causa communiter in alimento, ad nutriendum minus idoneo et improporcionado, consistat, dum pauperis rebus ad vitam necessariis destituti, panem impurum et male coctum longo tempore, in summâ famis urgentiâ, devorant, interdum etiam poma acerba et austera, fungosque et similia deglutitientes, sese eduliis crudis, immaturis, et astringentibus ingurgitant, de quorum depravatâ concoctione cruditates abortæ."||

A similar report of this epidemic is made by Sennertus in his chapter, "De febre maligno cum spasmo." And upon reading the allusion which Wepfer makes to the epidemic that raged in the Black Forest in 1693, I do not find the least mention of ergot, nor does that learned author appear to have been at all acquainted with it. Camerarius also positively asserts that the dry gangrene was frequently observed in the extremities of persons who had certainly not eaten any ergotted rye.¶

\* Webster on Epidemic Diseases, Vol. i. p. 146.

† Brompton, Angl. Scrip. 878.

‡ Short on Air, Vol. i.

§ Webster, Vol. i. p. 273.

|| Greg. Horst Opera, Vol. ii. lib. viii. obs. 22.

¶ Acad. Nat. Curios. Cent. 4, obs. 82.



Admitting, however, that these are cases still unsettled and disputable, we have recorded a very remarkable instance of gangrene having a strong similitude to that induced by ergot, but certainly not arising from it. And the only cause which can be assigned is that of imperfect nutrition, from the unwholesomeness and impurity of the bread. This case occurred in the year 1762, in the family of J. Downing, residing at the village of Watisham, the particulars of which are given by Bones, \* Wollaston, † and Parsons.‡ From their reports, it appears, that the father, mother, and six infants were seized with violent pains in the feet, legs, and thighs, the other parts not suffering materially. The affected limbs grew black, gangrenous, and fell off. The father, most triflingly attacked, was fortunate enough not to lose a limb. A child four months old died before any of the members separated. The mother, three girls, and two boys, lost collectively seven legs and four feet. The Rev. Mr Bones, minister of the parish, in answer to questions put by Dr Baker, states, that they made their bread the summer before, of what is there called clog wheat, for they had no rye. The grain was damaged, it had been laid, gathered, and thrashed separately; it was not mildewed or grown, but discoloured, and smaller than the rest. It made bad bread, and worse puddings.§

These facts I have submitted, not to invalidate what so many have attempted to establish, the destructive nature of ergotted rye, but to show the probability of spasmodic and gangrenous ergotism having in many instances arisen from food imperfectly nu-

\* Philosoph. Transac. Vol. lii. Nos. 84 and 85.

† Ibid. Nos. 83 and 98.

‡ Med. Museum, Tom. i. p. 442, Tom. ii. p. 449.

§ See Gentleman's Magazine for 1763, Vol. xxxii. p. 492.—Besides there are other seeds which have a tendency to induce diseases similar to gangrenous and spasmodic ergotism, and which in many instances have been intermixed with the grain, the farmer unknowing of their banefulness. Amongst these, perhaps the most remarkable is the *Raphanus raphanistrum*, which grew in vast abundance amongst the barley in the kingdom of Sweden during the years 1746 and 1754, when a disease precisely similar to spasmodic ergotism prevailed. And Linnæus, to discover its physiological influence, gave some of it to fowls, which, in consequence, suffered from strong and painful convulsions. He hence denominated the disease *Raphania*, (Amæn. Academ. Vol. vi.) which term has since been employed by Dr Cullen, who, however, wisely questions whether it be the same as the *Necrosis ustilaginea*, by which Sauvages has denominated ergotism. (See Cullen, Nosol. Meth. Gen. 52. Sauvages, Nosol. Meth. class 10, gen. 39.)

And Dr Tytler has shown that degenerated rice is capable of producing diseases very similar to those of ergotism, both spasmodic and gangrenous. He fed a healthy young goat with ouse rice, which diminished its appetite, caused excessive thirst, weakness, stupidity, watery eyes, and apparent suffering. The animal died in forty-two hours from the commencement. The only morbid appearance of moment was an "erythematic inflammation," extending from the stomach to the intestines.

In several instances the effects of this degenerated rice upon the human subject were very serious. (Remarks on Morbus Oryzeus, 4820, 8vo, p. 80.)

And Dr Peddie of Edinburgh has kindly furnished me with a pamphlet which he published, illustrative of a case of dropsy and gangrene occurring in a family from eating unsound potatoes. (See Edin. Med. and Surg. Journal, No. 115.)



tritive, as well as actually poisonous. And, therefore, to endeavour to lessen the popular prejudice which has so long presided over its history, by showing, that the maladies recognized as its production, have, in the greater number of instances, been the conjoined offspring of deteriorated grain and defective nutriment, I have been led to this train of reasoning from the fact of my own experiments by no means corresponding in remarkableness with those reported by the continental writers upon the same subject. And, without enlarging further upon matters at all problematical, I shall proceed to a faithful detail of my own experiments, from which will be attempted to be drawn whatever inferences are most correspondent with their character and kind.

SECTION V.—*Physiological action of Ergot of Rye, illustrated by Experiments.*

These experiments I have divided into two classes; 1st, the immediate injection of ergot into the system by the arteries and veins; and 2dly, its mediate introduction by the stomach, skin, and rectum. The former will be subdivided into three orders, comprising solutions of different degrees of strength, which will be particularized in each respective trial. The latter will form two subdivisions, embracing large and single doses, to determine the direct effects of the drug; and small continued ones, to illustrate its eventual or remote influence upon the animal system.

*Injection of Ergot into the Veins.*—*Expt. I.*—Three-quarters of an ounce\* of ergot of rye were infused in three ounces of water, † slowly evaporated until only half an ounce remained, which, after filtration, was injected into the right external jugular of a bull-terrier bitch, weighing seventeen pounds. She cried and struggled violently on receiving it, the urine flowing in a full stream, the pupil dilating immediately, the pulsations of the heart being too rapid to be counted. In four minutes its action was much diminished in force and frequency, and general muscular flaccidity prevailed, with slight quivering of the whole frame. In another minute the heart again beat with singular rapidity and force, during which complete opisthotonos came on. After the lapse of another minute and a half, she cried in a plaintive tone, the heart beat slowly and laboriously, the breathing was remark-

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\* Whenever the word ounce is used throughout this treatise, it implies an ounce apothecaries' weight.

† My mode of preparing this solution, whether for physiological or obstetrical purposes, consists in mixing the ergot, previously reduced to a fine powder, with cold water, and slowly heating it until near the boiling point. At the temperature of about 200° it is maintained for a few minutes, then poured into a strainer, and forcibly squeezed whilst hot. As the active principle of ergot is volatile, its aqueous solution should never be allowed to boil.



ably slow and profound, and under these symptoms the animal died, in exactly nine minutes from the period of injection.

*Autopsy.*—All the muscles of voluntary motion retracted from the knife. The heart was firm and rigid, but insensible to galvanism, whether transmitted, or from a closed circuit. The right cavities contained venous, and the left ventricle, arterial blood. The lungs had a natural appearance, but the trachea was lined with abundance of frothy mucus. The intestines were contracting vermicularly when exposed, and, as well as the stomach, had a natural appearance throughout. The other abdominal viscera were apparently healthy. The mouth was very livid and frothy; the pupil was dilated, and the conjunctiva reddened. The *dura mater* was slightly injected, but the other membranes of the brain and its substance exhibited nothing remarkable. The spinal chord was exposed throughout its whole extent, but it displayed no evidences of alteration.

*Expt. II.*—I intended to inject a strong solution of an ounce of ergot into the jugular vein of a shepherd's dog, weighing twenty-four pounds; but when the first syringeful had passed, which did not contain above half the quantity, excessive spasmodic action ensued, with dilatation of the pupil and discharge of feces. In three-quarters of a minute the convulsions had ceased, and there was only to be observed the most perfect helplessness and flaccidity of the limbs, with a quick and feeble pulse. This state continued through the further period of half a minute, when very slight tremor of the muscles of the hind and fore-legs succeeded, accompanied with a drawing down of the lower jaw, and perfect emprostotonos. The motion of the heart was now very slow and intermittent; the emprostotonos, with an occasional convulsive sigh, continued until four minutes and a half from the commencement, when all signs of life were gone.

*Autopsy.*—The pectoral muscles contracted remarkably when cut. The heart was quite still, but, after having been incised, began to pulsate, and continued to do so for sixteen minutes. Its right cavities contained venous, and its left ones arterial blood. The thoracic and abdominal viscera were natural. The brain was slightly injected upon the surface only. The spinal chord exhibited nothing remarkable. This experiment was witnessed by Mr Walker, Surgeon, of Bulwell.

To determine whether these results were at all influenced by the mere presence of foreign matter in so concentrated a form, without respect to any poisonous quality, I tried the following experiment, which satisfactorily proves that vegetable substances, not directly poisonous, may, with perfect safety, be injected into the animal system; and that the results in the two preceding trials



were dependent upon an active inherent property of the ergot, not characteristic of sound rye.

*Expt. III.*—Three-quarters of an ounce of healthy rye were bruised, and then boiled for some time in three ounces of water. The solution was then well squeezed through a coarse strainer, and when cool, injected into the jugular vein of a spaniel bitch, weighing sixteen pounds. With the exception of a slight increase in the action of the heart, and hurried respiration, she appeared to be unaffected by it. The wound healed readily, and during the three remaining weeks that she was allowed to live, no signs of injury appeared. This experiment I repeated, with similar results, in the presence of Mr Walker.

*Expt. IV.*—Three drachms of ergot were infused in as many ounces of water, evaporated to one ounce and a half, and when tepid, the liquid was slowly injected into the right jugular vein of a terrier dog, weighing fourteen pounds. Its introduction was almost immediately followed by heavy and laborious breathing, with increased action of the heart, its beats amounting to about 100 in a minute. The pupil was dilated at first, but soon contracted again. In ten minutes, he cried out wildly, and violent convulsions of the whole frame succeeded at intervals. Five more minutes passed over, his breathing continuing to be heavy and laborious, the action of the heart being quick and violent. He was perfectly unconscious, the eye was fixed and insensible to the touch, feeling, indeed, was quite gone; for punctures made in different parts of the body furnished no indications of suffering. In twenty minutes the heart began to falter, respiration diminished in frequency until it became unobservable, and in this state he continued without any alteration, until two hours and a quarter from the first injection, when life became wholly extinct.

*Autopsy.*—All the voluntary muscles were sensible to galvanism, as also the auricles, but not the ventricles of the heart. The latter organ was flaccid, containing venous blood in all its cavities. The lungs were dark-coloured and engorged, and the bladder was excessively distended with urine. The other viscera were natural. The membranes of the brain were slightly injected, and both lateral ventricles contained a little serous fluid, slightly coloured. A similar effusion was found upon the surface of the brain. I could discover nothing unusual in the spinal chord.

*Expt. IV.*—A solution furnished by half an ounce of ergot in three ounces of water, was slowly injected into the femoral vein of a large bull-terrier bitch, weighing twenty-three pounds. About half an ounce of the fluid was propelled at once, to each of which injections the system answered by very increased arterial action, and quick, hurried respiration. The first injection also produced violent convulsive movement of the whole body, but the hind-legs



were chiefly affected. The urine and feces flowed abundantly, and the animal cried in a plaintive and agonized tone. The convulsions lasted for about three minutes, when the dog became still, the whole frame relaxed, being totally insensible to pain. The pupil was dilated and motionless, the action of the heart scarcely audible, the respiration slow and profound. In eight minutes, the pulsations of the heart became distinct, and the respiration was hurried and difficult. In four minutes more sensibility returned to the anterior part of the body, and the animal stirred its fore-legs; the posterior extremities remained motionless and insensible. The pupils were excessively dilated, and the eyes glared hideously. Sight and hearing were, however, restored; for the dog watched my movements, and was startled by a sudden or loud noise. At this period the body was cold; in a short time the sensibility of the fore legs was again lost, the eye became fixed and glazed, the motions of the heart were feeble and quivering, and a rattling in the throat announced the period of dissolution. A little diluted spirit was now (half an hour from the commencement) poured down its throat, which seemed to operate as by enchantment. In a few seconds, the breathing became free, the motions of the heart were accelerated, the energies of the system were revived, and, as if invested with new life and vigour, the animal in a minute or two was upon its legs, followed me when called, but whined piteously from the wounds on its surface of which it was now sensible. The fore legs were moved with perfect freedom, the hind ones were not fairly lifted, but dragged along. It thus continued for about quarter of an hour, when paralysis again returned, and increasing progressively, terminated the function of animal life in exactly one hour and thirty-five minutes from the first injection.

Upon this experiment I may remark, that I have often succeeded in averting for a time the effects of an injection of ergot, by the exhibition of continued doses of stimuli; but I have never thus recovered an animal, to which a strong solution of ergot had been given, although its influence has certainly been modified. When weaker solutions have been employed, I am persuaded that this treatment has considerably facilitated resistance of the poison.

*Expt. VI.*—Five drachms of ergot were infused in four ounces of water, and the liquid when cool was rapidly injected into the left external jugular of a bull-bitch, weighing twenty-two pounds. Soon after its introduction the heart beat violently, sometimes intermitting, and again leaping excessively. The breathing was heavy, and considerably accelerated, the pupils widely dilated, and in about four minutes and a half the power of voluntary motion was completely lost. The abdominal muscles were violently convulsed, the urine and feces at the same time passing abun-



dantly. After the fecal evacuation, the tail began tremulously to move, and, increasing in force, at last waved rapidly from side to side. In seven minutes from the first injection, the *sphincter ani* contracted powerfully, and there was every appearance of severe tenesmus, which symptom was greatly augmented by touching the hind-legs or tail. The pupil was still dilated, the eye fixed and motionless, and, as well as every other part of the body, apparently insensible to pain. Even the hind-legs, which were convulsed slightly when touched, were freely incised without occasioning any symptoms of torture. In fifteen minutes, stertor came on, and there was a copious discharge of mucus from the nose. The heart was beating slowly, the pupils were contracted, and all the muscles except the *sphincter ani* were flaccid and powerless. In half an hour the animal had a copious bloody evacuation, accompanied with severe and protracted tenesmus. In forty minutes, the abdominal muscles became relaxed, the contractions of the *sphincter ani* ceased, and the tail in spasmodic movement made a complete circuit towards the back, in which position it continued, fixed in the most unyielding rigidity until death, which followed in three-quarters of an hour afterwards, the animal having survived the injection one hour and twenty-five minutes.

*Autopsy.*—The stomach was remarkably distended with air, and its mucous surface was coloured from the presence of deeply injected blood-vessels. Spots of a darker hue variegated its pyloric extremity. The intestines were in vermicular motion, and when opened, exhibited a deep-claret colour throughout their entire mucous surface. The tinge was deepened towards the rectum, at the extremity of which it was nearly black. The latter bowel contained an appreciable quantity of bloody mucus. The bladder was empty, and with all the other abdominal organs, natural in appearance. The heart was flaccid, containing dark blood in all its cavities. The lungs displayed no particular traces of engorgement, but were much darker than usual. The membranes of the brain were reddened from injected vessels, the lateral ventricles contained a little bloody serum, but the substance of the brain, as also the spinal chord, was in every respect natural. This experiment was performed in the presence of Mr Bowker, surgeon.

*Expt. VII.*—Three drachms of ergot were infused in four ounces of water, and by careful evaporation the quantity was reduced to three ounces. This measure was slowly injected into the left external jugular of a bull-terrier dog, weighing twenty-five pounds. The animal bore the introduction of the whole quantity without exhibiting any signs of suffering, or even of physical disturbance, very slight acceleration of the pulse excepted. There



was neither spasm nor convulsive motion of any kind. In the lapse of ten minutes every limb was flaccid and powerless; the breathing was natural, and the dog lay, giving no indications of pain, but was in the most complete state of paralysis. The hind-legs were totally insensible, and the susceptibility of the fore extremities was very trifling. The pupil was slightly contracted, insensible to light, and the eye was scarcely affected when touched. In this state he continued for half an hour, when reaction came on, and sensibility was in some degree restored. He rose upon his fore-legs, but, on attempting to support himself on the hind ones, fell. In a sitting posture, then, he crawled a few yards, using only the anterior part of the body, the posterior extremities being scarcely moved. In three-quarters of an hour the limbs again became weak and useless. The body grew cold, and the pulsations of the heart were indistinct and fluttering. The respirations gradually diminished in force and frequency, until they became imperceptible; and the feeble action of the heart, with an occasional sigh, was the only indication of life's continuance. Eventually, however, the heart ceased to beat, the termination of its functions marking the intervention of two hours and eighteen minutes between the commencement of the experiment and its close.

*Autopsy.*—The muscles of the posterior extremities were only very slightly affected by galvanism; the anterior part of the body was more susceptible, yet it was evident that irritability was in a great measure exhausted. The heart was uninfluenced by stimuli, flaccid in its texture, containing venous blood in the right cavities, and in the left ventricle arterial blood. The lungs had a natural appearance, but the trachea contained much frothy mucus. The stomach was distended with flatus, as also the bladder with urine, but nothing unusual was discovered in any of the abdominal viscera. The membranes of the brain, its substance, and the spinal chord, were in every respect natural. This experiment was witnessed by Mr John Wright, surgeon.

*Expt. VIII.*—Two drachms and a-half of ergot were infused for some time in two ounces of water, and the solution when tepid, was injected into the right external jugular of a terrier dog, weighing eleven pounds. The whole of the liquid was passed without any evidence of injury, but in about six minutes the dog was in a state of complete paralysis, voluntary motion being entirely suspended, and sensibility lost in every part except the head, face, and neck. The pupil was not affected, nor did the sight appear to be at all diminished. In twenty minutes, the sensibility of the eye began to decline, and its glassy fixed state indicated the mischief that was impending. The heart was almost unaffected until the lapse of half an hour, when its pulsations became slow and feeble, the respirations at the same time diminished in force and



frequency. In forty-five minutes the animal was quite cold, the heart and lungs continuing their functions in a body apparently dead. The dog remained in this state through the further period of half an hour, having survived the experiment one hour and a quarter.

