Belladonna

George Oury 1859
Atropa Belladonna — Deadly Nightshade. Common
Dewale — is allied in botanicals and
Physiological characters to Atropa belladonna
Aroncionum. As this plant is a native of
both Greece and Italy, it was probably known
by the Ancient writers, although it has been
impossible to identify it with the Stinglyus
manikos of Descordes or the Stinglyus of Riggy.
In the work of Francis P.D. 1532, Belladonna
seems to be the plant indicated as Atrama
hortense manikos. It is supposed to be the
plant which produced such remarkable
effects upon the Roman soldiers during their
retreat from the Parthians, mentioned in
Plutarch's Life of Antony, Buchanan, in his History of Scotland AD 1532 states that this plant grew in abundance in Scotland and the Scots on one occasion took advantage of its intoxicating effects, to drug some provisions which they supplied to the Danes during a treaty.

This plant belongs to the natural family Polygonaceae. It is found in this country in the neighborhood of ruins and waste places and seems to prefer a calcareous soil. It flowers in June and July and produces fruits in September.

The stem is annual, herbaceous, upright, 3 to 7, somewhat hairy, of a reddish hue and from 3 to 6 feet high. The leaves are sometimes alternate, more commonly in pairs, in which case one leaf of each pair is generally left than the other. They are ovate and acuminate, between 4 and 6 inches long, thin and soft, entire on the edge, without any hairs except on the nerves behind, and supported on a short leafstalk. When dry they have a brownish-green color, scarcely any odor, and a faint bitterish
taste, when fresh they have a feeble bitterish and subacid taste. The root is perennial, fleshy, and creeping. The whole plant is fetid when bruised. The flowers are imperfectly axillary, solitary, stalked, bell-shaped, drooping, dark rich purple in the bud, greenish towards the flowerstalk and about an inch long. The berry is of a thin appearance and about the size of a cherry. It is of a violet black colour, roundish but flattened at two sides. It contains many kidney-shaped seeds in a mucilaginous sweetish pulp. The juice of the berry stains paper of a beautiful and durable purple colour.

The root is generally collected in Autumn or the early Spring. It is branched and spreading, fibrous but pulpy and juicy - white internally, when fresh, greyish when dry, its taste is slight and has a feeble odour.

The flowering stems are collected in June and July before the flowers begin to blow, or soon afterwards, they are deprived of their leaves which are carefully dried. The leaves taken
from wild specimens are preferred by the
English, although it does not appear that
the virtues of the plant are diminished
by cultivation. They are sometimes
confounded with the leaves of the Polygonum
nigra and Polygonum Dolcamara, from
which they may be distinguished by the
following characters. The leaves of
D. Dolcamara are considerably smaller; the
leafstalk is nearly as long as the leaf, and
two pinnae are frequently developed at a
short distance from the base of the leaf.
Those of D. nigra are also comparatively
small, not acutely acuminate, and
costely serrated upon the edge.

Chemistry. The leaves of Belladonna
were analyzed in 1818 by Melandr., the
expected juice. 1809, Vauquelin, and the
dried herb in 1819 by Lord Bovrides. The
following is the result of Bovrides analysis.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Upermalate of Atropia</td>
<td>1.51</td>
</tr>
<tr>
<td>Bendorotoxin</td>
<td>6.05</td>
</tr>
<tr>
<td>Wax</td>
<td>0.70</td>
</tr>
<tr>
<td>Chlorophyll</td>
<td>5.84</td>
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<tr>
<td>Phytocolla</td>
<td>6.90</td>
</tr>
<tr>
<td>Gum</td>
<td>8.33</td>
</tr>
<tr>
<td>Starch</td>
<td>1.25</td>
</tr>
<tr>
<td>Albumen</td>
<td>10.70</td>
</tr>
<tr>
<td>Lignin</td>
<td>13.70</td>
</tr>
<tr>
<td>Salts</td>
<td>7.47</td>
</tr>
<tr>
<td>Water</td>
<td>25.50</td>
</tr>
<tr>
<td>Styg. 2.05</td>
<td>in 10.00</td>
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Pseudotoxin, is brownish-yellow, soluble in water, insoluble in Alcohol and Ether. It is colored green by the salts of Iron, and totally precipitated from its watery solution by the salts of Lead and Tincture of Galls. Liebigkind has described a volatile vegetable alkaloid which he thinks is distinct from Atropa and which he has named Belladonin. It is crystallizable, and has an ammonia odor. It consists of C$_{28}$H$_{22}$N$_{2}$O$_{7}$ + 3H$_{2}$O. Two grains when swallowed caused extreme heat in the throat, and constriction of the larynx. Richter describes a volatile crystallizable acid, distinguished from Kewpie acid by its not precipitating the salts of Iron; thus he calls Atropic Acid. M. Peschier of Geneva who examined the plant after M. Baudous, found an acid which held the Phosphate of Lime in solution, Atropa or Atropine was discovered by Baudous in 1819, but for some time afterwards his analysis was doubted, from other chemists having failed to discover the alkaloid.
M. Baudes report was at length confirmed by the researches of Runge, Dieder, Hesse and Klein.

