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PART I.

ORIGINAL COMMUNICATIONS.

I.

Observations on the Nature and Preparation of the Elaterium.
Read at the Medical Society of London, April 24, 1819.
By DR. CLUTTERBUCK, President.

THE subject of the following observations is, with the exception of arsenic, perhaps, and the *Hydro-cyanic* or *Prussic* acid, lately introduced into practice, the most active in the catalogue of the materia medica. It is also, according to my experience, one of the most useful, and applicable to many more purposes than is generally understood. I know of no medicine, indeed, from which I have derived greater benefit on various occasions, nor one in which greater confidence may be placed. Whatever can be accomplished in the cure of diseases by active purging, may be effected, certainly, by this medicine. It is not, however, my object to point out its particular uses in the treatment of diseases; these will probably make the subject of a future communication to the society; my present intention is to make some observations regarding its preparation and doses, — points, as it appears to me, that are by no means generally or sufficiently understood. The high price of the article in the shops, leads to great and frequent adulterations, by which the Practitioner is often disappointed in the effect expected from it; while, from the same cause, there is great uncertainty in regulating the dose; a circumstance not without danger, for when over-dosed, it is capable of producing the most violent, if not fatal, effects;

especially when employed in the debilitated habits of dropsical subjects, as is frequently the case.

The only sufficient preventive of adulteration, is a reduction of price, as far as is consistent with the goodness of the article; and it appeared to me an object of some importance to inquire, whether, by any change in the mode of preparation, such a reduction could be effected? This, it is clear, could only be expected from a previous determination of the *seat* of the active principle in the plant, as preparatory to the best mode of *extracting* it. With this view, I submitted to separate examination the various parts of the plant, — the root, leaves, and stalks, as well as the flowers and fruit; and I think have obtained in a great measure the object which I was in search of. Before observing upon what had been already done on the subject, I shall briefly relate the result of my own trials.

Several of the entire plants, with the fruit or cucumbers in a state of maturity, being procured, I submitted each part in turn to trial, in order to ascertain its effects.

1. *The Root.*

The *root* being carefully dried and reduced to powder, five grains of this were exhibited to thirteen adult individuals, of different ages, and labouring under different diseases. This quantity produced no sensible effect. The dose was afterwards increased to ten grains, but equally without effect. I then gave twenty grains in nine cases; in four of which it produced no effect—one, a boy, of fourteen, it purged four or five times. The others were purged in a somewhat less degree.

As my object was not so much to inquire into the relative powers of the different parts of the plant, as whether they could be substituted in small quantities for the elaterium itself, the subject was not pursued further in this direction.

2. *The Leaves.*

The leaves were carefully dried and reduced to powder. After exhibiting several smaller doses without effect, I gave ten grains to as many different individuals; and the result was as follows: —

In *five* of the cases, no effect was produced.

In *two*, the medicine occasioned five or six stools.

In *two* others, only one.

And in *one* instance it produced no effect till the following day, when the patient was purged violently several times.

3. *The Stalks.*

When these were exhibited free from the leaves, and in similar doses, no decided effect followed.

4. *The expressed Juice of the Leaves reduced to the consistence of an Extract.*

This was exhibited in different doses from four to twelve grains, but it had no effect. An extract was made from a decoction of the leaves, but this also, as might be expected, was inert.

5. *The Petals, or Blossoms.*

These appeared to be altogether inert.

It was pretty evident from these trials, that no adequate substitute for the elaterium could be found in the plant, exclusive of the fruit; and therefore I proceeded to examine the different parts of this.

It is hardly necessary to observe, that the fruit of the wild cucumber resembles, in its appearance and structure, the common garden cucumber, differing from it merely in point of size. When full-grown, it is from an inch to an inch and a half in length, and of proportionate thickness. The seeds, which when fully ripe are of a *black* colour, are lodged in a light green pulp, the interstices of which contain from half a dram to a dram of nearly limpid fluid. When the cucumber is in a state of maturity, it contracts with great force upon its contents, forces open the extremity, and suddenly scatters the seeds and juice about, to the distance often of several yards. Hence the name of the *squirting cucumber*. When the time is near at hand for discharging its contents, the slightest touch will often produce the effect; and when a quantity of the cucumbers, in a nearly ripened state, are carried to a distance in order to subject them to pressure for procuring the elaterium, a great number are sure to burst on the way (more or fewer, according to the degree of ripeness), and the contained juice is consequently lost.