*Autopsy.*—Muscular irritability was very slight. The heart was soft and flabby, containing in its right cavities venous blood, the blood on the left side being much darker than arterial. The mouth was very livid and frothy. A most careful examination was made of every other part of the body without the discovery of anything unusual. This experiment was performed in the presence of Mr Henry Taylor, surgeon.

In repeating these experiments, I discovered in two instances, that the paralytic state of the hind-legs may be considerably relieved by a stimulant injection. The dogs were quite unable to stir their hind-legs, when an enema of spirit in one instance, and of dilute ammonia in the other, restored for nearly an hour their motility, and for a much longer period their sensibility. Both, however, subsequently died.

*Injection of Ergot into the Arteries.\*—Expt. IX.* Half an ounce of ergot was infused in three ounces of water, and the solution, after a reduction to two ounces, was carefully injected into the right carotid artery of a fine bull-dog, weighing thirty-eight pounds. Upon receiving the first syringeful he cried loudly, and struggled with convulsive violence. The pupils immediately contracted, but in a few minutes dilated again. Each injection produced similar effects, and when the whole quantity had passed, the pupil remained contracted, and abundance of froth issued from the mouth. In five minutes, the heart's action, which a short time before had been hurried, became slow and heavy; the pupil was at this time so contracted as to be scarcely discernible. The breathing was stertorous, and scarcely any part of the body was susceptible of pain. Respiration gradually became more slow and profound, until thirty-five minutes had elapsed from the commencement, when life was terminated. Sensibility of the body in this experiment was not materially influenced until twenty minutes from the first injection.

*Autopsy.*—All the muscles readily retracted from the knife. The heart was tolerably firm in its texture, the auricles were remarkably sensible to galvanism, but the ventricles, before and after the evacuation of their contents, were unaffected by it. All the cavities of the heart contained dark blood. The lungs were

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\* Without giving a separate detail, I may observe, that I have injected a pretty strong solution of sound rye into the arteries, without producing any effect, except contraction of the pupil and tendency to sleep.



engorged, and the trachea contained much frothy mucus. All the abdominal viscera were natural, except the gastro-colic-omentum, between the folds of which was a large quantity of extravasated blood. All the mesenteric veins were highly turgid. The *dura mater* and *pia mater* were diffusely reddened from minute injection; the vessels upon the surface of the brain were congested; and the substance of this organ exhibited throughout its structure many distinct traces of extravasation. The ventricles contained only as much serum as was requisite for the lubrication of their inner surfaces. I could discover nothing unusual in the spinal chord. This experiment was performed in the presence of Dr John Percy.

*Expt. X.*—A solution furnished by half an ounce of ergot\* infused in four ounces of water, and carefully evaporated until only an ounce and a-half remained, was injected into the left carotid artery of a bull-terrier bitch weighing seventeen pounds. As the fluid passed, and before it was wholly transmitted, she yelled vehemently, and was the subject of strong convulsions. The pupil contracted instantly; the heart beat with increased activity, and the respiration was hurried and difficult. The urine flowed copiously, and the feces were discharged with severe tenesmus. Complete paralysis, with total loss of sensibility, resulted in less than a minute. In four minutes and a-half she fetched a deep sigh, the jaw was drawn down, and partial emprosthotonos appeared for a few seconds, when suddenly the muscles were relaxed; and the animal was dead.

*Autopsy.*—The appearances were almost identical with those in the last experiment, the effusion of blood in the abdomen excepted.

*Expt. XI.*—Three drachms of ergot were infused in three ounces of water, and the solution obtained was rapidly injected into the left carotid artery of a shepherd's dog weighing twenty-three pounds. The greater part of the fluid passed without producing any marked symptoms; but whilst the last syringe-ful was discharging, slight convulsions came on, with deep sighing and accelerated motion of the heart. In five minutes after the injection had been completed, hiccup prevailed, and the animal vomited a good deal of bilious matter. Afterwards, general twitching of the whole frame appeared, not amounting to convulsion, but having somewhat the character of rigor. All the hairs along

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\* The ergot in this instance, as in several others, had been well washed with cold water, to discover whether any diminution of activity would be the consequence. The results need no comment.

This mode of inquiry was suggested by the reports made upon the influence of the "sphacelus," which, when removed by washing, has been said to leave the ergot totally inert.



the spine became erect, and stood at right angles with the skin. The tail moved tremulously for some time, and then described a curve towards the back. In fifteen minutes from the commencement, paralysis of the hind-legs came on, but during a further period of twenty minutes, neither the motility nor the sensibility of the anterior part of the body was impaired. The pupil dilated without previously contracting, and it was not until ten minutes before death, that the eye was insensible to external impressions. Very little alteration was observed in the motions of the heart, though the respiration was much slower than usual. The skin for half an hour prior to dissolution was quite cold, and remarkably loose. No further symptoms occurred worthy to be particularized, until the death of the animal, which happened in two hours and forty-five minutes from the first injection.

*Autopsy.*—Excepting the presence of venous blood in the left cavities of the heart, there was no appearance meriting notice. The brain even was natural, and its membranes were but slightly marked by a few solitary vessels.

Paralysis that results from an injection of ergot into the animal system, is not always accompanied with a loss of feeling. In two instances where I have injected it by the veins, there has resulted an extraordinary increase of sensibility, so much so, that even touching the hairs at the extremity of the tail caused the animals to cry out in agony; a breeze of air produced the same effect; and again, without any apparent reason, there was a convulsive start, and a yell at the moment, expressive of acute suffering. Both these animals recovered.

In other cases, I have injected mild solutions of ergot into the arteries and veins, without producing any sensible effects whatever,—neither increase nor decrease of sensibility, no paralysis or stupor; and yet death has resulted in ten, fourteen, or twenty hours. The autopsies have failed to disclose any morbid appearances except the presence of dark blood in the left ventricle, and slight congestion in the lungs; circumstances attributable to the fact, that the respiration has diminished in a ratio disproportionate to the decrease of the action of the heart.

On the contrary, I have injected mild solutions of ergot into the arteries and veins without destroying the animals, though they have invariably looked meagre and sickly, and have never regained their previous strength or liveliness.\*

*Inferences.*—These experiments are of so plain and pointed a nature, as to require little enlargement in verbal explanation. They appear to justify the following conclusions.

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\* Dr Mackenzie informs me that he has injected a solution furnished by two drachms of ergot, into the femoral vein of a dog without any bad effects; the chief symptom being hurried respiration.



1. That solutions of ergot injected into the arteries and veins affect chiefly the brain and the nervous system.

2. Both may be influenced together, coma, more or less perfect, and paralysis appearing at once; or the spinal chord may be first affected, paralysis immediately resulting, and the brain participate subsequently, the comatose period being much delayed.

3. Its effects differ according to the strength of the solution employed. In a concentrated form it appears to paralyze the system instantly, no resistance to its effects being discernible. A milder preparation causes for a time, great excitement, the nervous energy is roused, but sinks eventually under the influence of the poison. A much diluted solution, on the contrary, produces at first no apparent effect, but seems, by a very progressive sedative action, to deprive the system of its energy, and so to exhaust it of life.

4. Its effects are produced more speedily when introduced by the arteries than by the veins. The brain then appears to be first affected, and the spinal chord subsequently; and in some instances, as in Experiment IX. stupor to a considerable extent may prevail, and yet the sensibility of the extremities be little impaired.

Ergot also appears to exert a deleterious influence upon the system through the medium of absorption, and its activity seems to be correspondent with the relative absorbent power of varied tissues, or with the sensibility of different membranes.

*Expt. XII.* Three ounces of a very strong infusion of ergot were injected into the peritoneal cavity of a mongrel dog. It produced but little impression for some time; but in the course of two hours he looked drowsy, his hind-legs failed, and eventually became paralytic, his fore ones were only affected with slight weakness. He frothed considerably at the mouth, and whined as if in pain. Death followed in about eleven hours from the commencement.

*Autopsy.*—The peritoneum was extensively, but not deeply inflamed, the blush was most conspicuous where the syringe had been introduced, no doubt from the local irritation caused by the instrument.

This experiment may not at first appear to be conclusive, and to a considerable extent it is not satisfactory;—the difficulty being to draw a distinctive line between the mechanical influence and the physiological effects of the drug. My object, however, in this investigation was not to discover whether the ergot would occasion death when injected into the cavity of the peritoneum; but I wished to know how the animal system would be affected through such a medium. That the results did not depend upon simple mechanical irritation, I proved from a comparative experiment,



which consisted in injecting into the peritoneal cavity of another dog, a strong solution of sound rye. No stupor, frothing at the mouth, or paralysis resulted. The animal appeared to suffer exquisite pain, and died on the following day, above thirty hours having intervened between the commencement of the experiment and its close. The peritoneum was much more extensively inflamed in this instance than in the former.

But I have injected strong solutions of ergot into the cavity of the pleura without any injury following it. The animals have generally survived the operation for two or three days, and the inflammatory state, ever apparent, has prevented my drawing any satisfactory inferences.

Its injection into the cellular tissue of animals, which experiment I have often tried, has invariably led to the formation of purulent matter; in some instances circumscribed within a cavity, bounded by parietes apparently formed of solid purulent matter, easily broken down, and feeling to the touch like soft cheese. In other instances it has been diffused throughout a great extent of tissue, burrowing amongst the neighbouring muscles, and forming a number of cavities, communicating finally with one common cyst.

The purulent matter thus formed has always been of a very offensive, and apparently unhealthy kind.

SECTION VI.—*Action of Ergot upon the Animal System, when given in large and single doses by the Stomach and Rectum.*

*Expt. XIII.*—An infusion of six drachms of ergot in four ounces of water, was evaporated to two-thirds, and then introduced by means of a gum-elastic catheter, into the stomach of a small terrier bitch, weighing ten pounds. In fifteen minutes after receiving it, she looked sickly, her eyes appeared heavy and red, and the contracted abdominal muscles, curved back, and prominent ribs, with an occasional hiccup, showed plainly the distress of the stomach and the prevalence of nausea. At this time the breathing was heavy and laborious, marked by an occasional deep inspiration, which was invariably accompanied with a shudder. At the end of twenty minutes, this tremor increased and prevailed during every inspiration, but none of the expirations were marked by it. In some instances it was considerably augmented, and nearly resembled convulsion, but this severity was only occasional. When twenty-five minutes had elapsed, she seemed inclined to doze, the eyes were heavy, and the conjunctiva reddened. When called, she raised her head, and looked very suppliantly, but refused to get upon her legs. In forty minutes she became very restless, whined much, and continually wandered about. No further symptoms of moment occurred until the lapse of three hours, when her hind-legs appear-



ed to be remarkably weak. She moved them with difficulty, dragging them after her, and, in turning abruptly, generally fell. The fore-legs participated in the affection but not so strikingly; nevertheless they appeared numbed, and she threw them carelessly about, as though unconscious of their touching the ground. This condition subsided in about nine hours, up to which time she had refused her food. On the following day, she displayed nothing peculiar, except debility, considerable thirst, and a disinclination to eat.

*Expt. XIV.*—In two days afterwards, I gave to the same dog a similar quantity of ergot prepared as before. Nothing remarkable occurred until the expiration of half an hour, when she looked wild and confused, displaying occasionally strong indications of cerebral excitement. The tremor upon inspiration, and the faltering step, characterized this, as they marked the previous experiment. At the end of an hour she seemed to labour under great nervous excitement, for the least noise caused her to start in fear. She evinced also great irritability, for when a dog, with which she had played, immediately before the administration of the drug, came near to her, she growled or snapped at him, being evidently annoyed by his presence. At the end of six hours these symptoms had subsided, but during that period she refused to eat, and passed urine copiously seven times. For three or four days subsequently, she remained listless and inactive, sleeping much and eating very sparingly.

*Expt. XV.*—Five drachms of ergot, reduced to a very fine powder, were infused in water, and the whole of it, without straining, was injected into the stomach of a terrier dog, weighing thirteen pounds. He appeared in a very few minutes to suffer uneasiness, his belly was drawn up, and he crouched as though in pain. In eight minutes after taking it he began to vomit, and continued to be distressingly agitated with nausea and retching for nearly a quarter of an hour, when these symptoms declined, and gave place to severe and protracted hiccup; this continued for above half an hour, when he fell asleep, and subsequently awoke, apparently little affected by the medicine.

*Expt. XVI.*—Twelve drachms of ergot, reduced to a very fine powder, were suspended in water, and then injected into the stomach of a mongrel dog, weighing twelve pounds. Immediately after its introduction the gullet was tied, to prevent the ejection of the dose. In five minutes, he made many ineffectual attempts to vomit, though the sickness was not so great as I anticipated. It continued for six or seven minutes, and then subsided. In fourteen minutes general tremor came on, and the dog was scarcely able to stand. He stared wildly about, and seemed to recognize nothing distinctly. He then staggered into a corner, falling seven-



ral times before reaching it, and in a few minutes began to doze. During sleep the limbs were twitched convulsively, the hind-legs were especially affected, and the abdominal muscles were in strong contraction. He snored loudly, and more than once I suspected a termination in coma. At the end of three hours he was somewhat easier, but hardly able to move. The eyes looked heavy, the conjunctiva reddened, and the mouth was filled with frothy saliva. The ligature was now relaxed, a further dose of twelve drachms of ergot was given, and the cord was tightened once more. This dose affected him much more than the former one, and in a few minutes after receiving it, he lay as if dying, moving his legs unconsciously in various directions. In a quarter of an hour he tried to vomit, and was evidently much agonized. He lay upon his side, occasionally fetching a deep sigh, and hiccupping severely; his look was remarkably wild, and the tremor upon inspiration excessive. After having been removed into a corner he fell asleep, snoring loudly, and frothing abundantly at the mouth. At the end of two hours and a half the ligature was removed, and the wound carefully sewed up. From the commencement he had passed no urine, but shortly after the removal of the cord, both urine and feces were evacuated involuntarily. In about six hours from the administration of the last dose, he ate three small pieces of bacon, and then refused whatever was offered to him. On the following day he was completely paralyzed in the hind-legs, and his command over the fore ones did not allow him even to crawl. He ate nothing during the day, but drank a good deal, and towards evening seemed to be a little relieved. On the second day he was able to stand, but when he attempted to walk he invariably fell, and was many minutes before he could rise again. He dozed almost continually, and was irritated by very trifling causes. His hearing now appeared to be nearly gone, for it required a great noise to startle him; his sight was also much diminished, and, indeed, I was several times of opinion that actual blindness had resulted. The sense of smell was totally lost, which was perhaps in some measure owing to the presence of an abundant and highly offensive mucus which poured from the nostrils. His victuals were obliged to be put into his mouth, for he could neither smell nor see them, and if left alone he must inevitably have been starved to death. Up to this day, I could discover no particular difference in the action of the heart, but it was now feeble and intermittent; the temperature of the body was much diminished, the nose perfectly dry, mouth parched, and in every particular he exhibited the most wretched picture of misery and suffering. On the third day profuse diarrhœa came on, after which the animal seemed a little better; his senses were more acute, and he was able to walk for a few yards. The wound in his neck discharged



a matter of the most offensive description imaginable, such as rendered the stable, though a large one, almost intolerable.

From this time he slowly improved, but he never regained his flesh or recovered his liveliness. His activity was gone, his faculties were enfeebled, and he displayed every unequivocal proof of physical decrepitude and decline.

*Expt. XVII.*—Twenty-four drachms of ergot in fine powder were infused in five ounces of water, and when tepid the whole mass was injected through a gum-elastic tube into the stomach of a terrier bitch, weighing fifteen pounds, the gullet being tied immediately afterwards. In about seven minutes she began to evince signs of uneasiness, whining piteously, and drawing up her legs. In twelve minutes she made the first effort to vomit, and continued to do so with evident indications of suffering for above quarter of an hour, when these symptoms were succeeded by calmness and lassitude. During the greater part of the time in which vomiting prevailed, she was lying on her belly, and was therefore not disturbed; but on the cessation of the sickness, it was found that she was unable to rise, and on being lifted upon her legs, she maintained the position with difficulty, and in a few seconds fell. The pupil was contracted, the conjunctiva reddened, an abundance of saliva issued from the mouth, and the breathing was slightly stertorous. In eighteen minutes further, spasmodic twitchings of the hind-legs came on, the abdominal muscles next, and those of the fore-legs subsequently participating. During the prevalence of this spasm hiccup appeared, which lasted for a short time, and on its cessation, the animal began to whine and exhibit other indications of pain and torture. At this time, three-quarters of an hour from the commencement, the heart became intermittent in its beats, and its pulsations, at first rapid, were slow and feeble. Urine and feces were abundantly evacuated, and slight emprosthotonos appeared, with desire to vomit. At the expiration of an hour these symptoms subsided, leaving the animal weak, flaccid, and motionless. She continued to froth at the mouth, the pupil remained contracted, the eye fixed, and, except when touched, not influenced by passing circumstances. In two hours and three-quarters from the commencement, the ligature was removed from the gullet. The extremities were now growing cold, the spasms had subsided, and nothing but slight tremor upon inspiration was discoverable. Respiration was very slowly performed, and insensibility much diminished; for when pricked she manifested no uneasiness, and a deep incision was required ere its influence was acknowledged with a groan. At the end of five hours, nothing of further importance having transpired, she was left for the night, and on entering the stable on the following morning she was found to be dying. The pupils were di-



lated, the action of the heart could not be felt, the body was perfectly cold, and equally insensible, and the only proof of vitality remaining was an occasional gasp, which was accompanied with a drawing down of the lower jaw. In rather more than an hour and a half afterwards she died, having survived the experiment nineteen hours and forty minutes.

*Autopsy.*—The body was opened immediately after death, but the muscles were not susceptible of galvanic influence. The heart contained blood in all its cavities, but the blood of the left side was of too dark a hue to indicate perfect arterialization. The substance of this organ was soft and flaccid, and the *venæ cavæ* for some distance beyond it were gorged with blood. The lungs were darker than natural, the trachea was lined with frothy mucus, and the bronchial ramifications were, in some instances, filled with it. The gullet exhibited nothing remarkable, but the lining membrane of the stomach was extensively reddened from minute injection, the loaded vessels being more conspicuous upon the summit of the rugæ than in their intervals. Only a small quantity of ergot was present in this organ, the greater part having passed into the intestines. The vermicular motion of the latter had ceased, and they contained abundance of bile. Feces were found in the rectum, and the bladder was full of urine. The uterus was natural. Upon removing the skull, the *dura mater* discovered a slight and diffusive injection, but distinctly less than the *pia mater*. The substance of the brain was little altered, and the left ventricle only contained a small quantity of serum. The spinal chord was natural throughout. This experiment was witnessed by Mr Henry Taylor.