This powerful alkaloid is found in all parts of the plant, and many different processes for obtaining it have been followed. The following is the substance of Weinsberg's:

Alcohol is added to the powdered root, which extracts from it a tattle of Atropia; this is decomposed by lime, which removes the organic acids and coloring matter. Sulphuric acid is then added to unite with the viscous Atropia; for this alkaloid when free, and especially when in contact with alkalis, readily undergoes decomposition by heat. The solution of Sulphate of Atropia must be evaporated at a very gentle heat, because the Atropia salt, especially in the impure state, easily undergoes decomposition. A small quantity of Carbonate of Potash is necessary to separate a semicrystalline substance which impedes the crystallization of the Atropia. An excess of the same salt is necessary to precipitate the Atropia.
quickly as possible, as its disappears when long in contact with watery fluids.
The Composition of Atriplex is C\textsubscript{44}H\textsubscript{23}N\textsubscript{2}O\textsubscript{7}. When pure, it crystallizes in silky prisms; it is permanent in the air and without odor.

It is said to have a bitter acid taste, but according to Meiss its watery solution is almost tasteless. When pure, it has a strong bitter taste and disagreeable odor and is not crystalline. It passes at 194°. It is soluble in all proportions in alcohol and from 15 to 25 parts of Ether and in about 60 parts of boiling water. It reacts on vegetable colors as an alkali. Nitric and sulphuric acids dissolve it without any change of color. Soda water gives a dense brown precipitate with its salt. Tannic acid precipitates it of a dingy white. Gallie acid has no effect upon it. Sulphuric acid and Bichromate of Potash produce with it, green oxide of Chromium.

It will be seen that none of these reactions are at all characteristic of Atriplex, as they are equally applicable to many other Alkaloids.
fluids, it may be detected by the process of
sed, and a small quantity of the matter so
obtained, applied to the eye, causes dilatation
of the pupil. But this does not serve to
distinguish it from either hyoscyanine or
daturine.

Having now stated the principal points in
the history and chemistry of the plant, I now
proceed to make a few remarks upon its
physiological actions.

Among the lower animals, Belladonna
produces poisonous effects in a much less
degree and herbivorous animals than upon
carnivorous. The seeds are often eaten
by birds with impunity and eight pounds
of the leaves have been eaten by a horse
without any ill effects following.

When half an ounce of the extract was given
be a dog, it caused dilatation of the pupil,
plaintive cries, efforts to vomit, weakness
of the hind legs, staggering gait, frequent
jerk and death. (Opia).

Action on man — In small doses Belladonna
diminishes sensibility and irritability —
This effect is best seen in morbid states, when these properties are preternaturally increased. There is always dilatation of the pupil, more or less. When taken in large doses, it manifests its remarkable influence upon the cerebrum and cerebro-spinal system. It causes dilatation of the pupil with indistinct vision, double vision, or complete blindness—visual illusions—rejection of the conjunctiva—feeling of numbness about the face—heat and dryness of lips, palate, and throat—dysphagia and aphonia—nausea, seldom followed by vomiting—general feeling of weakness—continual motion of the hands and fingers—delirium, often attended with extravagant fits of laughter—julie hurried and small.