In order to discover in which of the parts above mentioned the elaterium, or active principle resides, I separated them carefully from each other for trial. For this purpose I slit open the cucumbers longitudinally, and allowed the clear juice to percolate through a fine sieve. The seeds and pulp were then scooped out from the interior of the cucumber, and allowed to drain through the sieve. They were afterwards washed in cold water, separated, and dried. Thus there were *four* different parts for examination; the parenchyma, or body of the cucumber; the seeds; the light pulp surrounding these; and the clear juice lodged in the centre of the fruit.

The part first examined was the parenchyma, or body of the cucumber, after the interior parts (the seeds, pulp, and juice,) had been removed. The expressed juice of this part

was reduced to the form of extract. Of this two grains were given in *ten* different instances; in *eight* of them, no effect followed. *One* was vomited and purged briskly, and had headach. *Another* was purged several times on the following day.

Eight grains of the same extract were then given in four cases. In two only it produced sickness and purging.

2. A quantity of the bodies of the cucumbers, freed from the juice and seeds as before, was dried and powdered. This powder was exhibited in different doses, from five to ten grains each—it produced no effect, except in one of ten instances, and this was equivocal.

3. The *seeds*, after washing in cold water, were dried and powdered. *Twenty* grains of these produced no effect; this might have been expected, indeed, for mice are observed to eat the seeds greedily.

4. The light pulp immediately surrounding the seeds was washed in cold water, and then dried. It assumed a *gummy* appearance. This likewise was inert, in doses of two and three grains.

It appears sufficiently from these trials, that the most active principle belonging to this plant, is neither lodged in the *roots*, *leaves*, flowers, nor stalks, in any considerable quantity; nor is it to be found in the *body* of the fruit itself, or in the seeds contained within it: it was only in the juice around the seeds, therefore, that it could be looked for; and here it will be found, as is evident from the following trials.

This juice, as it first issues, without pressure, appears perfectly limpid and colourless. After it has stood for a short time, it becomes turbid; and after some hours it slowly deposits a sediment, which, being collected and gently dried, without much exposure to light, is of a yellowish white colour, slightly tinged with *green*. When dried, it is very light and pulverulent. This is the real *elaterium*, and it is extremely active as a medicine; an *eighth* part of a grain seldom failing to purge violently, and often with vomiting previously. The quantity contained in the cucumber is exceedingly small. From forty cucumbers I obtained only six grains; so that a single cucumber contains about an ordinary dose. Half a bushel, charged at half a guinea in the market, furnished less than two drams of elaterium; hence we cannot wonder at the high price it bears in the shops. This, however, is unnecessarily enhanced by the mode of preparation, and its not being known distinctly in what part the active principle is lodged.

The juice, after the elaterium had subsided, was evaporated to an extract. Two grains of this were given in *six* cases.

In *two* of them it produced several stools; *one* was vomited, and was purged on the following day; *one* was vomited in half an hour without purging; and in *two* it appeared to produce no effect.

I gave five grains of a similar preparation, obtained from Apothecaries' Hall, in *fourteen* instances. In *seven* of them it produced no effect; in *three* it appeared to operate gently by stool. Of the others there was no report.

It appears from hence, that the juice, after the fecula, or *elaterium* has subsided, contains but very little of the active principle; and *that*, probably, from the fecula having imperfectly subsided.

With regard to the *sensible* and *chemical* properties of the fecula, which subsides spontaneously from the juice contained within the cucumber, as above described, and which alone appears to be the true elaterium, I have already observed that it is a light, pulverulent substance, of a very pale green colour, approaching to yellowish white. To the *taste* it is acrid and bitterish. The juice itself, as it escapes from the cucumber, readily inflames the skin of the fingers; and on getting accidentally into the eye in one instance, it occasioned severe pain and inflammation, with an erysipelatous swelling of the eyelids, that continued till the following day. The fecula, in the dose of one-eighth of a grain, seldom failed to produce both vomiting and purging, and that often violently. Half this quantity, viz. one-sixteenth of a grain, generally excited considerable purging. From several trials I have made, it appears to operate in little more than half the dose of that obtained from Apothecaries' Hall; which, however, is far more efficacious than what is generally sold in the shops, the quality of which varies extremely. *Some* specimens have acted very well in half grain doses; *others* have produced no effect in the dose of two grains. These are either improperly prepared, or are greatly adulterated. The best and most active I have seen, was some which I obtained from Mr. Parrott, of Mitcham, who for several years raised the plant in his own garden, and prepared the elaterium in large quantity for the Apothecaries' Company.