*Expt. XVIII.*—Nine drachms of finely powdered ergot were, after slight infusion in three ounces and a half of water, injected, *en masse*, into the stomach of a rabbit, weighing five pounds and a half. There was no necessity to tie the gullet, as this drug, like most others, fails to induce sickness in such animals. At the end of half an hour it began to show signs of uneasiness, constantly turning about, and drawing together its legs as though pained. In about ten minutes this restlessness had subsided, and when an hour and a half had elapsed, the rabbit began to dose, twitching a little at the same time, particularly in the hind-legs and ears. He was watched for two hours longer, and nothing particular appearing, I left him for the night, and on the following morning found him well and lively.

*Expt. XIX.*—Sixteen drachms of ergot were, in a manner similar to the last, introduced into the stomach of a female rabbit, weighing four pounds and three quarters. The dose appeared to occasion a little uneasiness, indicated by a very frequent and somewhat peculiar change of position; but none other symptom



at all expressive of its influence could I discover until the termination of two hours and a quarter, when its fur was remarkably roughened, not having the softness of texture and uniformity of disposition characteristic of good health. This peculiarity of surface, unmarked, however, by any other symptom, continued until the following day, when its absence and a good appetite justified the inference that all indisposition had subsided.

*Expt. XX.*—Eleven drachms of ergot, after the customary infusion, were, without straining, injected into the rectum of a bull-terrier bitch, of about eighteen pounds weight. The enema was retained for twenty minutes, at the end of which time it was forcibly expelled with a small quantity of fecal matter, severe tenesmus succeeding. She then became uneasy, whined piteously, passed a little urine with apparent difficulty; the pupil dilating at first, and contracting subsequently. In a short time she foamed much at the mouth, twitchings were observed in the hind-legs, which in an hour afterwards were weakened and benumbed, their temperature, as also that of the body, being much reduced. On the following day she was quite well.

*Expt. XXI.*—Fifteen drachms of ergot were, in a manner similar to the last, given to a mongrel dog, weighing nine pounds and a half. The symptoms were almost identical with the preceding, except that he appeared to suffer considerably in passing urine, and in half an hour priapism came on, associated with hiccup. For two or three days this animal laboured under a dysenteric affection, and considerable weakness of the hind-legs.

From these experiments we may infer, that ergot is capable of exciting a local irritation upon the parts with which it comes into contact; determining when in the stomach nausea, vomiting, and hiccup; when in the rectum, tenesmus; and by sympathy, dysuria and priapism.

Its influence upon the brain and spinal chord is well expressed, on the latter especially; but it is evident that a considerable dose is required for the developement of any active results.

It will also be observed that rabbits are much less influenced by the ergot than dogs; a circumstance perhaps attributable to two causes; *1st*, vegetable diet being the one allotted to, and therefore best suiting them; and *2dly*, because they are able to bear a much greater quantity of narcotics and other substances of that class than carnivorous animals; the influence of such medicines upon them being of course greatly modified by idiosyncrasy.

The next experiments are intended, according as they may apply, to confirm or render nugatory the long prevalent opinion in favour of the production of spasmodic ergotism and dry gangrene from the protracted use of ergot of rye.

*(To be concluded in Next Number.)*



## EXPERIMENTAL INQUIRY, &c.

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(Continued from the *Edin. Med. and Surg. Journ.*, Vol. lii. p. 334.)

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### SECTION VII.—*Action of Ergot upon the Inferior Animals when given in small and continued doses.*

*Expt. XXII.*—THE animal first selected for this inquiry was a terrier bitch, weighing thirteen pounds. I commenced by giving her one ounce of ergot each day, in two, and sometimes three separate doses, to guard against sickness, and more effectually to secure its full constitutional influence. In beginning, I endeavoured to entice her to eat it by intermixing it with her food, but it was invariably refused.\* I was consequently under the neces-

\* And here I may remark, that I have never found an animal which would taste victuals of any kind, having a considerable intermixture of ergot; and I am fully



sity of pouring the ergot, whilst in suspension, down the animal's throat; an operation at first somewhat irksome to her, but which custom subsequently rendered much less annoying.\*

During the first week there was considerable tremor after each dose, and an approach to convulsion. The pupils were commonly dilated in about five minutes after taking it, and sometimes, though not always, contracted again after the lapse of half an hour or more. The abdominal muscles were usually drawn in, and hiccup not unfrequently appeared. The heart's action was commonly increased for about twenty minutes, becoming afterwards feeble, at which time disposition to sleep, and frothing at the mouth were often manifest. The animal generally evinced great disinclination to move, and weakness of the hind-legs was the almost invariable consequence of each dose, for two hours subsequently to the exhibition of which she generally discharged urine five or six times, and that copiously. The sight was evidently affected;—she stared wildly, and when her eyes were approached with the finger, it appeared to be no source of annoyance, and the lashes required to be touched ere the lids shrank and closed themselves.

During the period of three weeks, for which time the animal was daily fed with the quantity previously specified, it manifested its usual vigour and activity, keeping up its flesh, and following the ordinary pursuits characteristic of its nature. Being fond of water, she was allowed to bathe two or three times a week; but when under the influence of a recent dose of the ergot, she obstinately refused to enter the river: nor indeed was she inclined for amusement of any sort until its effects had subsided, when her vivacity usually returned. Fatty matters generally disagreed with her, and, if given shortly after the administration of the ergot, not uncommonly produced vomiting. At the expiration of three weeks, the daily quantity given was augmented to one ounce and a half, administered in three separate doses. Between the third and fourth weeks, she began to evince palpable signs of declining health. Her inclination for play was gone; she would not enter the water, and passed the greater part of her time in a corner, crouching as though frightened. She was excessively thirsty, her mouth generally dry, and her nose constantly so.

The respective doses of medicine now affected her much less than before; rarely had she contractions of the abdomen, or symptoms of gastric uneasiness after them. Her appetite became capricious, fat was invariably rejected, and she ate nothing but the

inclined to Tessier's opinion, that they will die of hunger rather than eat it. For out of more than fifty trials, I have met with but six dogs that would lap the infusion divested of the solid material; and that they took but in small quantity.

\* I need scarcely observe, that, to prevent any obstacle to the undisturbed action of the drug, the animal was allowed a large stable to roam in, a plentiful supply of wholesome food, and was exercised twice a day in the open air.



lean of meat, bread, broth, &c. I observed that she commonly held up one leg in standing, alternating the hind with the fore ones, and that which was elevated twitched frequently, without reference to the time elapsed after a dose of ergot. In walking, her legs, and particularly the hind ones, were curiously used, being put down, and often immediately lifted up, as if not feeling the ground. Of the numbed condition of the extremities I have no doubt; for when her paws were squeezed, she manifested no signs of uneasiness, and when pricked with a knife, but little apparent suffering was the consequence. The greatest sensibility, however, was in the anterior part of the body. She was much worse when compelled to lie upon wet straw, and displayed strong proofs of misery when kept there.

A distressing flatulence now came on, which, as well as the dejections, was of so offensive nature as to be almost intolerable. The eyes became weak, glued up in the morning, and during the day they poured out tears abundantly. Although eating a tolerable quantity of good food, she was very weak and emaciated; her legs were comparatively useless, for she walked with difficulty, and seldom turned round without falling. The spine also appeared to be affected, for she could not sit in an erect posture, but was always inclined in a lateral direction, the curvature being sometimes so great as to cause her to rest upon the dorsal surface of either ilium. The muscles of mastication were also much weakened, for the animal used to sit for an hour or more with the lower jaw dropped, and if its food were at all tough, it was chewed with difficulty. And so trifling was the secretion of saliva, that she seemed to swallow the ingesta in too dry a state for the gullet readily to transmit it.

During the fifth week, I tried two ounces of the ergot daily, but finding it to be more than could be easily borne, I reduced the dose to one ounce, preferring its protracted usage, and the full developement of slow poisoning, to a more rapid termination of life, without such progressive results.

At the end of the fifth week, she became much debilitated, lost flesh considerably, and her belly was remarkably contracted. The tears now appeared to be unusually acrid, for the eye-lashes fell off, and the hair on that part of the check down which the water trickled, disappeared; the surface subsequently reddened, and was ultimately excoriated. The animal showed signs of difficult breathing, and its nostrils were clogged with puriform matter, which was continually draining from them. Her sight and hearing were much impaired, and I have no doubt, could life have been sufficiently prolonged, that the use of each organ would have been entirely lost. She suffered extremely from flatulence, and her bowels were very irregular, being sometimes con-



stipated, and again equally relaxed, severe tenesmus being occasionally indicated. Her debility was gradually increasing, the slightest muscular effort was a fatigue, and unless roused, she scarcely ever got upon her legs. Every muscular structure seemed alike, for her jaws were so weak, and her tongue so insensible, that she was barely conscious of the presence of food in her mouth, and it was with the greatest difficulty that mastication was performed. During the last four days, she was totally unable to chew, and I was consequently obliged to feed her with strong broth, &c.

For the three last remaining days of her life, her body, which had been previously much reduced in temperature, became quite cold, and never regained perceptible warmth. The motions of the heart were slow and feeble, though its sounds were not unnatural. Respiration was very slow, and accompanied with a slight stertor. She was in a state of constant trembling, coiled up in a corner, and exhibiting the most abject picture of emaciation and debility. Her breath was disgustingly offensive, and the body had a peculiar and very disagreeable odour.

About 12 o'clock on the day preceding that which terminated her existence, she seemed to be dying; but the symptoms were merely an aggravation of those which had prevailed for a week before. The sight was entirely gone; touching the conjunctiva did not affect it; and the whole body appeared to be insensible to pain. The urine slowly dribbled away, and a slimy dejection passed in a similarly involuntary manner. There was no spasm, though in each inspiration the abdominal muscles contracted powerfully. About 4 o'clock in the afternoon, she began to move her head from side to side, and to moan plaintively. At 10 in the evening, the motions of the head had ceased, the action of the heart, I could neither feel nor hear, and the only discoverable sign of life was a convulsive gasp, which occurred about every four minutes. At 5 on the following morning, she was in precisely the same condition, gasping about every five minutes. At 1 A. M. she died, having taken in the first three weeks 21 ounces; the same quantity in the next two weeks; and 14 ounces in the two following weeks; making collectively, 56 ounces of solid ergot, in the space of seven weeks.

*Inspection.*—The animal's weight was reduced from thirteen pounds to seven pounds and a half. None of the muscles could be affected by galvanism. Most of the superficial ones were soft and pale, and in some instances easy of laceration. The heart was very flabby, and much smaller than I ever saw it in such an animal. The right cavities were filled with dark blood, as also the left ventricle, but the left auricle was empty. The lungs were much darker than usual, and were also extensively tuberculated.



The lining membrane of the trachea was occasionally thickened, so as to exhibit very distinct inequalities. When cut into, these enlargements did not appear to be anything more than indurated and thickened mucous membrane. The trachea and the bronchial ramifications were lined with a puriform fluid, having a very disagreeable odour, of a reddish colour, with an intermixture of green. The gullet had an inflamed appearance, as also the lining membrane of the stomach, which organ was distended with flatus, and the undigested portion of the last meal. The intestines were remarkably diminished in size throughout, and, in many places, distinct and well defined contractions were apparent. Their mucous membrane was injected with red vessels as far as the end of the jejunum; it then exhibited its natural appearance to within four inches of the termination of the rectum, when it again became highly florid and vascular. The kidneys were natural. The spleen was remarkably small, not one-third its usual size in such an animal, and from its minuteness, I had considerable difficulty both in finding and recognizing it. The liver was much enlarged, but not distinctly altered in either colour or consistence. The pancreas, uterus, and bladder, were all natural in appearance. The *dura mater* was slightly injected, but the other membranes, and the substance of the brain were of a healthy character. The spinal chord was examined throughout, but it discovered nothing unusual. I found distinct traces of ergot in the blood, but I was unable to detect it in either the brain or spinal chord.\* The inspection was conducted in the presence of Mr Bowker, surgeon.

The body was completely putrid in twelve hours.

*Expt. XXIII.—July 5th.*—On this day I commenced giving

\* The mode which I adopt for the detection of ergot in the blood, consists in separating its oil, the only constituent upon which a practical inquiry can be founded.

In this instance, 1000 grains of blood were taken from the dog, stirred to prevent coagulation, and then acted upon with successive portions of sulphuric ether. This fluid has the property of removing the crystalline fatty matter of the blood, but it also takes up its oily matter; and as it is a most active solvent of the oil of ergot, of course, it would separate three constituents, the crystalline fatty matter, the oil of the blood, and the oil of ergot. The ethereal solution was cautiously evaporated, and the residue treated with very dilute alcohol. This takes up the oil of ergot, whilst its degree of dilution does not allow it to touch the crystalline fatty matter, or the natural oily constituent of the blood.

The alcoholic solution, after evaporation, left fifteen grains of oily matter, which, when slightly heated, became black, and evolved the odour of an old tobacco pipe. It was volatile, and exhibited every appearance of the oil of ergot.

It is to be regretted that we have not more decisive tests of the presence of ergot in the blood. The means above described are all that are within my reach, and are necessarily imperfect, when we consider the similitude amongst oils. But the mode of analysis which the most established chemistry will warrant, (see Rees on the Analysis of Blood and Urine), in some degree justifies the conclusion. Then, the quantity of oil which I obtained is greater, by ten grains, than that which healthy blood will ever furnish.

As before observed, I could not detect it in the brain or in the spinal chord. I have also failed to discover a similar material in the blood of animals not taking ergot.



the ergot to a bull-terrier puppy, four months old, whose weight equalled ten pounds. Lest there should not have been time in the last experiment for the full influence of the drug, I determined in this instance to give it every other day, so as to protract the period of death, and allow the poison every opportunity of displaying its virulence.

I began with half an ounce, giving it in three separate doses, which occasioned symptoms resembling those previously described, though in a milder degree. At the end of three weeks, his appetite began to decline, and such irritability prevailed, that he was even offended at being fed, and attempted to bite the hand that was contributing to his sustenance. I need scarcely remark, that he was materially put out of humour when the medicine was given. Instead of having thus early, the diminished sensibility of body, characteristic of the last animal, his feeling seemed to be morbidly increased; and, whether from terror or pain I know not, but if at all roughly handled, he cried piteously. On the commencement of the fourth week, the quantity of ergot taken on each day of its administration was augmented to three-quarters of an ounce.

During the fifth week, he began perceptibly to lose his flesh; a diminution much more palpable in the hind than in the fore-legs. His appetite was not materially impaired; he walked with a staggering pace, but would never follow any one.

At the end of the sixth week, one of his hind-legs began seriously to fail, the coxo-femoral articulation being implicated, and I was almost led to anticipate, what the previous experiment had somewhat discouraged, the occurrence of dry gangrene. There was at this time a curious train of symptoms, somewhat indicative of a loss of common understanding. At one time, he would sit for an hour together, working his lower jaw, as if chewing something; this would perhaps be succeeded by a restless turning of the head in all directions, and then he would suddenly start as if frightened, and scamper off, crying at the same time. Again, he would commence to walk backwards, moving his lower jaw as though curbed by a bridle, then he would walk forwards, and stagger up to a wall or any other impeding object, apparently unknowing of its existence. At another time he would sit with his head elevated, constantly turning it round, as if seeking for something; or he would sullenly retire into a corner, and refuse to stir.

These are a few of the very numerous train of idiotic symptoms which the animal manifested. Some of them are to be explained by the fact, that he was nearly blind and deaf; but I think they also prove that he was suffering from a correspondent mental decline.

His evacuations were generally regular, and abundant in bile,



but exquisitely offensive, as also the flatus, which was a source of much annoyance. The secretion of urine was copious, but, in other respects, natural. The pupils were not influenced by light, and from the inner angles of the eyes, there distilled a thin, puriform, acrid fluid, which excoriated the parts over which it trickled. The motions of the heart were at first quickened by each successive dose of the ergot, but they were now uninfluenced, and maintained a slow and feeble character. The temperature of the surface was considerably diminished, and its sensibility also, but the irritability of the animal rather increased.

At the termination of the seventh week, he could not walk, though he made many and frequent attempts, in which he fell exhausted. The muscles of the lower jaw were now so weak that he could hardly move them; at least, I scarcely know whether to consider it actual debility, or a loss of voluntary command over them. It was perhaps both; for when food was put into his mouth, the act of chewing was a mimicry of the process, the substance being ludicrously tossed about, and finally ejected. I was therefore obliged to feed him as I fed the other. The senses of smell, vision, and hearing, were now, to all appearance, quite gone. The femoral articulation of the left side was weaker and more emaciated, and if touched, the dog yelled in torture. The abdomen was much contracted, and the right hypochondrium greatly enlarged, owing to the enormous size of the liver.

These symptoms, under daily aggravation, continued until the commencement of the ninth week, when the animal died, having taken in that time twenty-three ounces and a quarter of solid ergot. I may here remark that this dog had the distemper a few weeks before taking the ergot, and was fully recovered from it at the time the experiment was commenced.

*Inspection.*—The only parts of the body susceptible of galvanic influence were the pectoral muscles and the diaphragm. The heart was small and soft, containing dark blood in all its cavities. The lungs were much darker than usual, and their surface exhibited various spots like ecchymosis, not the consequence of gravitation, from their position, but apparently resulting from the stagnation of blood during life. They were extensively tuberculated. The lining membrane of the trachea was thickened in its entire extent, of a dirty yellow colour, and of a putrid smell. The stomach contained a little food, and was distended with air of an offensive odour. Its lining membrane, as also that of the intestines, was natural throughout. The latter organs, however, were much diminished in size, and in some places distinct bands of contraction encircled them. A small abscess, about a quarter of an inch in diameter, was discovered in the duodenum. The kidneys were pale and remarkably soft. The spleen was as much reduced in



size as the one described in the last experiment. The liver was excessively enlarged, and in some places indurated, but I could discover no traces of ulceration. The gall-bladder was full. The glands in the neck and groin were indurated and enlarged. The brain was softer than usual, as also the spinal chord; in one or two places the brain was semifluid, but I could discover no marks of recent inflammation. All the joints were examined without discovering any indications of altered structure, the coxo-femoral articulation of the left side excepted. Here the cotyloid cavity was found almost full of blood and purulent matter; the membrane lining it, as also that covering the head of the femur, being increased in thickness and much softened. The neighbouring ligaments were more lengthened, and less firm in their structure than usual. The body rapidly decomposed.