The dilatation of the pupil is always present. There are two cases on record in which the pupils were contracted during sleep, though dilated when the person was awake. These are frequently seen in persons, or longsightedness. This symptom seems to depend upon an impairment of the adjusting faculty of the eye. When experimenting upon the
subject, found that he could see objects distinctly at a distance, while he was unable to read a book which he held in his hand without the aid of a magnifying glass. In a case admitted into Guy's Hospital in 1876, the patient, besides exhibiting the usual symptoms of Belladonna poisoning, seemed to have lost all idea of distance.—The delirium is a pretty constant symptom. Though there have been instances in which there was little or no delirium, the patient being at once thrown into a state of fatal lethargy. (Carpenter's Works 1876). The delirium is generally attended with visual illusions of a pleasing character, as may be inferred from his frequent bursts of laughter; he makes frequent attempts to grasp the phantoms, groping for them on the ground or among the bedclothes. Sometimes there is a state like somnambulism, with insensibility to external impressions, but with the power of locomotion to unimpaired. In some rare instances the delirium amounts to frenzy, the patient requiring
to be possibly confined. At first, there is
great palpitation of the heart and restlessness.
The delirium generally subsides into torpor
and lethargy; this however may last longer
for a considerable time, and this torpor
has been known to precede the delirium.
Dryness of lips, tongue, palate and fauces
is one of the most characteristic effects
of Belladonna. The difficulty of swallowing
which is often present, may depend
a good deal upon the suppression of the
salivary secretion, as defluxion may be
accomplished without much difficulty
if some liquid be taken with each mouthful of food. The hoarseness of voice probably
arises from the same cause, as it is much
relieved by mouthfuls of water.
A cutaneous redness resembling the eruption
of scarlet fever has been sometimes observed
and in a case related by Dr. Garrod, there was
desquamation of the cuticle after the
eruption vanished.
Actual convulsions are rarely witnessed
unless in the case of very young children.
In some cases the power over the voluntary muscles is disorder but the nerves of common sensation are unaffected. When the person tries to walk, it is with a feeling motion, like one intoxicated. There is great feebleness of the lower limbs, and sometimes slight twitchings of the muscles of the face. There is seldom vomiting, and the most powerful emetics often fail to excite it. This seems to depend upon the centralizing effects of Belladonna upon the muscular fibres of the stomach.

Post Mortem Appearances.

The blood is everywhere fluid. The eyeball of the brain congested — the meninges — membrane of the stomach sometimes showing congested patches — stomach and intestines pale and flaccid — if the berries have been the poisonous agent, the stomach may be stained of a violet blue colour. Red patches have been observed on the throat and gullet. Retrospection takes place rapidly. The body often swells remarkably and shows numerous livid spots. On the
whole, no very good account has been recorded
of the post mortem appearances, or account
of the Comparative few fatal Cases.
Belladonna Causes suppression of the salivary
salivation—sometimes Colic and Diarrhoea—
bleeding stools—strangury and bloody micturation.
The secretion of urine is sometimes greatly
increased, and there is sometimes great
desire to pass urine, with inability to do so.
During the administration of Belladonna,
the whole proportion of solids in the urine
is increased and Uric Acid is somewhat
diminished. The coloured corpuscles of the
blood are decreased and coagulation is retarded.
The root, leaves, berries and seeds
have all proved poisonous when taken internal,
but the detection of the poison is a matter of
some difficulty. The leaves, fruit and seeds
may from their indigestibility be found in
some of the evacuations or in the stomach
after death. The leaves may possibly be
recognised by their botanical characters,
and from a direction of them causing dilation
of the pupils; but the presence of the seeds
and dark purple skins of the berries forms the best evidence of the kind of poison. The seeds may be found in the matter vomited or in the alvine evacuations, where they have been found 30 hours after injection. The seeds which are small and arculated on the surface, have been vomited and found at stool. Three days after they had been swallowed. They cannot easily be distinguished from those of Hyoscyamus. Both Dr. Runge and della Bezly detected the active principle of Belladonna in the urine of a patient who had taken the drug. Their test was the power of dilating the pupil. When the substance so obtained was applied to the eye of a dog, but still we have no proof the active principal was not Hyoscyamine or Daturine.

Antidotes — The stomach should be evacuated as soon as possible by means of the stomach pump. Emetics are more likely to act after cold fomentation has been applied to the head surface of the body. After the stomach has been emptied, vinegar is the best antidote
according to some, but previous to the use of vinegar some alkali might be given, in order to decompose any Sphacia which may yet remain in the stomach. During the comatose stage, stimuli should be administered.

