Narcosis and nightshade

Anthony John Carter

Although this year marks the 150th anniversary of the discovery of modern surgical anaesthesia, surgery itself has a much longer history. It is well that extracts from the opium poppy, Papaver somniferum, were used to dull the pain of surgery during ancient times but less well known that extracts from plants with sedative powers often accompanied them, producing primitive anaesthesia. Most of these sedative plants were members of a large botanical family, the Solanaceae. This paper describes some of them and discusses the ways in which they were administered. It also explains why, during the middle ages, these primitive techniques went out of use but how none the less they provided Shakespeare with the inspiration for some of his greatest plays. When the active principal of the Solanaceae was identified as scopolamine, it came to play a part in 20th century anaesthesia. The combination of omnopon and scopolamine lives on as a premedication, and the presence of poppy heads and mandrake roots on the arms of today's Association of Anaesthetists serves to remind us of the speciality's links with its past.

Seven months after the performance of the first operation under ether anaesthesia the *Lancet* published a short extract from a paper in a provincial French journal.[1] The extract was entitled "A substitute for the Vapour of Ether to annul Sensation during Operations," and this is what it said:

> At midsummer, when vegetation is at its height, *Solanum nigrum, Hyoscyamus niger, Cicuta minor, Datura stramonium,* and *Lactuca virosa* are gathered, and a sponge is plunged into their juice freshly expressed. The sponge is then dried in the sun, the process of dipping and drying is repeated two or three times, and the sponge is then laid up in a dry place.
>
> When the sponge is required for use, it is soaked for a short time in hot water; afterwards it is placed under the nose of the person to be operated upon, who is quickly plunged into sleep. The operation may then be proceeded with without any fear that the patient has any sensation of pain. He is readily aroused from the stupor by a rag dipped in vinegar, and placed to his nose.
>
> M Dauriol records five cases in which he has successfully employed this means of bringing about insensibility during operations.[2]

Although described as a "new procedure," Dauriol's method was in fact based on primitive anaesthetic techniques that had been in use from before the time of Christ until well into the middle ages. Those techniques and their legacy today form the subject of this paper.

Materia botanica

Before studying Dauriol's method, however, we must first look at his materials. Of the five plants in Dauriol's list, three, *Solanum nigrum, Datura stramonium,* and *Hyoscyamus niger* are members of a large botanical family, the Solanaceae. All three have sedative properties, and *Hyoscyamus niger,* popularly known as henbane, was cultivated for this property throughout Europe.

Like other medicinal herbs, henbane was grown in herbal, or physic, gardens, and indeed, in one such garden—London's Chelsea Physic Garden, founded in 1673 by the Worshipful Society of Apothecaries—it can still be found growing today. Apothecaries, whose roots lay firmly in the monastery, also studied and catalogued the plants they grew, and in *Gerard's Herbal* (1597) we find henbane's sedative powers described as follows:

> The leaves seed and juice taken inwardly causeth an unquiet sleepe, like unto the sleepe of drunkennesse, which continueth long and is deadly to the party.[3]

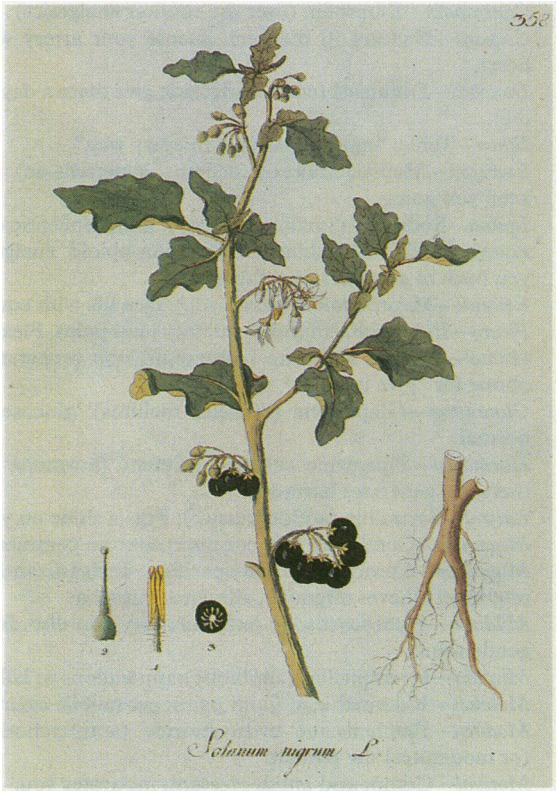
It was this ability of henbane to induce prolonged unconsciousness that particularly impressed the 18th century physician (and benefactor of the Chelsea Physic Garden) Sir Hans Sloane, who recorded the case of four children who accidentally ate henbane seeds. They slept for two days and two nights.[3]