Upon comparing these experiments and their results with those effects which are said to have followed the use of ergotted rye on the Continent, it will be found that a great and serious difference exists. How the discrepancies are to be explained I am at a loss to determine. All that I can do is to vouch the truth of my own experiments. It does not become me to deny what was previously written; and yet I must acknowledge that I have never been able to confirm the accuracy of the cases recorded in foreign publications. Allowance must be made, it is true, for the difference between the susceptibility of the higher and the lower animals; and were this the sole cause of variance, I should certainly be inclined to credit the reports upon the virulence of the drug; but as it is said equally to influence the human frame and that of brute animals, I am totally unable to solve the difficulty. The only reason which I think it possible to assign, is the liability of ergot to diminish in strength by keeping. That it spoils when not cautiously preserved every practitioner is aware; and Noel even asserts that it altogether loses its deleterious properties by being kept for a few months in sheaf.\* Nevertheless, this does not appear to be sufficient; for the activity of my sample was well attested by the preceding experiments; it is the difference of result which remains a problem. Whilst Tessier says that he has killed dogs, with from an ounce and a half to two ounces, within a fortnight, decided symptoms of gangrene having appeared, I have employed the same drug to the extent of above fifty ounces, and in one instance to above sixty ounces,† without any such consequences. I cannot help thinking that accessory circumstances must have greatly assisted Tessier's

\* Quesnay, *Traité de la Gangrene Séche*, p. 407. Paris, 1749.

Dodart, Languis, Larse, Taranget, and Vetillard, say that the new grain produces much more destructive epidemics than the old; but, on the other hand, Villeneuve, (*Mem.* p. 80,) denies that it is injured by keeping even for years. (*Thèse du mode d'action et des effets Therap. du Seigle Ergoté.* Par Adolphe Bouchor, p. 6.)

† See Experiment 24th.



results, and that his animals, unlike mine, were drugged and starved together ;—

“ Quicquid excessit modum  
Pendet instabili loco.”

This opinion is confirmed by the fact of other experimenters not having substantiated Tessier's conclusions. Pentrin has remarked, that in Silesia, when the bread has been composed of one-eighth or even one-sixth of ergot, people have eaten of it without sustaining any injury.\* Mr Froggart of Westminster has given an ounce of ergot in less than an hour, without any remarkable effect save frequent micturition.† Michell relates a case in which an ounce was taken by mistake. After the lapse of two hours and forty minutes it was ejected by vomiting, but no injury was discoverable. And he further states that he took eighteen drachms in fourteen days, without experiencing any sensation above that which follows a glass of old beer.‡ Parmentier took every morning, during eight days, half a drachm of ergot on an empty stomach, and his freedom from injury he thus describes: “ My sleep was tranquil during all the time, nor had I the smallest headache.” Maier, as reported by Wesner, took ergot in increasing doses, to a very considerable amount, without being materially affected by it. Goupil states that he has taken two drachms and a half for a dose, and that sickness, vomitings, colic pains, and slight headache were the only bad symptoms which followed.§ Professor Murray gives the cases of two beggars, who took every day, for eight days, an ounce of bread each, containing three drachms of ergot, and suffered no inconvenience.|| Prescott states that he has given six ounces of ergot in nine days, without producing any bad effects.¶

On the contrary, it must be admitted, that there are instances recorded in which small doses of ergot have produced very energetic and violent consequences; though the small number of such cases requires that they be ranked as the exception, and their converse as the rule. M. Cordier swallowed two drachms of ergot, which caus-

\* Neale on Ergot, p. 68.

† *Lancet*, 1828-9. Vol. i. p. 190. ‡ Michell on Ergot, p. 122.

§ *Journ. des Progres des Sciences et Institut. Medicales*.

|| *Apparatus Medicaminum*, Vol. v.

M. Lalesque reports the case of a female who took a decoction of ten ounces of ergot in twenty days; and another in which eight ounces were taken in a month, without the production of any mischief. (*Journ. Hebdom. Univ. Tom. xii. p. 245.*) And it would appear that the ergot of some districts is very little injurious. “ *Model dit avoir expérimenté que l'ergot des environs de Saint-Petersbourg n'est pas délétère; Pallas dit qu'il ne régnait point de d'épidémie dans plusieurs provinces Russes, qui en faisaient usage dans leur nourriture.* (Thèse du mode d'action et des effets Therap. du Seigle ergoté, p. 6. Par Adolphe Bouchor.)

¶ See *Lond. Med. and Phys. Journal*, 1816, Vol. i. p. 380.



ed violent and protracted vomiting of sour matter, smelling strongly of ergot ; and a perceptibly sour smell was given to his perspiration.\* The latter symptom is rather remarkable, and has been repeatedly noticed.† Dr Maunsell relates the case of a female, four months pregnant, who was rendered delirious by two drachms of ergot, given in the space of half an hour.‡ Another case is related by this author, in the same Journal, in which half a drachm of ergot, given in two doses, caused at the expiration of fifteen minutes, violent headach, stupor, and depressed pulse. He also mentions an instance related to him by Dr Johnston, where two drachms of ergot, given in two separate doses, produced in six hours, incomplete coma, livid face, and muttering delirium. Dr J. Y. Simpson, of Edinburgh, mentioned to me an instance occurring to his own observation, in which small doses of ergot produced symptoms almost amounting to intoxication.

The spasms which have been said to follow the use of ergot I can fully believe ; for in animals such as dogs, whose susceptibility is greatly inferior to that of man, I have noticed symptoms strongly resembling convulsion, and the injection of ergot into the arteries and veins, as before shown, is most decidedly productive of violent spasm. And hence I can believe it possible for gangrene in the human subject occasionally to have followed its use as an article of food ; and the state of the cotyloid cavity in the last experiment, would almost justify the inference, that so great a quantity of ergot, if administered to man, would have caused a loss of the limb.

But in speaking of the production of gangrene by ergot, it must be remembered that many other circumstances are liable, not only to assist in its formation, but, independently of the drug, actually to occasion it. We know that, if a ligature be put upon the crural nerve of a rabbit, gangrene takes place in a few days, and sloughing follows. Cutting away a portion of such nerve is said to be attended with a similar result,§ and the presence of a hard tumour, or any other foreign body, may, by continued and increasing pressure upon a nerve, be productive of a like consequence. Cold, || by diminishing the circulation in any part, and innutri-

\* Journ. Gen. Avril.

† Experiments with ergotted rye on Man and Animals. "Versuche und Beobachtungen über die Wirkung des Mutterkornes auf den menschlichen und thierischen Körper, &c. &c. Dr C. J. Lorinser. Berlin, 1824."

‡ Lond. Med. Gazette, 1834, June 26, p. 605.

§ See Lond. Med. and Surg. Journal, 1828, Vol. i.

|| It will be found on referring to the history of gangrenous ergotism, p. 19, that its production was in one instance, as much attributed to the inclemency of the season, as to the use of ergotted bread. In other cases, it will be observed, that it raged in marshy situations and in the villages, more than in cities and dry places, p. 16.



tion,\* by lessening the actual quantity of invigorating blood, may equally contribute to the same end. Obliteration of the arteries, by impeding the necessary admission of blood into any part, especially into the extremities, may produce gangrene, which, in the absence of due investigation, might be imputed to another cause, innocent of its origin.

In conversation some time ago, with a medical friend, he informed me that a case of gangrene once occurred to the observation of Dr Elliotson, whilst physician to St Thomas's Hospital, in the person of a man who was taking ergot of rye. I immediately wrote to Dr Elliotson, who, in reply, kindly informed me, that he "once saw a patient in St Thomas's Hospital, whose leg became gangrenous whilst taking the ergot of rye; but upon examination, it was found that the main artery of the leg was ossified and obstructed." He further added, "I have used ergot extensively, and sometimes for a fortnight together, without ever observing any signs of gangrene."

From this fact, it is obvious how careful we should be not to attribute a destructive tendency to any medicine, without being satisfied that no concurrent circumstances have contributed to deceive us.

Nevertheless, from the numerous substantial cases in which the virulence of ergot is represented, I am inclined to the opinion, that gangrene may have frequently succeeded its use. For the symptoms described as preceding dry gangrene, I have more than once seen from comparatively small doses of ergot.

During the month of October 1837, in the absence of Mr Walker, I attended in a medical capacity at the Poor House of Basford, in the county of Nottingham. Amongst the number of patients submitted to my charge, was a woman, who, in consequence of repeated attacks of flooding, had been treated for a fortnight previously, with the *Secale cornutum*, in doses of half a drachm three times a-day, which had the very desirable effect of mitigating her sufferings. I increased the dose to one drachm, directing it to be taken four times a-day. When visiting her, five days after the alteration of the dose, she observed unsolicitedly, that she was excessively nervous and irritable, sparks appeared to flash before her eyes, her head was sometimes heavy and throbbing, and again so light and giddy that she could scarcely stand. She remarked further, that, on awaking in the morning, she had a peculiar tingling sensation all over the body, sometimes merely a slight creeping feel, and at others, the symptoms increased even to painfulness. These she declared never to have felt prior to the augmen-

\* Dodart observed that the poor were more subject to gangrenous ergotism than those whose circumstances in life secured to them a greater extent of domestic comfort. See page 18.



tation of the dose of ergot, and was firm in her belief of its production thereby. As her complaint had ceased, I did not deem it prudent to gratify my own curiosity at the patient's risk, by continuing the medicine;—its use was consequently stopped, and in a few subsequent days all the unpleasant symptoms had completely disappeared.

The following case, still more demonstrative of the influence exerted by this remedy, upon the nervous system, was kindly communicated to me by Mr John Wright, surgeon of Nottingham.

“ Mrs S., a person of delicate habit, and already the mother of two children, began to complain of approaching labour about seven o'clock in the evening of August 15, 1837, and, continuing to grow worse until three o'clock on the morning of the following day, she requested my attendance. Soon after entering her apartment, I learned, from an examination conducted in the usual way, that the *os uteri* was largely dilated, and disposed still further to yield to the foetal head, which was descending into the cavity of the pelvis. The pains then recurred at intervals of eight minutes, but, becoming progressively more frequent, they were observed about seven o'clock to succeed each other with distinct intermissions of three minutes only. The head had not yet fully occupied the cavity of the pelvis, partly owing to the circumstance of the face having been directed towards the pubes, instead of falling into the hollow of the sacrum, and partly to a declination of vigour in the uterine efforts. The soft parts were favourable to delivery, and the pains, as already intimated, were sufficiently frequent, but were ineffective in their character. The case thus inviting a trial of the ergot of rye, I infused two drachms of it in half a pint of boiling water, and after allowing it to stand for ten minutes I cooled one-half, and administered it exactly at half-past seven o'clock. The third pain, which followed the draught, I thought increasingly urgent;—the next, decidedly so, though following its precursor at no shorter interval of time than was previously noticed. She now took the remainder of the infusion—the pains acquiring a still more expulsive character, but marked as yet by distinct intermissions. Not content with negative evidence of the latter fact, I more than once asked her, during such intermissions, if she were free from pain, when she assured me, that, with the exception of a sense of weight referable to the perinæum and anus, she was quite easy. Presently, however, the uterine action grew more intense, and on being desired to spare herself during the absence of pain, all expressions of suffering, so that she might be better provided with strength to support that which should be forthcoming, I was told, as is no uncommon occurrence when the ergot has not been given, that the pains were never wholly absent. She was delivered within half an hour from the



time of taking the first dose. On calling upon her the next day, she observed that, in a few minutes after I had left her, she became sick, and vomited what appeared to be the medicine she had recently taken. Presently afterwards she lost all voluntary motion, and even the power of utterance. Her heart she described as having beat very rapidly for a long time, and her breathing as having been exceedingly laborious. Nevertheless, she was conscious; but the room presented to her the impression of water excessively agitated on its surface. She could compare it only to the 'foaming of a troubled sea.' After some hours the heart beat more quietly for a time, and then fell into inordinate activity as before; intermitting in this manner throughout the day, during the earlier part of which she lay perfectly motionless, but without pain, recovering gradually towards evening the suspended animal function. In the course of the day she made much water, of the escape of which she was perfectly conscious; and along with the return of voluntary motion, she dated the recurrence of sensibility and a consequent suffering from after-pains. She declared that such was her helplessness at one time, that 'had the child been falling out of bed, or had the house been on fire, she could not have made the least muscular effort.' But supposing her condition to have arisen from the medicine she had taken, and enduring no pain, she and her friends thought it useless, until the time when, according to custom, I should next visit her, to report that condition with which I was supposed to be perfectly familiar. With the exception of an unusual fretfulness and an occasionally hurried action of the heart, she suffered no further inconvenience throughout the puerperal state."\*

I may add, that I called with my brother at the house of this patient, and heard, in her own declarations, the substance of the report.

Michell also appears to have noticed similar results. Speaking of ergot he says, "Its effect on the mother is to cause a deadness on all parts of the body."† In another place he observes, after

\* A similar case is recorded by M. Flaubert.—*Observations Pratiques sur l'Emploi du Seigle Ergoté pour combattre l'inertie utérine*. These. A Paris, 1832. He says, Obs. xiii. p. 22-3, "Après avoir pris la seconde dose du seigle ergoté, la malade ressentit une vive douleur dans la cuisse droite, qui cessa peu de temps après, et fut suivie d'un engourdissement du pied tel, que Madame A..... perdit plusieurs fois sa pantoufle sans s'en apercevoir; jusqu'au moment d l'accouchement, elle se plaignit toujours de ne point sentir son pied. Lorsqu'elle fut replacée dans son lit, je visitai cette partie; le pied jusqu'aux malléoles était pâle et froid; je fis frictionner avec du vin chaud, et envelopper ensuite avec un morceau d'étoffe bien chauffé, et je recommandai à la malade de tenir le pied malade sur une bouteille de grès remplie d'eau bouillante, jusqu'à ce que la chaleur fût revenue. Pendant trois jours le pied resta froid, et l'engourdissement ne se dissipa entièrement que quinze jours après l'accouchement."

† On the Uses of Ergot, p. 73. A declaration certainly at variance with that of M. Barbier, who says that, upon a healthy subject, ergot has no action, affecting



giving ergot, "The woman's legs were completely useless from the cramp pains in them."

Paralysis, from the use of ergot, is by no means an uncommon occurrence where its employment is protracted, or the doses are large. Larrey is of opinion, that the involuntary jets of urine in a case related by Barbier were a consequence of paralysis of the sphincter of the bladder, and that the ergot did not excite the organ as many have supposed.\*

Upon the preceding experiments illustrative of slow poisoning by ergot it may be remarked, that although gangrene did not appear, yet the medicine produced a very decided impression upon the nervous system. The defect in the functional power of the different organs of sense, and particularly the blindness, loss of feeling, and coldness, favour the idea, that nervous susceptibility was much diminished, and its beneficial influence upon the system consequently much lessened. Indeed, it seemed to produce a slow and gradual decline of nervous energy, its exhaustion finally terminating in death.

But, upon further investigating the subject, it will appear that besides debility, actual disease was induced. The watery condition of the eyes, overflowing of the tears, puriform discharge from the nostrils, thickening of the membrane lining the trachea, enlargement of the liver and of the absorbent glands, and tubercles in the lungs, clearly, and I think indisputably prove, that a scrofulous condition was engendered. Some may urge that this was not caused by the ergot, but was merely an attendant of emaciation. That innutrition is too common a source of scrofula I am sorry to admit, but that it was the exciting cause in these experiments will, in my opinion, require much confirmation. For every precaution was taken to give full liberty to, and obviate every influence with the operation of the ergot. The experiments were all performed in the country, where good meat, abundant exercise, and clean airy residence were always provided. Then Expt. XXVIII., where the animal slowly poisoned with foxglove, exhibited the emaciated and reduced condition of those destroyed by ergot, does not show us any proofs of a scrofulous state; and Expt. XXIV., in which the appetite was little impaired, and yet the mesentery was studded with tubercles, brings all the evidence which actual demonstration can adduce, of the disease having arisen from the ergot and not from starvation.

There are also a few other symptoms which it will be proper to notify. Animals slowly poisoned with ergot are said to have retained a good appetite and an unimpaired digestion until

neither the stomach, the circulation, nor the head.—(Arch. Gen. de Med. xxvi. 131.)

\* Arch. Gen. de Med. xxvi. 132.



death. This (with one exception) I have never observed; on the contrary, the appetite has gradually diminished, until the animals have totally refused food, and have therefore required feeding. And the flatulence, with its extreme offensiveness, supports the idea, that digestion was both imperfect and depraved.

The heart (in dissections) is said to have been empty in all its cavities. \* On the contrary, I have more than once found all the cavities full. And never have I seen them empty. Tissot says, that M. Des Essurs, Lieutenant-colonel of a regiment at Blois, in a letter to MM. the authors of the *Journ. Encyclop.* 1772, Tome ii. Février, p. 122, reports the advantage which attended the administration of milk, by M. Plouche, an old physician, in the cases of animals poisoned by ergot. † And Michell explains the mildness of ergot in his hands, by saying that he usually gave it in milk. ‡ This fact I have not been able to confirm. I have repeatedly made cats sick by giving them an infusion of ergot in milk; and in administering it to dogs whilst in the process of poisoning by ergot, I have invariably found them worse,—the coagulum being apparently more than their stomachs could bear.