A doctrine has been lately promulgated which deserves some notice, although it still lies yet in the stage, viz. that Opium and Belladonna are mutually remedial, when either of the two has entered the circulation in a poisonous dose. Dr. Benjamin Bell, in a paper which he read before the medicoscientific society of this city, last year, gives a history of the development of the doctrine, and relates some apparently most successful experiments regarding the therapeutic relations of Opium and Belladonna to each other.

Dr. Corrigan of Dublin, while attending with the late Dr. Youce, a case of Syphilis Fever, in which there were head symptoms, with contracted pupils, suggested, that under similar circumstances, narcothes which produce dilatation of the pupils, might be of service. After a series of observations and experiments
Dr. Graves came to the conclusion that "the internal use of Belladonna is a valuable remedy, in cases of cerebral excitement, coming on in the course of fever, when there is marked tendency to that very unfavorable symptoms, contraction of the pupils." In 1853 Dr. T. Anderson, having satisfied himself of the soundness of Dr. Graves' opinions, conceived the idea, that Belladonna might be of service in the coma with contracted pupils, of poisoning by opium. On the first favorable opportunity he tried the experiment. A patient had swallowed in the course of 24 hours, two ounces of solution of bichloride of morphia, for the Cure of Delirium Tremens. He was in profound coma, his breathing stertorous, only 4 or 5 respirations per minute, and his pupils very much contracted. His pulse was weak and slow, and it was found impossible to cure him. A draught of such of Belladonna was administered every half hour; after the third dose his pupils began to dilate. In four hours and a half from the beginning of this treatment, six draughts having
been swallowed, a great improvement in his condition had taken place; the coma was nearly gone, the respirations between 200-25 per minute, the pulse 120 and increased in strength, while the countenance, from being cold and pallid, had become flushed, and the whole body much warmer. Another case was treated in the same manner and the result was satisfactory. He also quotes a case of a child who swallowed, without any harm resulting, two suppositories, each containing 2grs of Opium and 2grs of Extract of Belladonna. Dr. Bell relates two cases in which he had injected solution of Atropin into the Ciliary Fissure for the Cure of Neuralgia. Symptoms of poisoning came on soon after, which were almost immediately relieved by an injection of Bichloride of Morphine. It is established that Belladonna and Opium be antidotes to each other, the fact will be of undoubted service, especially in the more frequent cases of Opium poisoning.
Uses — Belladonna is much more frequently employed for internal administration after the Continent than in this Country. At the present time M. Trouseau is making extensive experiments with this drug, at the Hotel Dieu, the result of which when made known, will no doubt throw some light upon its peculiar physiological actions, and its relative value as a remedy. In this Country has been chiefly employed as an external application to relieve pain, or as a means of dilating the pupil in ophthalmic surgery. Many have been deterred from giving Belladonna a fair trial, owing to the apprehensions entertained regarding its poisonous properties, and there is good cause for the apprehensions if we regard the very faulty preparations which up to a recent time, were sold by druggists in this country. Many of the extracts were almost inert, from their having been prepared at too high a temperature. Since the different statements which exist with regard to the effects of the plant,
At one time two grains of Extract are said to cause alarming symptoms, while at another 60 grains have been swallowed without causing any dangerous effects. The active principle of Belladonna, in the shape of some salt of Atropin is now generally employed for internal administration.

Without enumerating all the diseases for which this remedy has been recommended, I shall merely instance some of those in which it appears to have been of service. In the treatment of Neuralgia, Belladonna has frequently been employed as a means of relieving pain, and we have evidence of its success in the published cases of Bailey, Hutchinson, and other practitioners. In 1842-3 Dr. Hutchinson of Nottingham made a series of trials of this drug in the treatment of Neuralgia. The persons to whom it was administered were all out-patients of an Hospital near Nottingham. They were all well-marked cases of Neuralgia, and to test the efficacy of the remedy, nothing but Belladonna was administered. The characteristic effects of the drug followed its administration, and
in each case the neuralgic pain disappeared as soon as the physiological effects were produced. The patients took the remedy internally, and no other treatment was resorted to. This drug, like a hundred others, has had its full amount of praise as a remedy for Epilepsy. It seems to modify the nervous susceptibility and diminish the intensity and frequency of the attacks. Dr. Delbruey, prefers it to all other medicines as a therapeutical agent, in the treatment of Epilepsy. In the space of 25 years, he had employed it in about 200 cases, and he says that there was scarcely one case in which its use was not attended with advantageous results. Generally, the fits were diminished in intensity and frequency; sometimes they were all together suspended for weeks, months, and years. Some patients had no relapse for 5 or 7 years. The same remedy has been used with occasional success, at the Civil Hospital of Venice.