Much of this medicine, as it is ordinarily met with in the shops, is of a dark green colour, approaching to black: it is likewise compact and heavy, and breaks with a shining resinous fracture. This is usually prepared by strong pressure of the cucumber, and consists, of course, in great part, of the ordinary juices, as well as the elaterium. It is very uncertain in its operation, and very weak, in comparison with that which has been properly prepared. The quantity is much increased by this mode of preparation; and hence it is sold at

a much lower rate. The difference in price of this drug is extreme; the Apothecaries' Company charging sometimes as much as twelve shillings a dram, while it is sold at Corbyn's and some other shops, at *four* shillings. The quality, indeed, is superior at the Hall; but in no degree proportioned to the price. Yet I do not believe that either obtains an exorbitant profit; the difference arising chiefly from the mode of preparation, which, by the Apothecaries' Company, who adhere rigidly to the directions of the Pharmacopœia, is extremely wasteful, as I have satisfied myself by inspection.

With respect to the *chemical* properties of this substance, I shall enter no further into these, than is connected with the purposes of pharmacy.

Water, whether *hot* or *cold*, appears to have no action on pure elaterium. An infusion of eight grains, when filtered, produced no effect. Its insolubility in water, indeed, might be inferred from its spontaneous subsidence in the fluid; yet it is said, by Dr. Woodville, in his "Medical Botany," to be soluble both in spirit and in water. What it is that keeps the elaterium in a state of solution in the juice as first discharged, I have not ascertained.

The *elaterium* procured from the spontaneous subsidence of the juice, without expression, and which may be considered as in a state of purity, dissolves almost entirely in alcohol. Of the best specimens from the Hall, spirit dissolves more than a half; while of inferior sorts, a *fourth* part is thus dissolved. The residue, after repeated affusions of spirit, is quite inert as a medicine. The active principle therefore may be considered as of a *resinous* nature; by which I only mean, however, that it is soluble in alcohol, which it tinges of a pale green colour. When the spirit is slowly evaporated, a resinous looking extract is obtained, which is very inflammable, and which is extremely active as a medicine; the *sixteenth* part of a grain generally producing considerable purging, and often vomiting. When the dose was increased to one-fourth of a grain, the effect was more considerable, and often took place in a very few minutes.

History of the Elaterium.

According to Dr. Parr*, the term elaterium was often used by Hippocrates to denote internal applications of a detergent or digestive nature. It has also been applied to any purgative that acts with violence. As applied to the wild cucumber, this substance appears to have been in use at a very early period, though subsequently in a great measure

* "Medical Dictionary," article *Elaterium*.

laid aside; of late years it has been restored to use; but in a limited degree, and by no means in proportion to its utility. It was at first employed as a *cathartic* merely; but in later times as a remedy for dropsy. *Simon Pauli* says, that from the extreme violence of its operation, it should not be used till milder means have failed. *Lister** and *Hoffman* both assert, that it produces often great heat and pulsation at the very extremities of the fingers. Others say, that it affects the head; which I have often observed to be the case. Dr. Cullen seems hardly to have used it at all; for he says, in his *Materia Medica*, Vol. II. page 544, that he had never known it employed by itself, and only as added, in a grain or two, to other purgatives. He adds, that if Lister's observation of its *heating* the body is well founded, he should not think of employing it at all. The *elaterium* was also occasionally employed as an errhine.