The pulse is said to have been unaffected throughout. This is a result which I have never yet witnessed. I have never seen an healthy animal under the influence of a liberal dose of ergot, without the heart's action being at first considerably increased, and subsequently diminished both in force and frequency. This circumstance has also been observed by others. Dr Cusack saw a case in which a drachm and a-half of ergot were given, and the pulse sunk from 120 to 90, considerable stupor and epistaxis supervening. § The same physician, in the 5th volume of the *Dublin Hospital Reports* states, that, in three instances where it was given in half drachm doses, symptoms of an apoplectic kind came on, and the pulse did not exceed 40 in a minute. Dr Ryan says that he has seen the pulse quickened in some instances, and lowered in others, by the ergot. Dr Rollet found the pulse affected, but he does not pointedly describe it, merely saying “*que la mere de la malade trouva comme moi, une notable difference dans la vitesse du pouls.*” || The remarkably diminished size of the spleen is an interesting and a curious fact. I am not able to account for it, unless in acknowledging the function usually ascribed to that organ, the dyspeptic state is regarded as having contributed to lessen it.

*Expt. XXIV.*—I commenced feeding a large doe rabbit, weighing seven pounds and a-half, with the ergotted rye, in the

\* Dict. de Med.

† Tissot, *Traité des Nerfs*, &c. Tome vi.

‡ Michell on Ergot, p. 126.

§ Lond. Med. Gazette, 1834, June 6th, p. 606.

|| Journal Hebdomadaire.



dose of three-quarters of an ounce daily, given in two equal quantities, night and morning. From the smallness of the gullet in this animal, I was obliged, in each instance of administration, to introduce an elastic gum-catheter into the stomach, and (with the aid of a syringe, adapted to the free extremity,) to inject the drug, during its suspension, into that organ.

For several weeks the animal remained unaffected, and I was somewhat doubtful whether the ergot would kill her, how protracted soever its use might be. She was with young when I commenced the trial, and I waited anxiously for a natural birth, as there was evidently no tendency to abortion; and at the usual time she brought forth six young ones, lively, of good size, and apparently in good health. The day after delivery she was again put to the male rabbit, and the young ones during the period of three weeks were allowed to remain with her, and when removed, showed no symptoms of declining health. Towards the close of the last period of gestation, the rabbit appeared to be ill; she looked drowsy and moping, sitting in a corner, and not as before, startled when touched. Her hair became long and erected, having the rough, coarse aspect, usually presented in winter. She exceeded her previous period of gestation by five days, and then brought forth three young ones, two of which were dead, and not more than half-grown;—the other, alive when born, was triflingly larger, and died in a few hours. I could discover no morbid appearances; every organ seemed to be in a natural state.

The sexual appetite of the mother did not return, and of course she never conceived again.

In the ninth week, an extensive tumour formed under the lower jaw, which on being opened, poured forth a quantity of greenish-yellow purulent matter. In a few more days, a fresh quantity of matter was formed, which continued to discharge until about a week prior to her death.

During the eleventh week three of her front teeth dropped out, and the remaining one disappeared shortly afterwards. Her eyes were covered with a puriform secretion, and the hair in their vicinity came off. It was not until this time that I observed any marked decline in her appetite. Its keenness had been diminished, but not conspicuously. Now, however, she ate but little, and that consisted entirely of green food. For two or three days prior to her death, she was scarcely able to stir, made a great quantity of water, and was much purged.

In the middle of the twelfth week she died, having taken in that period about sixty-four ounces of solid ergot. Her weight was reduced from seven pounds and a half to five pounds and a quarter.

*Autopsy.*—In the presence of Mr Walker, surgeon, I examin-



ed the body a few hours after death. The heart contained blood in all its cavities, that on the left side being as dark as venous. The blood in this organ, as also that in the larger veins, was uncoagulated, and on examination furnished decided indications of the presence of ergot. The lungs were dark and extensively tuberculated. The bronchial ramifications and trachea contained mucus tinged with blood, and smelling offensively. The lining membranes of the stomach and intestines were natural, but the latter organs were in many places distinctly contracted. The spleen was less reduced in size, and the liver much less augmented in volume than those of the other animals subjected to the same experiment. The mesentery was studded with tubercles, which exhibited throughout their numerous range every variety from early formation, to the advanced period of ripening and discharge. The other abdominal viscera looked pale and unhealthy, communicating a sense of softness and flaccidity to the touch. Upon removing the lower jaw, the molar teeth were found to be loose and easily detached from their sockets. The jaw was carefully sawn through, and in front, at the roots of the incisor teeth, was a cavity filled with puriform matter, and opening externally by a small, jagged, irregular orifice, which communicated with a cyst under the jaw, containing also puriform fluid. The upper jaw displayed nothing peculiar, nor could I discover any traces of mischief in the various joints of the body which were subjected to examination. The brain and spinal chord though carefully searched, exhibited nothing unnatural.\*

To endeavour to support by analogy the view which the preceding experiments suggested, of the action of ergot, and of the consequences resulting from its use, I performed the two succeeding experiments, which I think satisfactorily establish the inferences before drawn.

*Expt. XXV.*—A dog was given to me, which, only a few hours before, had broken its thigh about the middle of the bone. The hair was carefully shaven off, and the broken extremities of the bone were put into favourable apposition, and kept so by means of strapping, bandages, &c.

This practice, which would be scarcely justifiable in the human subject so quickly after the receipt of any injury, is allowable in the inferior animals, where feverish excitement and inflammatory disposition are never very urgent. But to guard against danger,

\* In this, as in the other experiments, I could discover no traces of inflammation along the arteries.

I need scarcely observe, that knowing how easily a scrofulous condition is engendered in rabbits, I took every possible precaution to obviate in this instance such an occurrence from ordinary sources. The room in which she was allowed to run was 18 feet by 16, and possessing every freedom of ventilation.



the limb was carefully attended to, and every liability to inflammation obviated.

On the day of the injury he took an ounce of ergot, which quantity was repeated every day in three separate doses, for three weeks. During this time he grew very thin and meagre, the injured leg being reduced much below the others in bulk. Yet his appetite was tolerably good, but he looked emaciated and miserable, exhibiting in the weakness of his eyes, and the discharge from his nose, the symptoms described in the foregoing experiments. He was kept for a week after ceasing to take the ergot, and was then killed.

Upon dissecting the broken thigh, it was discovered that no union whatever had taken place, and the only apparent indications of restorative action were cartilaginous deposits at the ends of the fractured part. A large cyst was formed round them, containing a great quantity of purulent matter, and burrowing extensively into the adjacent muscular tissue. The main cavity had distinct boundaries, which, when touched, crumbled under the fingers, having a cheesy consistence.

*Expt. XXVI.*—A spaniel bitch that had met with a like accident in the fore-leg, was similarly treated, but the ergot was continued only during the space of a fortnight, in consequence of a large slough having formed, which rendered it unnecessary to protract the trial.

Upon examining the injured part there did not appear to be the least tendency towards reparation; indeed the very irregular surface presented by the bone led me to infer that caries had commenced. A great quantity of purulent matter covered the fractured ends, implicating very extensively the neighbouring integument, and opening externally by a large irregular orifice. There was general emaciation of the body, but I did not discover any satisfactory marks of disease elsewhere.

I may further observe, that I have many times given ergot to animals having limbs weakened or crippled from injuries of long standing, and have invariably found such parts to suffer before any direct signs of constitutional disturbance were recognizable. In some instances I have found them, after a few strong doses, totally unable to use a limb in which only a little debility or stiffness had been previously discernible.

I have also intentionally wounded dogs that had been taking ergot for some time, whence has almost constantly resulted extensive sloughing, cavities deep and burrowing, cicatrices puckered in their formation, and dark-red or livid in their hue.

As I failed to produce gangrene in the previous experiments, I was induced, by the suggestions of some intelligent friends, to feed a dog entirely upon ergot, and the results were as follow



*Expt. XXVII.*—A mongrel dog, weighing fifteen pounds, was fed with two ounces of ergot daily, during the period of fourteen days. At the end of this time, the poor wretch was nearly starved to death—like Gonela's horse, "*tantum pellis et ossa fuit.*" As no signs of gangrene appeared, I stopped the ergot, and attempted to recover him by good food, but the powers of life had been so much exhausted, that in a few more days he died.

I could discover nothing remarkable upon examination, except an inflamed appearance of the alimentary canal, and general emaciation of the body.

Dr Mackenzie has kindly furnished me with the results of a similar trial, which are as follows; "May 6th 1837, at 1 P. M. to a dog seven weeks old, I gave one ounce of ergot; he had had no previous food that day.

May 7th, gave the same quantity in the morning, and repeated it in the afternoon.

May 8th, 8 o'clock A. M. moaned much, and died in three hours afterwards.

*Dissection.*—Little ergot was found in the stomach; but in the mucous end of the cardiac portion, were several small places of softening, varying in size, the largest being equal to that of a pea. The powder was found along the greater part of the alimentary canal, apparently little acted upon, except at the *caput cæcum coli*; and yet the lacteals were not distended, as we generally find after starvation. The urine was very yellow; the gall-bladder was distended with green bile." The Doctor asks, "Might not similar appearances result from feeding an animal on sugar, &c. alone."

Various theories have been suggested to explain the *modus operandi* of ergot in its production of gangrene; but, without referring to the old notion of poisoning the blood by the introduction of putrescent matter therein, I think the sedative action of the ergot accounts for it;—especially as its impression seems to be chiefly directed to the spinal chord, diminishing not only the nervous energy of the system, but impeding the circulation; either liable, but both eminently so, to produce gangrene.

Entertaining this view, I tried the following experiment with foxglove, which, from the analogy it offers to those instituted with ergot, leads me to the inference, that the chief injury derived from the latter substance is referable to its sedative influence upon the animal system.\*

\* In speaking of the sedative action of ergot, I do not wish to be understood to maintain, that the drug exerts an influence primarily sedative. The experiments already detailed will show the propriety of considering it strictly a narcotico-acrid; but, like many other poisons of that class, it is secondarily sedative, and in a much greater degree than the previous stimulus will account for. And by referring to the experiments on slow poisoning, it will be found, that after its employment had been protracted, scarcely



*Exp. XXVIII.*—I commenced giving to a bull-terrier dog, weighing twelve pounds, one drachm of freshly gathered leaves of foxglove, three times a-day. This I continued for a week, occasionally exhibiting a dose of castor oil to prevent accumulation, when, no signs of injury appearing, the quantity was augmented to two drachms. At the end of another week, his weight was diminished, he staggered in his walk, his coat was rough, eyes watery, the pulse feeble and intermittent, the surface cold, and appetite weakened. There were also shivering and slight convulsion. At the end of the third week, he could scarcely walk, his emaciation was excessive, though he ate with tolerable greediness. All the hair under his belly came off; and sensibility was much diminished, for he could bear slight wounds without manifesting any apparent signs of torture. The pupil was dilated, and unaffected by light; he became partially blind, and the sense of hearing was equally obtunded. The mouth was parched, and the urinary secretion was abundant. Two days before death, the body exhaled a foetid, putrid odour. He had scarcely any feeling; he lay motionless, in a state of extreme exhaustion, and quite cold. He died towards the close of the fourth week.

I am not able to say what quantity of digitalis this dog took, for, living in the neighbourhood of its growth, sometimes it was given directly upon being gathered, and again, not before it was two or three days old.

*Inspection.*—The heart was small and soft, containing venous blood on the right, and arterial on the left side. The lungs exhibited marks of adhesion, but no tubercles were found. The mucous lining of the intestinal canal was inflamed, presenting occasional patches of a much darker colour than the rest. The kidneys were very soft and pale. The membranes of the brain were slightly injected. The pituitary membrane was thickened, and emitted a purulent offensive odour. The body rapidly decomposed.

*External application of Ergot of Rye.*—When applied to the sound skin, ergot does not appear to produce any sensible effects whatever. I have kept it in a state of moisture, in contact with the inner side of a dog's thigh, (the part having been previously shaven, and well washed with soap and water,) and repeated it night and morning for a fortnight without occasioning any perceptible alteration in the part, save a little redness. I have also worn it in a similar state, in contact with my own arm, for more than a week together, and have felt no inconvenience from its presence.

Applied to an abraded surface, however, it gives rise to profuse any stimulus was observable; a diminution both of circulation and sensation almost immediately following each dose.



sloughing. I have tried it upon wounds nearly healed, and in less than twenty-four hours they have discharged purulent matter abundantly. The matter has generally been of a very offensive nature, and the wounds thus treated have, even under the application of proper curative means, been long and tedious in healing. In the form of powder it is very serviceable in arresting hemorrhage. Its mechanical influence has doubtless some share in the effect; but it does not entirely depend upon it, for the efficacy of flour, or any similar material, is not nearly so great. I have tried many comparative experiments, and have found the ergot succeed, when other simple powders have failed.

Even in the form of infusion, it has the power of arresting hemorrhage in an extraordinary degree. Whilst trying my experiments upon dogs, I repeatedly observed a subsidence of bleeding from the divided vessels of a wound, after a solution of ergot, from entering a vein with difficulty had trickled over the part. But I was not led to an investigation of the circumstance, until I saw a report of some interesting experiments upon the subject by Dr Müller.

He divided the popliteal artery in a sheep, and completely arrested the bleeding with lint dipped in an infusion of ergot. The caudal artery of a horse was cut, and the bleeding similarly subdued. The anterior crural artery was also divided, and its stream of blood with equal facility arrested.

To these experiments I may add, that I have several times divided the external jugular and the *vena saphena major* veins, and have never failed to arrest the hemorrhage by an infusion of ergot; though with arteries I have generally been less successful. And in the greater number of my experiments, I have used a dilute solution of ergot in the place of warm water, to sponge the incised parts, and have always succeeded in preventing that continued flow of blood, which is often a serious obstacle to the safe direction of the knife.

As I have never found any impediment to the healthy union of parts treated with an infusion of ergot, I have no hesitation in advising it as a valuable means of preventing the troublesome hemorrhage from small vessels, in the course of surgical operations.

And upon the same principle, I believe the injection of a similar solution into the uterus, in cases of flooding, will be found to answer every practical end that can be wished for.

#### SECTION IX.—*Obstetrical History of Ergotted Rye.*

There is no doubt that ergot was employed as a therapeutic agent at a period far antecedent to that at which the medical history of rye thus diseased is found to commence. It has been previously observed, that various other plants are liable to this



form of degeneration; amongst which are several species of *Arundo*; and in the *Pharmacopœia* for 1660, the *Diapenidion* reed is found to enter into the composition of an electuary recommended in menorrhagia and hemoptysis, and it is generally supposed that such properties were dependent upon the presence of ergotted portions.\* The *Junci* are also liable to this disease; and Gerard in speaking of them says, "The seeds of rushes dried at the fire, and drunke with wine, stayeth the laske and the overmuch flowing of women's termes."† These properties, not ordinarily possessed by such vegetables, are very likely, when present, attributable to their being accidentally ergotted.‡

For more than two centuries, ergot of rye has been known to possess the property of expediting the process of labour when given after the commencement of uterine action; and with such intention it has been extensively used by matrons, empirics, and legitimate practitioners. From this property it has been distinguished by the names "*pulvis parturiens*,"§ "*pulvis partum accelerans*," || "*poudre obstetricale*," and "*poudre ocyotique*."¶

The earliest account we have of its obstetrical employment is from Camerarius, who states that, about 1668, it was used by matrons in Germany, to hasten the process of labour.\*\*

In 1747, an accoucheur in Holland acquired great celebrity from its use, but it does not appear that it was a very popular remedy; and it was some time ere his secret, which was held with all the pertinacity of empiricism, became generally known.

In 1774, from its reputed virulence, its use was proscribed in France by legislative enactment. Nevertheless, it continued to be secretly employed in that nation by a few zealous practitioners, and particularly by a Madame Dupille, who subsequently extolled its virtues highly. At this period it was also used in America by the midwives, who administered it under the name of "blasted rye tea."†† And the matrons of Scotland are said to have employ-

\* I think this is somewhat doubtful, for we find the roots of the same vegetable employed with a like intention. Vogel, in speaking of the *Arundo vulgaris*, says, "Nostro anno prorsus negligitur, præterquam quod Deidierium, decocto usum esse ad provocandos menses retentos legam;" (*Hist. Materiae Medicæ*, p. 232.) alluding to its emmenagogue properties, which are also said to be possessed by ergotted rye.

† Herbal, Lib. i. p. 36.

‡ Morgagni mentions the *Leucoion Luteum vulgare*, as having properties similar to those of ergotted rye. (Letter 48, art. 41.)

The *Lolium* or Darnel, as its derivation implies, δολιος, deceitful or adulterine, the δ being changed into λ, *euphoniae gratia*, was anciently found to be the subject of ergot. And hence perhaps its reputed powers. Gerrard says, "it causes drunkenness when eaten in hot bread, when taken in wine it stayeth the fluxes of the matrix." According to Dioscorides, "a fume made by darnel, barley, frankincense, saffron, and myrrh, applied to the belly, healeth conception, and facilitates the birth."

§ Stearns.

|| Desgranges.

¶ Bordot.

\*\* Actes des Curieux de la Nature. 1668. Art. 6. Obs. 82.

†† London Med. and Phys. Journal, 1825, Vol. liv. p. 3.



ed it very extensively about this period ; though so much superstition appears to have been interwoven with obstetric history, as to render many of its features exceedingly doubtful.\*

In 1777, Desgranges, an accomplished accoucheur at Lyons, extolled its efficacy, published many luminous reports of its activity and usefulness, and eventually succeeded in bringing it into general use.†

For some years it maintained its character, and in 1787 was much praised by Pawlisky; (Baldingers, *Neue Magazin*, Tom. xi. c. 1, p. 44, and *Lancette Franc.* Tome viii. p. 164,) but its reputation again declined, and at the commencement of the 19th century, it was in that state of unmerited disuse, into which valuable remedies are often allowed to fall, through the unseasonable praises and unqualified abuse which they are equally compelled to sustain.

But in 1807, the attention of the medical world was again directed to the merits of this drug, by the publication of Dr Stearns's (of New York) letter to Dr Akerly, in which he fully illustrated its therapeutic values, and demonstrated its claims to general employment.

In 1813, Dr Prescott read a paper‡ before the Massachusetts Medical Society, which contributed much to confirm the views of Dr Stearns, and to extend the employment of the medicine. Since then, its reputation has only been equalled by its use, and we now find it, as we trust it will ever remain, one of the most popular articles in the *Materia Medica*.