Although not used by Dauriol, one other solanaceous plant must be mentioned, for it is associated with the very earliest attempts at anaesthesia. *Mandragora officinarium,* popularly known as the mandrake, grows naturally around the Mediterranean, and the plant's anaesthetic power first came to attention during the time of the Roman Empire, when a method for using wine to extract its active constituent was described by the Greek physician, Pediacus Dioscorides:

> The wine of the bark of the root is to be given to such as shall be cut or cauterised. They do not apprehend the pain because they are overborne with dead sleep.[4-5]

However, according to the writer Celsus, the Romans also knew that the anaesthetic power of solanaceous plants was increased when they were combined with extracts from the opium poppy, *Papaver somniferum*:

> There is another, more efficacious way for producing sleep. It is made from mandrake with opium seed and seed of henbane bruised up with wine.[6]



Solanum nigrum (black nightshade) (Royal Horticultural Society, Lindley Library)

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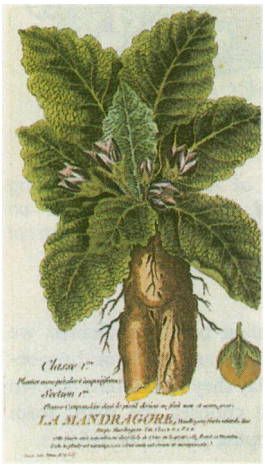
Hyoscycamus niger (henbane) (Royal Horticultural Society, Lindley Library)



Mandragora officinarium (the mandrake) (Royal Horticultural Society, Lindley Library)

Christ's tribulations in a 13th century manuscript from Salerno. Traditionally this sponge contained vinegar (Sloane manuscript 1977, by permission of the British Library)

The spongia somnifera

The Roman Empire finally collapsed around the fifth century, and much of our knowledge of it today is due to the custodial work of monks in the early Christian monasteries. In one of these, the Benedictine monastery at Monte Cassino, was found early this century a ninth century method for inducing anaesthesia in the manner described by Dauriol—that is, with the aid of a sponge. According to this description, the sponge was:

> Steeped in a mixture of plant juices, including those of the opium poppy, henbane and mandragora, and dried. When the sponge was moistened, the vapour it produced was ready to be inhaled by the patient.[7]

Although sponges were widely used during the early days of both ether and chloroform anaesthesia, the Roman *spongia somnifera* is most strongly remembered today for the association it had with the punishment of crucifixion. Traditionally, these sponges contained mandrake wine, which, when used for this purpose, was known as *morion*, or death wine, because of its ability to make victims appear dead when actually still alive. Although its mode of action is unclear, it was so effective that centurions had orders to spear the bodies of victims before releasing them.

While we do not know whether the Romans used similar methods to induce surgical anaesthesia, the instructions found at Monte Cassino, and more detailed ones from the first organised medical school in Europe which opened two centuries later at nearby Salerno,[8] must at least raise the distinct possibility that they might have done.