There is a remarkable tolerance of this remedy in Petrasus; two grains of the extract have been given every two hours for a length of time.
In a case of punctured wound of the foot, the patient suffered from Petrunia in its severest form—All the usual remedies had been given without effect, and death seemed imminent. The Tincture of Belladonna was rubbed over the whole of the abdomen, and the muscles of the back and neck. In quarter of an hour, the respiration became easier, and the muscular contractions began to yield. Three ounces of the tincture were applied in this manner, when it was dis- continued in consequence of the improved condition of the patient. (Profe) Two cases of Petrunia in the Dreadnought Hospital were treated successfully with Belladonna plasters externally, and supporting the system with good diet. The Delirium Tremens, it has been employed during the second stage, in which the pupil is always more or less contracted. In a case in which hypnagogicism, Opium had failed to procure sleep, a blister was applied between the scapulae, and Extract of Belladonna laid upon the raw surface. In seven minutes the pupils began to dilate, and the patient became very drowsy. The Belladonna was very speedy
off, and in five minutes the patient was asleep. The sleep seemed to be quite natural and lasted for seven hours (7°02). In another case, the patient was sleepy and much troubled with spectral illusions, and his pupils were slightly contracted. When extract of Belladonna was rubbed on his eyelids, the pupils dilated and the spectral illusions vanished (Sire). In this case the boy seems to have acted by counteracting some cerebral state characterized by contracted pupils and spectral illusions, or the dilatation of the pupils rendered the eye less adapted for false visions.

In Rheumatism, it is said to cause immediate cessation of the flying pain, which is perpetually shifting along the direction of the muscles from one joint to another. It seems to stop the spasm of the muscles and so cause cessation of pain. (Atkome).

It is serviceable in spasmodic structure of the Arms and Urethra. It may be applied to the Urethra in the form of Extract smeared on the point of a Catheter.

In strangulated Hernia it has been employed
in the form of an Ointment composed of one part of Extract to three of Arum. This is
applied to the tumours, with the effect of relieving pain and tension, and rendering
the retraction by tazer more easy (de Boffa).
M. de Mignot says, that no section of the
juice etc should be had recourse to in the
treatment of Rhinosis and Paraphymosis.
all the practitioner has tried the effect of
Belladonna Ointment. This Ointment has also
been used with success for relieving Chordee.
Belladonna has been most successfully used
in the form of Clyster in the treatment of
Hem. A case is related, in which after five
days unsuccessful treatment by the ordinary
methods, a draught of the powdered root was
given in an enema. In a very short time
the pain and vomiting ceased, and in half
an hour a copious stool came away, and
the patient recovered, without any constitutional
symptoms having occurred (Becker)
In incontinence of Urine occurring in children.
especially if there be irritability of the Bladder.
Belladonna has been found of great service.
A number of cases have been recorded within the last few years, and the beneficial effects of this remedy seem well authenticated. During lingering labours or intraperine convulsions, it has been employed to relieve the rigidity of the uterine (Chausier, Belpain, Conquest). Dr. Rocker applied a decoction of the leaves to the uterine in a case of rigidity with complete success. Dr. Canas has also employed it successfully in the form of injections of the watery extract. He remarks, that the want of success complained of by some practitioners, is owing to their not securing direct contact of the drug with the uterine. It is very useful in the form of plaster applied to the abdomen for relieving after-pains.

In that form of Dymenorrhea, which is not accompanied by organic change or the discharge of membranous sheets from the uterus, and in which the pain is referred to the abdomen immediately over the uterus, Dr. J. Bird has found Belladonna of the greatest efficacy. He gave it in the form of pills combined with Sulphate of Zine.
A decided astringent effect is produced by the exhibition of this medicine in some chronic discharges from mucous membranes. In ulceration of the trachea it diminishes the secretion and relieves the cough (Cey).