#### SECTION X.—*The value of Ergot as an obstetrical agent considered.*

The character which this medicine early obtained for its speedy

\* Thus we find an old author declaring the sterility of all the females in one of the Orkney Islands. "Mulieres hic steriles sunt, et si gravidæ evenerint, nunquam cum vita pariunt." A church, however, dedicated to the Virgin Mary, was a propitiation commonly resorted to. (*Ben Orchadiarum Insularum Descriptio*, ad an. 1529, in MS. v. Dairsay.)

Enchanted powder is also spoken of, which was directed to be put into the hair for the relief of labour-pains, and the expediting of parturition. (*Trial of Eufane Macalyane*, 9th June, 1591. *Rec. Inst.*)

The *Ovum anguinum* was said to "give ease to women in child-birth, by being tied about the knee." (*Penant, Tour in Scotland, and Voyage to the Hebrides* 1772, p. 298.)

Margaret Stewart exhibited "ane quhyt stane of crystall, guid for seik women in their travell." (*Halyrudhous, K.S.R.* July 8th, 1628.)

A stone kept in St Ronan's Chapel in the Isle of Rona, had the supposed power of facilitating delivery. (*Martin, Western Isles*, p. 21.)

A small round stone, not larger than a plum, was described to Wodrow as "helpfull to severall weemen in childbirth." (*Wodrow, Analecta*, in MS. 5. 3. p. 83.)

† *Gazette de Santé*, 1777. See also *Bulletin de la Faculté*, Tome vi. p. 23.

‡ This paper was reprinted in England, and shortly afterwards translated into French by M. Charbonnier.



and efficient action in promoting the expulsion of the foetus, has long been substantiated by the almost unvarying testimony in its favour, afforded in the united experience of its many successful employers. But, as might be expected, a little diversity of opinion has prevailed regarding its merits.

Some have alleged, that, no matter how eligible the circumstances, or how adaptable the dose, no uterine action has followed its administration. Such have, therefore, stigmatized it in the open avowal that it is useless and inert. Of this class is Le Mercier, who says, that he found it altogether inefficacious when given, either to quicken the birth of the child, or to expel the placenta. Le Maire Lysancourt, at a meeting of the Section of Pharmacy of the Royal Academy of Medicine, maintained after Beclard, that ergot possesses none of the advantages attributed to it; an opinion, however, ably refuted by Caventou and Chevalier. Basset and Legouais declare that it is useless, and that it has sometimes appeared to do good by being given just at the period when uterine action was beginning to increase. Dufes says that it is absolutely inefficacious; and M. Chaussier, when officiating as Professor at the reading of M. Bordot's thesis, drew up a memorandum upon it, to the effect, that, after many trials, he had come to a practical assurance of its inutility. And Madame La Chapelle, after years of experience, declares respecting it "*son innocence est sa plus grande vertu*."\* Desmoreaux† and Gardien‡ both express their doubts upon its supposed power of exciting uterine contractions; and M. Capuron stated to the Academie de Médecine, in a memoir, that he regarded ergot "*as a drug which it is requisite speedily to expunge from the list of the Materia Medica*,"§ simply because he thought its phosphoric acid would disorder the stomach.

Others, on the contrary, have found it to be so rapid in its action, and so energetic in its effects, that they have described it as too violent a remedy to employ—its impression being destructively transmitted from the mother to the infant, in some instances even involving both in the same sacrifice. Thus Dr Houston says, "*it has caused several fatal demonstrations, and from what I have seen and heard, that more children have perished by the injudicious use of ergot during the few years which have followed its introduction into the practice of this country, than have been sacrificed by the unwarrantable use of the crotchet for a century past.*"|| Again, it is said that there are many instances in which it does good; "*but from what we know of the very hasty and*

\* *Accouchemens*, Tome i. p. 52.

† *Dict. de Med.* Tome i. p. 224.

‡ *Traité d'Accouch.* etc. Tome ii. p. 253. 2d edit.

§ *Transact. Med.* Tome viii. p. 77.

|| *North American Med. and Surg. Journal*, January 1829.



indiscreet manner in which it has too often been resorted to, we fear that its introduction into obstetrical practice has, upon the whole, been productive of more harm than good.”\* Dr Hosack, in his letter to Dr Hamilton, says, “although no evidence existed previous to the use of this medicine that the fœtus was not living in every case in which it was administered, the child was still-born.”† Dr William Moore, of New York, remarks, “it appears to be injurious to the child at all times.”‡ Dr Holcombe, in a letter to Dr Dewees, reprehends the employment of scruple doses, asserting that, when given to that extent, he has seen “several fatal demonstrations of its impropriety.”§ MM. Evrat and Moreau have both certified that it destroys the child. Hall states, that whenever ergot fails to excite uterine contractions, it produces more or less constitutional derangement,—an opinion which Neale altogether denies.|| But I think the former opinion a very justifiable one, from the many instances which we have of its powerful impression upon the nervous system. Mr Smith of Chertsey relates a case, in which a parturient female to whom the ergot was given, exclaimed in anguish, only a few minutes after taking it—“What have you given to me?—It flies all over me like lightning.” Michell also gives an instance where the woman asked what she had taken?—exclaiming, “I am dying!” And Broussais has wisely remarked, that this medicine must sometimes produce painful impressions on the nervous system.¶

Others, however, contend that the ergot may, if judiciously exhibited, be always given with advantage, the safety of the mother or of the child being never endangered. Of this opinion is Michell, who says, “I consider it to have saved the lives of many children, and were it introduced into general practice, the death of a woman in childbed would never be heard of.”\*\*\* Dr Church, whose experience entitles his opinion to some acknowledgement, says, he has “not observed that the ergot in any case caused the death of the child.”†† To these names may be added those of Godquin,‡‡ Voillot,§§ Campaignac,||| Guersent,¶¶ Doumerc,\*\*\* —Desgranges, Chevreul, Bongiovanni, Bigeschi, Balardine, Henschen, Davies, Clarke, Mackenzie, and numerous others. And if my own testimony may be at all worthy of regard, as tending to the validation of what has been previously adduced, I would

\* North American Med. and Surg. Journal, Jan. 1829, quoted in the Lond. Med. and Phys. Journal, N. S. Vol. ii. p. 258.

† Lond. Med. and Phys. Journ. Vol. vii. p. 183.

‡ Loc. sup.

§ Ibid. p. 181.

|| Researches on Ergot, 8vo, Lond. 1828, p. 60.

¶ Quoted in the Lancet, 1827-8, Vol. ii. 278.

\*\*\* On the use of Ergot, p. 78.

†† Practical Observations on Ergot, Philadelphia Journal, May 1824.

‡‡ Thèse, No. 244, Paris, 1832.

§§ Bibl. Med. Tome ii. p. 251.

||| Repert. Med. 1831.

¶¶ Lancette Franc. Tome i. p. 90, Tome iv. p. 6.

\*\*\* Thèse, No. 122, Paris, 1830.



venture to remark, that I have never seen a case justifying the conclusion, that mischief has followed the cautious employment of ergot; nor should I, from my own experience, consider it a medicine, the exhibition of which, in a judicious manner, would be at all likely to injure either parent or offspring.\*

Its tendency to injure the child when given during the parturient stage only, I can scarcely believe, unless the impression be mechanical, and the foetus be hurt from the contractions of the uterus upon it; or, from a disproportion between the external parts and the foetus, the head suffer from being impacted in the pelvis. But if freely given for some time prior to the period of delivery, I am fully inclined to the opinion that it may, by deteriorating the health of the parent, so communicate its influence to the offspring, as actually to destroy its life, or materially to reduce it in strength and soundness. For in giving it to pregnant animals at intervals varying from a few days to as many weeks antecedent to delivery, I have almost always found the produce injured or destroyed in consequence. And Dr Holcombe is of opinion, that it may be advantageously given to reduce the size of the child in cases of contracted pelvis. This experiment he has tried, and in one instance the weight of the child was reduced to five pounds and a half; the previous ones of the same mother had been above ten pounds.†

Another charge against the ergot, and one which seriously impugns its practical character, is its tendency to produce abortion. M. Gerardin, in a paper read before the Academie Royale de Medecine, says, that, in the colonies, it is regarded as a sure means of producing abortion, and of destroying the life of the *fœtus in utero*.‡ And it was a belief in its possessing this property which induced Pelletier and Planche, in a report to the French Minister of the Interior, in the name of the Royal Academy of Medicine, to advise its exclusion from practice. Lorinser also, as quoted by Hufeland, firmly maintains the opinion, that it will bring on premature labour; which view is also entertained by Rose and Guibert. Waller states, that he knew a case in which abortion was wilfully produced by a female two months pregnant taking it.§ And Goupil says, as it is capable of provoking abortion, it should never be given without the sanction of a medical practitioner.¶ Mr Corry of London says he has produced uterine action in a female seven months pregnant, by administering ergot; but it does not appear to have extended itself to abortion.

\* In some instances of amenorrhœa and of illegitimate impregnation, ergot has been given to the extent of quarter of a pound in twenty-four hours, without producing any injurious effects upon either the mother or the child.

† Journal of Medical Sciences, 1826. No. 3, p. 448.

‡ Revue Med. Sept. quoted in Lond. Med. and Phys. Journ. Vol. lii. p. 530.

§ Neale on Ergot, p. 78.

¶ Journal des Progres des Sciences.



Mr Ingleby says, that in two instances he prescribed it with the intention of producing abortion in cases of projection of the sacrum, and that it "clearly originated uterine contraction."\* In one instance the child was dead, in the other living. And Drs Ramsbotham † and Merriman ‡ believe that it will produce abortion. The latter author also says, that where the foetus has been sometime dead, and putrefaction to any extent has taken place, the remedy is altogether inert. § But when it is remembered that ergot will expel the placenta after its protracted retention, || we may imagine the expulsion of a dead foetus to be possible, and indeed we have cases illustrative of it. ¶ In some instances, however, it fails to detach the placenta. M. Delaporte, D. M. of Vimontiers, details the expulsion of twins by ergot, but no succeeding doses would detach the placenta.\*\*

The testimony in favour of its powerful action upon the uterus at any period of impregnation, certainly forms a strong contrast with the preceding reports declarative of its innocence. But in support of its inability to induce premature labour, we have the experience of Prescott, who maintains that it never occasions abortion.†† Dr Hall of St Albans has given it to a female threatened with miscarriage and reduced by hemorrhage, in whom the symptoms of abortion quickly subsided, and she went through the usual period of pregnancy. And Michell reports a case in which six drachms of ergot were given to a female eight months pregnant, but no signs of premature labour succeeded.‡‡ Chataud and Balme distinctly state that it has no influence upon the uterus, unless the action of that organ shall have already commenced. Villeneuve says it is not proved that ergot will produce abortion, for many women have taken it in large doses with impunity.§§

My own observation does not justify me in saying whether or not ergot will induce abortion in the human subject, never having had occasion for its employment; but I have seen many instances in which its administration in the earlier period of parturiency was not followed by any increased uterine action; and by a train of analogical reasoning, I should certainly infer that it has no tendency to induce premature delivery. And I believe the experience of most practical men is in favour of its increasing, but not originating, the pains of labour. This I believe to be the rule, but it is no doubt liable to exceptions.

\* Ingleby's *Obstetric Cases*, p. 233.

† *Lond. Med. Gazette*, 1834, June 28.

‡ *Synopsis*, 4th edition, p. 198.

§ *Ibid.*

|| Dr Worrel, of the U. S. army, gives the case of a female whose placenta was retained for three days, and five doses of ergot (fifteen grains each) brought it away.

¶ *London Medical Gazette*, 1829, Vol. iv. p. 100.

\*\* *Bull. Therap.* quoted in the *London Medical and Surgical Journal*, 1832, Vol. i. p. 453.

†† *American Medical Recorder*, No. 20.

‡‡ *Essay on Ergot*, p. 110.

§§ *Mem.* p. 28, 73, and 112.



It has even been stated that ergot is capable of either expediting natural delivery, or of occasioning its premature advancement in the inferior animals; and rye-bean is said to have acquired amongst farmers the character of being able to produce abortion. (Med. Repository, N. S. Vol. i. p. 265.) Possibly from its containing ergot. In southern France it is said to be given with success to cows to promote natural labour; and Mr Dick, Professor of Veterinary Surgery in Edinburgh, informs me that he has known ergot to hasten labour in cows, when given after the commencement of uterine action. Oslere, an American physician, declares that it will produce abortion in the lower animals as well as in women.\* Chapman reports it as a fact, but without giving any proofs, that, when administered to pregnant animals, it never fails to induce abortion. Chatard, however, contradicts this, and adduces an instance in which an ounce of powdered ergot was given to a sow about to "farrow," which only augmented the secretion of urine and produced agitation. Three ounces given in two days to a she goat, near the time of parturiency, failed to excite uterine action. Three ounces, given in the space of two days to a young sow about the middle of gestation, caused no remarkable symptoms. Four ounces given to a cow, four months with calf, produced only a loss of appetite. Wasener give it to a bitch with young, which went to its full time and pupped safely. This experiment was repeated by Dr Villeneuve, and with the same results. M. Combes made similar trials upon bitches, with the same effect, but in one instance the ergot occasioned violent agitation, with considerable loss of blood, and the expulsion of four puppies. But not having mentioned the period of gestation, his experiment is invalidated for want of precision.†

Imagining from the contrariety of opinion prevalent upon this subject, that it was still open to investigation, I performed a series of experiments in connection with it, which, divested of any comment, I shall now detail, leaving the facts simply as they occurred to me, to the consideration of my readers.‡

\* Lond. Med. and Phys. Journ. N. S. Vol. viii. p. 84.

† Neale on Ergot, Ch. 14. p. 89.

‡ Some might consider it requisite that the contraindications to the obstetrical employment of ergot should be given; but as they abound in all works on midwifery, and ought to be known to every accoucheur, I do not feel justified in occupying any time by quoting them.

A much more philosophical theme is comprised in the question, how does ergot influence the uterus? It is a subject which I have long studied; but the discrepant reports made by different authors upon the effects of ergot will not yet allow me to decide upon it. But I must acknowledge that I am not a convert to the doctrine of its specific action upon the uterus, though I am fully convinced of its power in expediting natural labour. We know that where an exciting body is present, as for instance in the stomach, whatever depresses the system, or exerts a sedative influence upon it, will favour the activity of the excited organ. Thus, when an individual is only slightly intoxicated, sudden fright or disappointment will turn him pale, and



SECTION. XI.—*Experimental Inquiry into the tendency of Ergot to induce premature labour in the Inferior Animals.*

*Expt. XXIX.*—A doe rabbit, immediately after impregnation, was compelled to swallow two drachms of ergot, which quantity was daily repeated for a fortnight, and then omitted. The animal went its usual time, and then produced five young ones, in a well matured, and apparently in a healthy state.

*Expt. XXX.*—I administered to a rabbit the day after its impregnation, three drachms of ergotted rye, and repeated it daily, until the period of gestation had expired, and the young ones were to all appearance unaffected by the drug.

*Expt. XXXI.*—This inquiry was prosecuted in a manner similar to the last, only the dose daily given was one ounce, administered at three separate times. The rabbit was obviously affected, but her appetite being good, and her flesh abundant, I inferred that the young ones could not suffer from want of nutriment. At the common period she brought forth six little ones, two of which were dead, and no doubt recently; four were alive, but they were very meagre, and died on the following day.

The mother was put to the male rabbit the day after delivery, and allowed to go through the next period of gestation without taking any ergot, but the produce, though more healthy than before, exhibited very decided marks of innutrition, and they all, with one exception, died within a month.

Lest any uterine action, not amounting to abortion, and therefore overlooked, should have followed the administration of the ergot, I performed the following experiment at the suggestion of my friend, Dr Hutchinson of Nottingham. This inquiry was pursued under the impression that it was possible for the uterus to be influenced by the ergot, and yet the action to be so trifling as not to be discoverable through the parietes of the abdomen.

*Expt. XXXII.*—To a rabbit, two days off delivery, half an ounce of ergot was given, suspended in water. After waiting for quarter of an hour without discovering any signs of uterine action, the animal was stupefied with carbonic acid gas, the abdomen then laid open, and the uterus fully exposed. No motion

faint, and he vomits. On the contrary, the best means of obviating drunkenness, is to relieve the local excitement, by giving it a general diversion; hence the sobering influence of ammonia. May not the sedative action of ergot upon the system favour the disposition of the uterus to expel its contents, and so facilitate delivery by a general, instead of a local impression? We know that, after a hard day's labour, in the evening, when depression prevails, women are often prematurely delivered. And bleeding, as also nauseants, and opium, when it does not stimulate, expedite labour. The subject, though a difficult one, is wonderfully supported by analogy; but as its investigation would lengthen this paper too much, I shall reserve it for a subsequent occasion.



whatever was discoverable, except what arose from an occasional struggle of the young ones, which to the amount of half a dozen, were then alive in the cavity of this organ.

This experiment I repeated twice, and with similar results.

*Expt. XXXIII.*—Fearing that the carbonic acid gas might have occasioned some impediment to the full influence of the ergot, I gave to another rabbit, upon the day which should have terminated its period of utero-gestation, four drachms of this substance. I waited for twenty minutes without observing any expulsive efforts, and then administered four drachms more. I waited for half an hour, when, observing no uterine action, I injected a tolerably strong solution of ergot into the right external jugular vein, to deprive the body of sensibility, and so to favour my design. When all signs of feeling had subsided, I opened the abdomen, (the animal being still alive) but the uterus showed no indications of augmented action, and I consequently inferred that no direct impression had been communicated to it.

*Expt. XXXIV.*—I gave to a sow, seven weeks pregnant, one ounce and a half of ergotted rye, but no symptoms of abortion followed, and, at the usual time, she brought forth a fine litter of young ones, all of which lived, and grew well.

*Expt. XXXV.*—A spaniel bitch, a few days before pupping, took half an ounce of ergot. There were no signs of abortion, and at the end of five days she had six young ones, two of which were dead.