Decline and fall

The sponge was, however, far from being the only method used to administer anaesthesia, as can be seen from an English account dated 1328. Once again we find opium and henbane mentioned, with the following instructions:

> Medle al hem to geder, and boyle ham a lytal, and do hit in a glasen vessel, well stopped, and do ther of III spoonful to apotel of good wine....and let hym that shall be coruen, sytte agens a good fyre, make hym drynke therof til he falle aslepe, and thou moyst savely corye hym.[9]

A similar, but fictional, account appears in a short story by the popular renaissance writer Giovanni Boccaccio (1313-75):

> Now the doctor, supposing that the patient would never be able to endure the pain without an opiate, deferred the operation till the evening; and in the meantime ordered a water to be distilled from a certain composition, which, being drunk, would throw a person asleep as long as he judged it necessary.[10]

It was around this time that the use of these primitive techniques seems to have reached a peak, but the problems that would eventually lead to their abandonment were now becoming apparent. In his surgical textbook *Chirurgia Magna*, for example, the French surgeon Guy de Chauliac (1300-67) describes the soporific sponge, but then gives asphyxia, congestion, and death as complications of its use.[7]

It is not hard to find reasons why such problems should have arisen. Although the potency of these extracts varied enormously—depending, for example, on the climatic conditions under which the plant had been grown and the method used to concentrate its juices—there was no method of measuring the dose actually administered. Not surprisingly, the results were highly unpredictable for, as the Italian surgeon Gabriel Fallopius (1523-62) pointed out:

> If soporifics are weak, they do not help; if they are strong they are exceedingly dangerous.[11]

The use of these techniques now began to decline, but at precisely the time that they were being abandoned by one profession another one was adopting them.

Perchance to dream

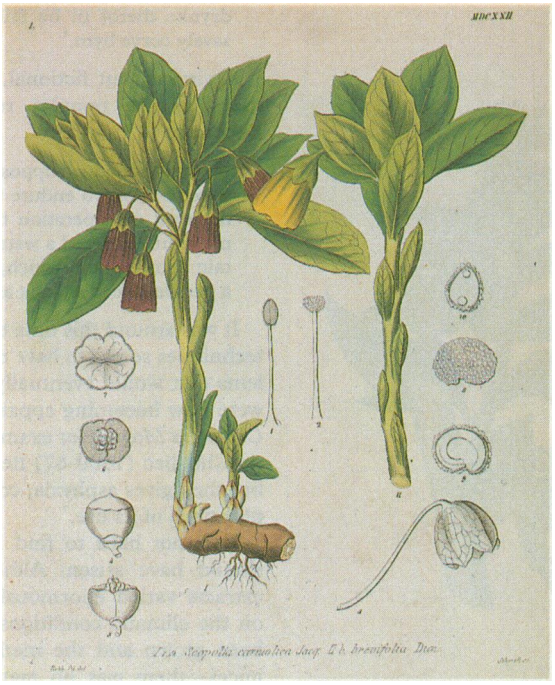
The plays of William Shakespeare contain many references to herbal medicines, particularly those with sedative powers. In *Othello* act III, scene iii, for example, the moor is told that nothing can return to him his once peaceful state of mind:

> Not poppy, nor mandragora,
> Nor all the drowsy syrups of the world,
> Shall ever medicine thee to that sweet sleep
> Which thou owd'st yesterday.

Like countless other writers since, Shakespeare realised the dramatic potential of substances that could produce temporary unconsciousness, and when, in act IV, scene i of *Romeo and Juliet*, Juliet asks Friar Lawrence for help in finding a way to avoid the marriage arranged for her the following day to Paris, her fellow Capulet, Shakespeare describes a state not unlike that of anaesthesia itself. The friar tells Juliet:

> Take thou this vial, being then in bed,
> and this distilled liquor drink thou off:
> When, presently, through all thy veins shall run
> A cold and drowsy humour; for no pulse
> Shall keep his native progress, but surcease:
> No warmth, no breath, shall testify thou liv'st;
> The roses in thy lips and cheeks shall fade
> To paly ashes; thy eyes' windows fall,
> Like death, when he shuts up the day of life;
> Each part, depriv'd of supple government,
> Shall, stiff and stark and cold, appear like death:
> And in this borrow'd likeness of shrunk death
> Thou shalt continue two-and-forty hours,
> And then awake as from a pleasant sleep.