The wild cucumber plant has several synonimes; as *cucumis agrestis; sylvestris;* and *asininas.* The Linnæan name, which our college employs, is *momordica elaterium.* The preparation from this, which we use under the name of *elaterium,* is, in the late editions of the Pharmacopœia, called an *extract,* but with no propriety; for it is not prepared in the manner of other extracts, nor is it at all the same with *extract* (chemically speaking), for this implies solubility in water, which the *elaterium* does not possess. It is likewise often called a *fœcula,* a name applied to *starch;* but as starch is soluble in hot water, it has no analogy with elaterium. From the observations above made, it evidently approaches to the nature of a *resin.*

Lewis (in his *Materia Medica,* page 262,) says all the parts of the plants are strongly purgative: this opinion he appears to have borrowed from Geoffroy, who says, (as quoted by Woodville,) "*radicum* vis cathartica major est quam *foliorum;* minor vero quam *fructuum.*" *Lewis* observes further, that in Holland an extract from the root in wine is exhibited for the elaterium, and found equally efficacious. The trials which I have made, and which are described above, show that the different parts of the plant, and even the fruit itself, with the exception of the contained juice, possess very little of a purgative property, and are not at all adequate substitutes for the *elaterium.* The cucumber altogether, dried and powdered, is said, by Boulduc†, to be a good hydragogue: this is probable; but from what is stated above, the dose must be large.

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* In Appendix to Opera Mortoni, page 25.

† Hist. de l'Academie Royale des Sciences de Paris, 1719, p. 46.

The wild cucumber plant is an annual, and a native of the southern parts of Europe. It is very easily cultivated in common garden ground in this country, and in favourable seasons is very productive. Those Practitioners who have the opportunity, would do well to raise it themselves, as the preparation of the elaterium is sufficiently easy.

Mention is made, by Berguis, of *two* kinds of elaterium, the *white* and the *black*. The *white* is prepared from the juice that flows without pressure from the fruit simply cut open. The juice is suffered to form a deposit, which is dried by the heat of the sun. It seems to be the precise substance which I have described above. *Berguis* says it is dissolved by digestion in water, but this appears to be a mistake.

The *black* elaterium is prepared from the expressed juice of the cucumber altogether, and of course contains a great deal of extractive and colouring matter along with the real elaterium. This black preparation, instead of being light and pulverulent, is said to be heavy and glutinous when masticated, and sticks to the teeth; it is irritating to the fauces. It dissolves in considerable proportion in *water*, but only partially in *spirit*. It is also deliquescent in some degree. The white is more *resinous*, the black *gummy*, in its properties.

The mode of preparing the elaterium in different pharmacopœias is far from uniform, and the medicine varies accordingly, independent of adulteration. According as more or less *pressure* is used, the medicine will approach to the *black* or *white* species, described above. It appears, from the account I have given, that pressure is not at all necessary in order to obtain the elaterium, and can only serve to deteriorate its quality, and to render the dose uncertain. It is in this way that I account for the large doses prescribed by some writers, without any caution. Sydenham recommends two grain doses without reserve; and Woodville extends the dose from half a grain to three grains. These quantities where the medicine is in the most active form, would, I think, be often attended with danger.

The method recommended by the London College, and which is strictly followed at Apothecaries' Hall, is the least objectionable, as it directs only the slightest pressure to be made use of. It is, however, liable to objections in other respects, from it not having been known that the elaterium resides *exclusively* in the juice lodged in the hollow of the cucumber. Hence this has been often wasted and lost. Another source of waste, and that to a great amount, is the bursting of many of the cucumbers during their removal from the country.

I have obtained the greatest quantity of the medicine by pursuing the following method:—

The cucumbers should be gathered when as nearly ripe as possible, and without violence, that might endanger their bursting*. They should then be wetted by the affusion of cold water, that less of the juice when they are cut may adhere to the external surface. In this state they should be cut through longitudinally, and the juice allowed to strain through a fine sieve, placed in a large earthernware vessel. The seeds and surrounding pulp should be scooped out upon the sieve, and washed with repeated affusions of cold water, by which they will be freed from all adhering juice. Something will be saved also by afterwards rincing the split cucumbers themselves in cold water, from which a portion of elaterium may be collected.

After standing a few hours, a sediment is formed from which the clear liquor is to be poured of; it is then to be thinly spread on fine linen, and exposed to the air to dry: a gentle warmth may be employed without injury; but the access of sunshine destroys the fine green colour which the substance otherwise acquires.