*Expt. XXXVI.*—A similar quantity of ergot was given to a cat, which, from its size, was obviously not far from terminating its period of utero-gestation. She retained the dose for about twenty-five minutes, and then vomited severely. There was considerable agitation for about two hours, at the end of which time another dose of two drachms was given. This was retained on the stomach, but it failed to induce abortion. Upon examining the young ones produced a few days afterwards, I could discover no palpable signs of their having suffered from the experiment upon their mother.

*Expt. XXXVII.*—Half an ounce of ergot was administered to a terrier bitch, about five weeks gone with young. It produced no immediate effect, but the puppies, which were expelled at the usual time, were small and sickly, and two of them died on the second day.

*Expt. XXXVIII.*—A bull-terrier bitch took half an ounce of ergot daily through the last three weeks of her pregnancy. She went to the full time, and then gave birth to seven young ones, three of which were dead, and the others, weak, meagre, and scarcely able to stand, died in a few days afterwards.

I have also given ergot to animals in the early period of utero-



gestation, and though in some instances all the young ones have been brought forth dead, yet I have not been able to satisfy myself of their having died at a period far antecedent to that of delivery. In one instance only was the term of pregnancy shortened. In this case the bitch pupped about nine days before the usual time; the young ones were all dead, and appeared to have been so for some days. This animal took about five ounces of ergot in three weeks.

*Expt. XXXIX.*—To a bull-terrier bitch, whose period of gestation was nearly completed, three-quarters of an ounce of ergot were given. She retained the dose for half an hour, and then ejected it by violent and continued vomiting. On the following day, no signs of abortion having appeared, she was bled to eight ounces, to reduce the energies of the system, and so if possible to favour the operation of the drug, which was subsequently given in the dose of half an ounce. This was retained for several hours, producing great prostration of strength, failing of the hind-legs, and an excessive discharge of frothy saliva, which continued for two hours and a half. No signs of abortion succeeding, a similar quantity was again administered on the evening of the same day, and with similar results. In three days afterwards, she brought forth five puppies, all of which were dead.

*Expt. XL.*—A bull-terrier bitch was watched until the period of delivery had arrived, and, when two young ones had been expelled, half an ounce of ergot was given to her, which appeared to produce almost immediate effects. She cried loudly, and bent her head back in agony, at which time another puppy was forcibly expelled. In a few minutes, violent convulsion of the abdominal muscles came on, with symptoms resembling hiccup. There was much frothy discharge from the mouth, and the pupil was strongly contracted. For three hours she continued to be distressed in her breathing, and was only able to raise herself upon her fore-legs, the hind ones being in a state of paralysis.

Towards evening the symptoms had slightly abated; she drank plentifully of milk, but refused solid food. On the following day there was less hiccup, and her breathing was easier. About mid-day she parted with another puppy, which was dead. Thirst was very urgent, but she would not eat solid food of any kind. Throughout this day she continued in the same condition, and in the evening the pulsations of the heart, previously indiscernible from the concussion of the chest, were now found to be slow and feeble. She was unable to stand, the surface gradually became colder, the eye acquired a fixed and glassy stare, and at three o'clock on the following morning she died, having survived the first dose forty-one hours.

*Inspection.*—The uterus contained two dead puppies; no marks



of inflammation were discoverable in it or in any of the abdominal or thoracic viscera. The membranes of the brain were deeply injected, and the vessels upon the surface of the brain were congested.

*Expt. XLI.*—I kept a bull-terrier bitch that was with young until the time of pregnancy had expired, and on visiting early one morning I found her pupping. Two young ones were born, when I gave to her three drachms of ergot, which produced no apparent effect. In half an hour I gave to her four other drachms, the influence of which was equally imperceptible. At the expiration of two hours from the last dose another puppy was born, which appeared in no degree to be affected by the ergot the mother had taken. The bitch looked drowsy, and frothed considerably at the mouth. In the evening, thirteen hours from the last dose, two more puppies were expelled, both of which were dead.

This experiment I have several times repeated, and with similar results. *Expt. XL.* is the only instance in which I have noticed any thing like an influence upon the uterus by the ergot, and that case has a very doubtful appearance.

In addition to these, I may add that I fed a bitch, suckling three puppies, with ergot to the extent of an ounce daily for a fortnight, but I was not able to discover any particular impression upon the young ones. They lost a little flesh, and appeared to be weak and feeble, but I suspect it was merely the consequence of the debility of the mother, and not referable to the influence of the ergot upon them. When it was suspended the mother began to improve; they did likewise, and, in a few weeks, appeared to be no worse for the experiment.

I have also given ergot in the form of enema, in doses varying from half an ounce, to one and a-half ounce, but have never succeeded in producing even the appearance of abortion. In one instance only, out of many trials, were the puppies thus sacrificed, and in that case six ounces had been given in four injections. But I have always observed the ergot to produce a much more powerful effect, especially upon the brain, when given either by the mouth or by the rectum, to animals with young, than when administered to such as were unimpregnated.

*Expt. XLII.*—To a spaniel bitch, one or two days before pupping, three drachms of ergot were given, which produced no sensible effect. In half an hour afterwards, I administered half an ounce, and it proved equally inefficient. In fifteen minutes after the last dose, the animal was stupefied with carbonic acid gas, and the abdomen then opened, and the uterus exposed. It was found to be perfectly still, except when moved by the young ones, which were yet alive in its cavity.

*Expt. XLIII.*—A solution, furnished by three drachms of ergot in two ounces of water, was injected into the right jugular



vein of a terrier bitch, whose period of gestation, from her enlarged teats and copious secretion of milk, I inferred was near its completion. This injection produced a train of symptoms resembling these previously described; the paralysis continued for above two hours, no abortion followed, and the animal died without any appreciable influence having been communicated to the uterus. She was opened immediately after death, but all the young ones were dead.

I repeated this form of experiment upon another bitch, and after having allowed her to remain one hour and forty minutes (sensitivity being gone) her abdomen was opened, there was no uterine action, and all the puppies were dead.

This train of investigation I have been particular in describing, because I am aware that the conclusions are at variance with many that have already been submitted to the scientific world. Dupuy is said to have facilitated calving by injecting a solution of ergot into the veins of a cow. Percy and Laurent state that a similar decoction mixed with half as much brandy, and injected into the veins of a cow, expedited the process of parturition.\*

My own experiments, it will be seen, do not correspond with these, nor am I able to account for the difference. I have candidly stated the facts, and without any comment I leave them.

## SECTION XII.—*General therapeutic employment of Ergot.*

*Expulsion of foreign bodies from the Uterus.*—For this purpose ergot has often been employed with advantage. It has been given in hydatids of the uterus, and has succeeded in expelling them in a few minutes.†

Clots of blood, which often remain in the womb after delivery, are in general readily expelled on the administration of ergot. Waller gives a good illustration of its powers, in the recital of a case which fell under the notice of Mackenzie. Several large coagula remaining in the uterus of a female who had been recently delivered of twins, were evacuated in half an hour after the ergot had been given.

*Uterine Hemorrhages.*—I believe the American physicians first discovered the value of ergot in these dangerous and often intractable states. Chapman, Stearns, Dewees, Hosack, and Church, speak of it in the highest terms, and some even regard it as a prophylactic. Their views have been ably supported by Bigeschi in Italy, by Goupil, Bordot, and Prefet in France, and by a vast number of able and accomplished practitioners in our own country.

A very good instance of the cure of hemorrhage in the fourth

\* Neale on Ergot.

† Lond. Med. and Phys. Journ. Vol. iv. p. 545.



month of pregnancy has been related by Mr Board of Bristol.\* And Mr Ker of Manchester† has recorded a very interesting case of the value of ergot in *prolapsus uteri*.

In hematemesis it has also been found serviceable. Mr Ings of Henly, Warwickshire, relates the particulars of a case which he succeeded in curing with it.‡

In hemoptysis, hematuria, and epistaxis, it has been employed by Drs Spairani and Pignacea, with notable advantage.§

Dr Ryan speaks highly of its use in gonorrhœa, and imagines that it excites a powerful influence upon mucous membranes.|| It has also been extolled in gleet; but here I think its efficacy somewhat doubtful, or it requires confirmation.

*Puerperal Convulsions*.—Dr Stearns particularly advises the employment of ergot in protracted labours, which either are or are likely to be attended with convulsions.¶ Dr Waterhouse appears to have used it with success in the convulsions consequent upon delivery. Dr Holcombe is further of opinion that it will prevent puerperal fever.\*\*

*Diarrhœa*.—In both the acute and the chronic form of this disease it has been given with advantage. I have seen it in doses of five grains three times a day effect a very desirable change in one instance, where symptoms of a dysenteric nature were coming on. And Dr Stout of Bethlehem, Pennsylvania, speaks in high terms of its use.††

*Amenorrhœa*.—In this affection ergot has been employed with advantage by Dr Beckman, although it is said, and particularly by Lentin and Taube, that amenorrhœa is generally attendant upon ergotism.‡‡ Dr Davies is of opinion that it is serviceable in these cases, though Prescott positively affirms that it is not. To the testimony, however, of Drs Beckman and Davies, I may add that of several respectable physicians of my own acquaintance who have repeatedly seen the deranged menstrual function duly restored by a persevering use of ergot.§§

\* Lancet, 1827-8, Vol. ii. p. 337.

† Lond. Med. Gazette, 1834, June 26, p. 604.

‡ Ibid. 1834. February 1st, p. 672.

§ Medico-Chirurg. Review, N. S. Vol. xv. p. 171.

|| Lond. Med. and Surg. Journ. 1833, Vol. iv. p. 590.

¶ American Medical Recorder, No. 20.

\*\* Anderson's Journal of the Medical Sciences for 1826, No. 3. p. 448.

†† Lond. Med. Repos. 1823, Vol. xx. p. 151.

‡‡ Neale, p. 7.

§§ And if this property of ergot be, as we have every reason to anticipate, general, it will perhaps tend to explain the marvellous influence at one time imputed to beans. The occasional effects induced by them may have arisen from ergotted portions; the apparent extravagance characteristic of the detail will be excused from the mystical age through which this tradition was compelled to circulate, ere it was formally represented upon the pages of history.

Beans were at one time considered aphrodisiac, for which reason Tiraquellus imagined that they were interdicted to the Flamen Dialis, or high priest of Jupiter



Solutions of ergot have also been applied externally for remedial purposes.

“A falling of the upper eyelids followed an attack of erysipelas. The eyelids were recommended by M. Carron to be continually wetted with a warm infusion of ergot of rye in boiling port wine, (*quatre gros de seigle ergoté dans du vin rouge bouillant.*) The cure was completed in two days.”

“Paralysis of the eyelids from partial asphyxia following the respiration of charcoal fumes, was cured in eight days by fomentation with an aqueous infusion of ergot.” *Medico-Chir. Review*, No. 60, April 1, 1839, p. 613.

The active principle of ergotted rye will be treated of in a subsequent paper.

at Rome. And some commentators regard a relative passage of Plutarch's Roman Questions, as comprehending peas and vetches. (*Tiraquellus, Glossæ Primæ, p. 15, § 123, Lugduni, 1628, in fol. ; Plutarch, Questiones Romanæ, T. vii. p. 183, 8vo.*) Carena describes the punishment of an old woman who was whipped through the city of Cremona for having endeavoured to influence the affections of a young man, by giving him beans over which mass had been celebrated.—Carena, *Annotationes*, § 14, p. 499, ap. Pegna, *Praxis Inquisitorum*.







# OBSERVATIONS

ON THE

## OIL CONTAINED IN ERGOT OF RYE.

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(Continued from the *Edin. Med. and Surg. Journal*, Vol. liii.)

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### SECTION XIII.—*Preparation of the Oil of Ergot—its Physical and Chemical Properties, &c.*

IF ergot of rye, in a state of fine powder, be heated in a retort, there distils over, a thick oily matter, having an offensive smell, a bitter acrid taste, and a colour varying from a light brown to a perfect black. This is the oil of ergot in an empyreumatic form, and the characters above expressed, are strong in proportion to the heat employed. It was thus separated by Vauquelin, and was consequently described by him as thick and rancid, having the appearance of fish-oil; properties, which, as will shortly be seen, belong not to it in its natural condition, and are only produced by its partial decomposition.

Another way in which this oil may be obtained, is by squeezing the ergot (previously reduced to powder, and placed in a canvass or a muslin bag) between two plates of iron, heated to the temperature of boiling water. As thus separated, the oil is more fluid, lighter in colour, and less offensive to the smell, than when prepared in the manner first described.



A third process, and a convenient one for ordinary purposes, is to digest the ergot in *liq. potassæ* at a temperature of 120°—150°, until a perfect saponaceous solution be formed. The liquid is then to be diluted with half its weight of water, exactly neutralized with sulphuric acid, and submitted to distillation from a saline or an oil bath. The product is white, adhesive, and fatty-looking, almost free from empyreuma, and nearly tasteless.

It may also be separated by digesting ergot in alcohol for some days, filtering the fluid, and then allowing it to evaporate spontaneously. The oil thus obtained, however, is not pure, owing to the alcohol being an active solvent of the osmazome and colouring matter.

The readiest and best, though unfortunately, the most expensive way of obtaining this oil, is by percolating ergot in a state of fine powder, with sulphuric ether. By allowing the ether to evaporate spontaneously, the oil of ergot is left in its purest form.

As thus prepared, it usually consists of two portions—the one, colourless and translucent, the other, having a reddish-brown hue. The latter character is an acquired one, and simply dependent upon the age of the ergot. In old specimens, the oil is coloured throughout, and often deeply; in recent ones, on the contrary, it is not unfrequently entirely free from colour.

Its taste is oily, and slightly acrid, its odour is similar to that of ergot, though more agreeable, and neither heightened by acetic acid, nor destroyed by long contact with a clear plate of copper or of iron. When heated, it blackens rapidly, acquires a disgusting empyreumatic odour, like that of an old tobacco pipe, and an acrid biting taste. If the heat be long continued, complete volatilization takes place; but if the oil be suffered to cool, it thickens, solidifies slowly, and ultimately becomes resinous.

By long exposure to light and air, at a moderate temperature, it assumes a reddish-brown colour, though it is little altered in either smell or flavour. The purple hue of ergot appears to be owing to the action of light and air upon the oil, aided by the free phosphoric acid. By mixing the colourless oil with flour and a little acid, and exposing the mass to air and sunshine for some weeks, I have succeeded in producing the distinct colour of ordinary ergot. It will be remembered that the latter, when growing, is never darkened so long as it is completely shielded by the glume.

Oil of ergot is of less specific gravity than water, and when these are agitated together, the latter becomes slightly odorous, and the former is rendered somewhat opaque. It is soluble in all the ethers, alcohol, naphtha, and bisulphuret of carbon, from which it is imperfectly separated on the addition of water. It is dissolved by all the essential oils, and mixes intimately with some of the



fixed ones, particularly almond and olive oil. It is likewise soluble in creosote, caustic alkalies, earths, and ammonia. With the latter substances, it forms a soapy solution, from which it may be separated by an acid. Sulphuric, nitric, and hydrochloric acids in the dilute form, have little action upon it, but, when concentrated, they convert it into a deep-brown or black mass. When long exposed to light and air, at a moderate temperature, the oil thickens, deepens in hue, and diminishes in strength; yet, if kept in a stoppered bottle, it is patient of preservation, and will retain its activity for years. On this account, as also from the fact of its embodying all the active properties of ergot in a safe and manageable form, I am persuaded it will be found a much more advantageous officinal preparation than the crude drug.

As will be seen in the experiments next recorded, whatever of activity is possessed by ergot, is centred in its oil; whether this oil be the active principle, or the mere vehicle for containing it, has yet to be proved. From some experiments which I have lately performed, I am inclined to the latter opinion; but my observations being yet incomplete, I shall defer their publication for the present.

#### SECTION XIV.—*Experiments illustrative of the Physiological Action of the Oil of Ergot.*

*Expt. I.*—Three drachms of the oil of ergot, obtained by the spontaneous evaporation of its ethereal solution, were diffused through half an ounce of water, at temperature 98°, and then injected into the right external jugular of a terrier dog, weighing thirteen pounds. The fluid had scarcely passed, when the heart's action became excessively violent, urine and feces were discharged in abundance, and the abdominal muscles underwent strong convulsion, in which the whole frame shortly participated. When one minute and a quarter had elapsed, the action of the heart became less urgent, and the respiration was very slow and profound. The pupil then contracted; the eye became fixed; hiccup prevailed; the convulsive motion subsided into a quiver of the whole frame; the animal cried loudly, then sunk into calmness, and in three minutes and a-half ceased to live.

*Autopsy.*—All the voluntary muscles were highly sensible of galvanic influence, as also the diaphragm and intestines, the vermicular motion of which, though beautifully performing when exposed, was much increased by the stimulus of the pile. The heart was firm and rigid in its texture, but no renewal of its contractions took place when it was scratched with the scalpel, or subjected to the influence of galvanism. The right auricle contained a little fluid blood; that, in the left cavities, was coagulated. All the thoracic and abdominal viscera had a natural aspect. The



membranes of the brain were slightly injected, but its substance, as also that of the spinal cord, displayed nothing remarkable.

This experiment was witnessed by Dr Tancred, in whose presence I performed a similar one on the following day, which resembled the former so closely, as not to require a separate detail.

*Expt. II.*—One drachm of the oil of ergot was diffused through two ounces of water, and then slowly injected into the left external jugular of a mongrel dog. There was a momentary quickening of the heart's action, which was attended by a very feeble quiver of the whole frame; the animal fetched a deep sigh, and at the same instant, his pupil slightly dilated. When a minute and a half had passed, the heart was observed to be feeble, slow, and intermittent in its action, with deep and interrupted respiration.

This state continued until the lapse of twenty-one minutes, when general paralysis prevailed; the animal was totally unable to move, and was insensible to punctures, in whatever part they were made.

Gradually, heart's action diminished in force and frequency, the surface of the body was universally cold, though the limbs were perfectly supple and pliant, respiration subsided into an occasional gasp, occurring about every three minutes, until, at length, two hours and forty minutes from the commencement, life became extinct.

*Autopsy.*—No part of the body was sensible to the stimulus of galvanism. Even the diaphragm was unaffected by it. The heart was filled with blood, in which there was no distinction in colour between arterial and venous. The lungs were dark and frothy. The brain was slightly congested on its surface, and at its base was a little bloody serum; but the spinal cord was natural throughout. The blood did not coagulate, and the body rapidly decomposed.