Considerable benefit has been derived from the use of Belladonna in hooping cough. Its efficacy depends in part, probably, on its power of obliterating spasm of the bronchial tubes and of decreasing the insusceptibility of the bronchial membrane to the influence of the exciting causes of the paroxysms. Dr. Casserly, Forbes, Thomson, Dr. Whitehead of Manchester has used it frequently both in the form of powder of the leaves and solution of atropin. He succeeded in shortening the duration of the disease, very considerably.

It has been used in Angina Pectoris (Davies) in the Scarlina of Phthisis (Delaunde) in Hemoptysis (Brieger), Croup (Chelton). Its power of arresting the salivary secretion has been turned to account in the treatment of Mercurial salivation (Cooper).

In 1829 M. Raugue, Chief Physician to the Hôtel Dieu at Orleans employed a liniment composed of Extract of Belladonna, Selflacie
Ether and Laurel water, which he applied to the breasts of females who were threatened with milk abscess. It has since been frequently employed to relieve the pain and tension of an over-distended breast. It is said to cause absorption of the milk, and arrest of the secretion from the gland (Cham. Todd). It has been employed in fever with rapid symptoms and debilitated contracted pupils (Graves, Anderson).

At one time, Belladonna enjoyed considerable reputation as an antiphlogistic, more especially in the treatment of Erysipelas, over which disease it seems to have a mostsalutary influence. (Hilton). It has been used with advantage in orchitis and inflammation of the Spermatic cord. It is often advantageously combined with Scopolia. A syrup made with the expressed juice of the berries, to be given in Dysentery, in all cases in which opium is contraindicated, has been recommended and is said to be very efficacious (Seer).

The influence of Belladonna upon the iris
was discovered by Professor Reesmann and made
known by Daries in 1776. Since that time
this drug has been in universal use for the
purpose of dilating the pupils, in order to
enable us to examine the condition of the
deeper parts of the eye. It is used for facilitating
the operation for cataract; in vitreus, to
prevent adhesions; in partial opacity of the
cornea, for dilating the aperture of the pupil
so as to get its circumference beyond the opaque
spot, and so improve the vision. It is a
remarkable fact, that although it is used
habitually for this purpose for many years,
its effects are never diminished, and a solution
of the same strength as that first used, will
cause full dilatation after a lapse of 20
10 years. The modus operandi of belladonna
upon the iris has long been a disputed point
in physiology. Some believe that absorption
is necessary to its action, while others, and
among them Müller consider it a purely
local action. Müller says that the action
depends upon the local paralyzing influence
of belladonna upon the ciliary nerves, and
it cannot in the slightest degree be the result of absorption, because the other eye is un-
affected. His reason here assigned seems scarcely sufficient. In the first place, in the greater number of cases, both eyes are affected, although Belladonna be applied to one only. If Belladonna be taken internally, dilatation of the pupil is one of the very first effects; this at all events must be the result of absorption.

It seems to act principally upon the sympathetic system of nerves in all cases in which it is taken into the body. It paralyses all involuntary muscular fibres, more especially sphincters, and in this manner may paralyse the branches of the sympathetic supplied to the circular fibres or sphincter of the iris.

Belladonna has been introduced into practice as a prophylactic against scarlet fever. This doctrine was first brought forward by Hahnemann. According to the homopathic doctrine "similia similibus curantur" it was assumed that because the drug when taken...
internally sometimes gave rise to an eruption and affection of the throat resembling that of scarlatina, therefore Belladonna had the power of guarding the system against the reception of scarlet fever. Many Continental observers admit the truth of the doctrine, but it has been generally disbelieved in this country. Many careful investigations and experiments were entered into in this country, in order to test the truth of the doctrine, but no very satisfactory evidence was ever brought forward to prove even some practitioners having failed and others having succeeded.

I have thus endeavoured to bring forward a few of the most interesting facts relating to the physiological and therapeutic actions of this remedy. I have mentioned the principal diseases in which it has been used, not to uphold its efficacy on the strength of a few solitary cases, but to bring forward a number of recorded facts, that we may of possible deduce conclusions therefore, concerning its general actions. I think a remedy
with actions so varied and powerful, and differing in many respects from all the other centro-spinal medicines, is well worthy of further investigation, so that by studying more closely its peculiar physiological actions, we might be enabled to use it as a therapeutic agent with more certainty and success.

George Dodd.