*Expt. III.*—Two drachms of the oil of ergot, diffused through half an ounce of water, were injected into the right common carotid of a terrier bitch, weighing eleven pounds. Immediately upon its introduction, she cried, and struggled violently, the pupils contracted instantly, and in a few seconds the mouth was filled with foam. When three-quarters of a minute had elapsed, she became calm; the muscles were flaccid and powerless; the eye was fixed; the heart's action was imperceptible; and an occasional gasp was the only indication of life's continuance. At the expiration of two minutes and a half, the pupils dilated, the heart throbbed violently, and the whole frame quivered, though respiration still remained indistinct. At the end of three minutes and a-quarter, the tail began tremulously to move in various directions; it was at length drawn rigidly towards the back, in which position it was



retained for a few seconds, when it again relapsed, and never stirred more. When four minutes had elapsed, the pulsations of the heart were barely perceptible, and respiration was totally indistinct. At the termination of another minute, there was a slight twitching of the abdominal muscles, in which the whole frame shortly participated; suddenly, it was checked by a deep sigh, which terminated the animal's existence.

*Autopsy.*—The mouth was very livid and frothy. The conjunctiva was deeply injected. The pectoral muscles contracted powerfully when cut, as also the abdominal ones. The heart was insensible of stimulus; it contained venous-looking blood in all its cavities; the right ones, with the two cavæ, were much distended; the left contained but a small quantity of blood. The lungs were congested, and very dark-coloured. The stomach was distended with flatus, but its lining membrane was natural, which appearance distinguished the whole intestinal canal. The bladder was extremely contracted, and so hard, as scarcely to be indented on pressure. The *dura mater* was marked by deeply injected vessels, and occasional extravasations of blood were met with throughout the substance of the brain. The lateral ventricles were nearly filled with bloody serum. The spinal chord was natural throughout.

This experiment was witnessed by Mr Walker, surgeon.

*Expt. IV.*—One drachm and a half of the oil of ergot, diffused through half an ounce of water, were rapidly injected into the common carotid of a spaniel dog, weighing twenty-six pounds. In a few seconds, the pulsations of the heart became excessively violent, respiration being hurried and laborious. Shortly, the heart's action was rendered intermittent, and at last was scarcely perceptible. Urine and fæces passed involuntarily, and the pupil dilated widely. When two minutes had elapsed, he yelled loudly, and violent spasms of the hind-legs came on, which also prevailed, though in a milder degree, in the fore ones. In six minutes, slight reaction appeared, the pupils became sensible to the influence of light, the motions of the heart were audible, though an occasional convulsive gasp was the only respiratory movement. The diaphragm and abdominal muscles were now convulsed, and the jaw was spasmodically drawn down; yet the animal was incapable of voluntary movement, and totally insensible of punctures, wherever they were made. In this state he continued for a few more minutes, and then, with a convulsive struggle, he died, having survived the injection fifteen minutes and a half.

*Autopsy.*—The muscles of voluntary motion were acutely alive to the stimulus of galvanism, the heart slightly so, but the diaphragm not at all. I have often known the diaphragm to be ex-



citable when other parts were not ; but this is the only instance in which, without any convulsion of it during life, I ever observed the converse. The heart contained venous-looking blood in a state of coagulation, in all its cavities. The lungs were congested, and the bronchial ramifications and trachea were almost filled with frothy mucus. The membranes of the brain were rather deeply injected, but neither effusion nor extravasation was discoverable.

To determine whether the mechanical influence of the oil at all affected the results, I injected three drachms of olive oil into the jugular vein of one dog, and a similar quantity into the carotid artery of another. There were no appearances at all correspondent with those which marked the previous experiments. In each case, life was prolonged for above eighteen hours ; the symptoms resembled those of asthma, and death at last appeared to result from asphyxia, caused by impeded circulation in the lungs. The autopsies fully justified this conjecture.

From these experiments it will be evident, that the action of oil of ergot, when injected into the arteries and veins, is precisely that which characterizes an infusion of the crude drug. There is exactly the same influence exerted upon the brain and spinal chord ; subject to all the modifications which attend dilute and concentrated doses. An infusion of ergot when injected into the arteries or veins, has sometimes the singular effect of morbidly increasing instead of diminishing sensibility. This curious property is occasionally manifested by the oil, as shown in the following example.

*Expt. V.*—In the presence of Mr John Wright, surgeon, I injected two drachms of the oil of ergot, diffused through an ounce of water into the jugular vein of a mongrel dog, weighing fourteen pounds. During the transmission of the fluid, he cried loudly, and struggled with much violence, but shortly afterwards became still. In two minutes, the heart's action was greatly increased, respiration being correspondently hurried. In five minutes the pupil was contracted, conjunctiva reddened, mucus discharged in abundance from the nose, and much foam was collected in the mouth. In eight minutes, the pupil was widely dilated, strong muscular contractions became evident in the hind legs, and the tail twitched convulsively towards the back. He was totally unable to rise, but occasionally made an attempt to do so. When half an hour had elapsed, very increased sensibility of the hind legs came on, in which the tail subsequently participated. The slightest touch upon either of these parts caused a violent convulsive start, and an accompanying yell. Independently of being touched, or even approached, the hind legs would suddenly start, the tail being simultaneously twitched towards the back. This symptom occurred about every three minutes for an hour and a-



half, when it subsided considerably. At the end of two hours, the dog was able to raise himself upon his fore-legs, but he had no command over the hind ones, which, when touched, retracted spasmodically as before, and with the production of equal suffering. When six hours had elapsed, he was considerably improved, yet could not walk many steps. On the following day, he was still better, though he was remarkably weak, nor did he thoroughly regain his strength until after the lapse of a fortnight.

I have produced once again, similar effects by injecting the oil of ergot into the veins, and it is very remarkable, that in all such cases, whether arising from an employment of the oil, or the infusion of ergot, the animals have recovered, although in some instances the preparation has been very strong.

As the following cases illustrate, the physiological action of the oil of ergot, when taken into the stomach in either solitary or successive doses, is precisely that of the crude drug, with the exception of the former possessing greater activity, in consequence of its extreme concentration.

*Expt. VI.*—Thirty drops of recently extracted oil of ergot were poured down the throat of a young blackbird, three weeks old. In four minutes, it lost entirely the use of its legs, fell on one side, and gasped as if suffocating. In about twenty minutes, it revived a little, but was still unable to walk. In this state it continued during the further space of three hours and a-quarter, when it died, without exhibiting any remarkable symptoms immediately antecedent to death, or any morbid appearances afterwards.

*Expt. VII.*—A drachm of the oil of ergot was given to a kitten three weeks old. It was retained for sixteen minutes, and was then vomited pretty severely. Nevertheless, when half an hour had elapsed, the heart was observed to have become very feeble and intermittent in its beats, the hind legs were in a state of imperfect paralysis, and the sensibility of the whole frame was much diminished. Unfortunately, during my temporary absence, the mother found it and carried it off, so that I was unable to satisfy myself of the results.

*Expt. VIII.*—Four drachms of the oil were passed into the stomach of a bull-terrier puppy, five weeks old. In a few minutes after having received it, he began to whine plaintively, and at the end of a-quarter of an hour, attempted to vomit, but discharged nothing. When half an hour had elapsed, his limbs were almost powerless, and the heart's action was fluttering and indistinct. The abdominal muscles were drawn in, and he appeared to suffer pain. Subsequently, he improved a little, and was able to walk, though his motions were staggering and awkward. On the following morning I found him dead. The autopsy revealed no-



thing of moment, save vascularity in the lining membrane of the stomach and duodenum.

*Expt. IX.*—Three drachms of oil of ergot were given in the form of injection to a crow. The fluid was retained for four minutes and a-half, when it was forcibly ejected, and vomiting occurred at the same moment. He soon lost the power of voluntary motion and fell on his side,—his eyes closed, and he gasped laboriously. Slight muscular agitation then came on, chiefly confined to the legs. In seven minutes, the feathers became ruffled all over the body, and no indications of life were discoverable. In twelve minutes, he began slightly to revive, opened his eyes, and attempted to stand, but fell in each effort. At the end of half an hour, he was able to support himself upon his legs, but he preferred a crouching posture. During the next two hours he lay with his beak wide open; his eyes, which were half shut, were unaffected when either touched or scratched. He died at the expiration of seven hours. I could discover no morbid appearance except redness of the cloaca.

*Expt. X.*—Three sparrows, confined in a large cage, were compelled to swallow, each, ten drops of the oil of ergot daily, in three separate doses.

When given in this divided form, they did not appear to suffer immediately from its effects; but if the daily dose was administered at once, it occasioned symptoms of intoxication; the birds reeled about in a state of blindness and stupidity; subsequently, incomplete paralysis would prevail, and the power of voluntary movement would not return until the lapse of an hour or more.

One of the birds refused his food on the fifth day; his feathers were ruffled; he crouched in a corner; shunned his companions; and slept almost constantly. On the seventh day, he died.

Another was similarly affected about the ninth day; it afterwards became quite blind and stupid, and died on the twelfth day.

The third maintained its appetite surprisingly; nevertheless, it lost much flesh, and was so weak that it could not stand for many seconds together. Signs of convulsion were sometimes prevalent; the feathers on the breast and tail came off, and one of the eye-lids sloughed away. At last total blindness resulted, and death took place on the fifteenth day. In not one instance was I able to discover any morbid appearances; but the bodies rapidly decomposed.

In trying similar experiments with rabbits, I have found them much less susceptible of impression from the oil of ergot, than dogs and cats. But this appears to be greatly dependent upon the kind of food they eat. I have given six drachms of the oil with impunity, to a rabbit that had been previously fed for



some time with lettuce ; whilst a similar dose has killed another of the same age and weight, which had been kept upon bran and cabbage.

During my investigations of the chemical properties of this oil, I was sometimes confined for several hours in a close room, where it was elevated in the form of vapour ; and not unusually on such occasions, I felt a curious tingling sensation over my limbs, distressing lassitude, irritability, and giddiness. This train of symptoms led me to the consideration of their probable cause ; which I suspected to be the respiration of oil of ergot in a vaporized form. To satisfy myself of it, I performed the two following experiments.

*Expt. XI.*—A bull-terrier puppy, 14 days old, was put under a bell-glass receiver, capable of holding about a gallon of water, and subsequently, there was introduced the vapour furnished by half an ounce of the ergot-oil. The dog breathed very heavily for a minute and a quarter, when it drew up its legs and appeared to be dying. It was then removed, but it was quite unable to crawl. In about half an hour general convulsions supervened, which occasionally alternated with local spasms, the hind legs being chiefly affected. The fore-legs were sometimes stretched backwards, and the jaw was simultaneously drawn down. When an hour had elapsed, emprosthotonos came on in fits ; the rigidity produced was nearly equal to that which occurs from strychnine. The sensibility of the body was much diminished, as also its temperature, and the heart's action was very slow and feeble. When six hours had elapsed, he began to revive, and his sensibility was such, that he cried furiously when only stroked with the hand. At the end of ten hours he had completely recovered the use of his legs, but he never appeared lively again, and died in eight days. The autopsy revealed nothing meriting notice.

*Expt. XII.*—The form of experiment adopted in the previous instance was repeated in this one, upon a spaniel puppy, three weeks old. It had respired the vapour for scarcely half a minute, when its inspirations became very deep and labouring ; the mouth frothed abundantly, and the abdominal muscles were powerfully contracted. When a minute and a quarter had elapsed, the animal was removed, but scarcely any signs of life remained ; every limb was flaccid and powerless ; reaction never came on, but coma gradually supervened, and death took place at the expiration of two hours and twenty-five minutes.

These experiments were witnessed by Mr Bowker, surgeon.

#### SECTION XV.—*Therapeutic employment of the Oil of Ergot.*

We have learnt from the experiments already detailed, that the



oil of ergot possesses exactly the same physiological action as the crude drug. We have next to inquire whether there be the same resemblances in therapeutic action? From a considerable number of trials made by myself, and by several medical friends, I am fully prepared to answer in the affirmative.

I have employed it in nine different instances, where the exhibition of ergot was peculiarly indicated, and in all of them it answered most satisfactorily. In four of these cases, in which the contractions of the uterus were sluggish and imperfect, yet the *os uteri* sufficiently dilated, it produced very increased action in six minutes, and delivery speedily followed. In three similar cases, the same effect was produced within ten minutes succeeding the exhibition of the drug, and the termination was equally favourable. In another instance, where the pains had ceased without any evident cause, and the progress of labour was interrupted, it restored the contractions of the uterus in thirteen minutes, and within half an hour, an easy and a safe delivery was effected. In the ninth example, the pains were for the most part suspended, from sudden terror with which the patient was seized; the pulse had risen from 75 to 130 beats per minute, and an alarming irritability of the whole system was prevalent. The administration of the oil in this case reduced the pulse to 90 in less than ten minutes; the irritability in a great measure subsided, and during a state of calmness, the uterine contractions were vigorously and steadily renewed, and within an hour from the time at which the dose was given, parturition was fully completed.

Dr J. Y. Simpson, Professor of Midwifery in the University of Edinburgh, very kindly tried the oil of ergot, and his opinion of its efficacy is thus expressed, in a communication with which I was recently favoured by him. "I have repeatedly employed your preparation of the ergot, and have always preferred it of late, because it has appeared to me to act with more precision than the infusion of the powder, and its dose is more easily regulated. I have used it both in cases of lingering parturition, dependent on deficient uterine contraction, and also in instances of *post partum* hæmorrhage. In one case of the latter, where the uterus relaxed, again and again, after the repeated introduction of the hand into its cavity, I gave your preparation in a large dose, (60 drops and repeated,) and very shortly afterwards the uterus began to contract firmly, and the woman, who was much reduced by the flooding, complained of the severity of her after-pains."

M. Meisser of Paris, to whom I sent a quantity of the oil, observes respecting it;—"I am much pleased with your preparation of ergot. I think it superior both to the infusion and the tincture. It has all the advantages, without the inconveniences of the former. It is easily regulated, does not offend the stomach,



and operates with quickness and certainty. Since receiving your kind communication on the subject, I have employed it constantly, and it has ever equalled my desires. I have also recommended its use to many obstetricians, and they have found it most serviceable."

Two other friends, Dr Gordon and Mr Wilkinson, surgeon, inform me, that, after repeated trials, they are "satisfied the oil is much superior to any other preparation of ergot." In their use of it, "it has never produced sickness, nor offended the stomach in any way; its effects have been rapidly and certainly developed; nor has any injury or inconvenience followed its repeated employment."

I have seen oil of ergot administered in two cases of retained placenta; in each it produced energetic contractions of the uterus, and was speedy in promoting the expulsion of its contents. I have also witnessed its good effects in an instance of violent flooding which succeeded delivery. Here it had the happy effect of calming the irritability of the system, rendering the pulse softer and steadier, and inducing a full and complete uterine contraction, upon the absence of which the previous loss of blood had chiefly depended.

Besides the cases already mentioned, I may state that I have twice administered oil of ergot in troublesome diarrhoea, and with very marked advantage. The dose was 10 drops every three hours, and both the patients were cured on the following day. It must be understood, however, that this remedy acts simply by subduing any inordinate irritability of the intestines, for it is not physiologically an astringent.

I have also repeatedly given it in cases of irritability and cramp of the stomach, and have never known it fail to relieve or remove the symptoms.

The dose of the oil is from 20 to 50 drops. It may be given in any convenient fluid vehicle, such as cold water, warm tea, or weak spirit and water. The two latter I have found to be the most serviceable; for the result of some comparative trials which I have made has been, that the action of the oil is best secured by administering it in a dissolved or tolerably diffused form.

As an officinal article, the oil of ergot possesses many advantages which are wanting to the crude drug. It is of easy preparation, and may be kept for any length of time. I have a specimen which has been prepared for four years, and on trying it the other day, I found its activity to be in no degree diminished. The rules to be observed in its preservation, are simply to keep it in a well-stoppered bottle, and in a cool, dark place. An elevated temperature will volatilize it if there be any opening for its escape, and if not, there is produced deep discoloration. The prolonged



action of sun-light has a similar effect. In either case the strength of the oil is diminished.

It is more easily and readily given than an infusion of the grain ; it has a much less disagreeable taste, and operates with greater rapidity. It has also the very desirable advantage of rarely producing sickness. The nauseating effects of the common infusion are frequently complained of ; and, not seldom, have they been a means of its popular condemnation. But the oil is in a great measure free from this objection. I have never known it to produce sickness or vomiting, and similar has been the experience of my medical friends.

#### SECTION XVI.—*External application of the Oil of Ergot.*

When this oil is kept in contact with the sound skin for some hours, it causes a little redness, but neither pain nor inconvenience of any kind.

I applied it to the skin of a bird daily, for the space of a fortnight, the feathers came off, and the surface was excoriated. In repeating the experiment upon a dog, no effect was produced. When applied to a recently wounded part, it occasions a little smarting, and quickly arrests the flow of blood. If an ulcer be dressed with the oil of ergot, the discharge is increased, and rendered very foetid. Dropped into the eye, it produces violent and continued pain, an abundant discharge of tears, and much subsequent inflammation.

I have found this oil a valuable external application in cases of local rheumatism. I have tried it in three instances, and in all of them it has proved curative. The affected part should be well rubbed with it for a quarter of an hour, night and morning, until relief be obtained. It is one of the best remedies with which I am acquainted for the cure of toothache. I have repeatedly known it subdue the pain when creosote has failed. But, perhaps its greatest value, as an external application, is in the arresting of hemorrhage. I have often wounded small arteries in dogs and rabbits, and subdued the bleeding completely with a drop of this oil. Hemorrhage from the jugular and femoral veins has been similarly arrested. The troublesome bleeding which sometimes follows the extraction of a tooth, and leech-bites, it is equally efficient in stopping.

In a severe case of epistaxis, I arrested the hemorrhage, by injecting up the nostrils equal parts of very dilute spirit and oil of ergot ; and I have little doubt that in the severe cases of flooding which succeed delivery, the injection of this oil diffused through water into the uterus, would be productive of the happiest results.