Although much of Shakespeare's remarkable knowledge is said to have come from herbals, it is surely impossible not to find in these words a suggestion of experience more personal in nature.



Scopolia carniolica—the source of scopolamine (Royal Horticultural Society, Lindley Library)

Twilight sleep

Dauriol's attempt in 1847 to reintroduce, as an alternative to ether, a technique that had been by then long abandoned, was rightly greeted with a dignified silence. It did not, however, take long after the discovery of ether and chloroform for it to become apparent that the use of these agents was also not without risk. The search for a safe anaesthetic went on, and in 1888 the physician Benjamin Ward Richardson decided to investigate the anaesthetic power of the mandrake. Richardson obtained a mandrake root and prepared from it a tincture in exactly the manner described by Dioscorides, which he tested both on animals and on himself. He concluded:

> The wine of mandragora is a general anaesthetic of the most potent quality. The action no doubt depends on the presence of an alkaloid which is like, if not identical with, atropine and which would, I have no doubt, be one of the most active anaesthetics we have yet discovered.[12]

Unknown to Richardson, however, the alkaloid had already been isolated from another solanaceous plant, *Scopolia carniolica*, which grows naturally in the Slovenian province of Carniola. In the same way that atropine, its near relative, had previously been named after *Atropa belladonna*, the deadly nightshade, so this new alkaloid was now given the name scopolamine.[13]

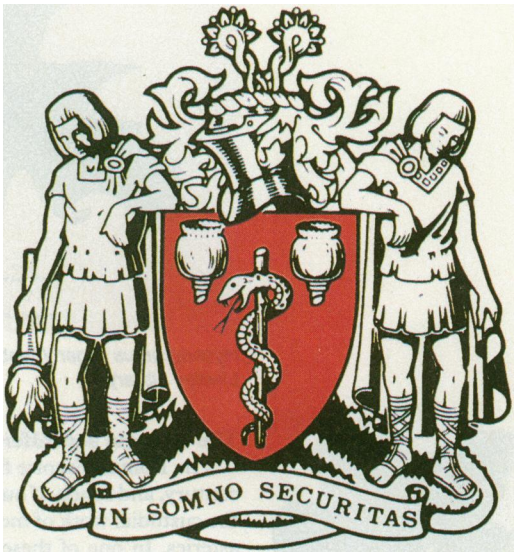
In 1900, stimulated by continuing concerns about the safety of chloroform, doctors in Germany began to experiment with the use of morphine and scopolamine as an alternative to mask anaesthesia.[11] The technique, which involved giving one or two hourly injections until anaesthesia was considered adequate, never gained popularity in British operating theatres, but in 1910 the anaesthetist DW Buxton wrote:

> A terrified patient after a sleepless night is in the worst condition for an anaesthetic and an operation. In such patients I am convinced that the use of scopolamine and morphine injections before a general anaesthetic is valuable.[11]

Many examples are known of medical techniques that have been abandoned, only to be rediscovered by a new generation. There is, however, surely no finer one than that of this ancient partnership, known to the Romans and perhaps to Shakespeare, and now reborn as the 20th century anaesthetic technique of premedication.

In somno securitas

Although less frequently prescribed today, morphine (or omnopon) and scopolamine still remain in certain situations a pharmacological partnership without equal. Furthermore, like the mandrake roots and poppy heads on the arms of the Association of Anaesthetists, the combination serves as a reminder, in this the quintacentenary year of ether anaesthesia, that the desire to alleviate the fear and pain of surgery, if not always the ability to do so in safety, has been with us since time immemorial.



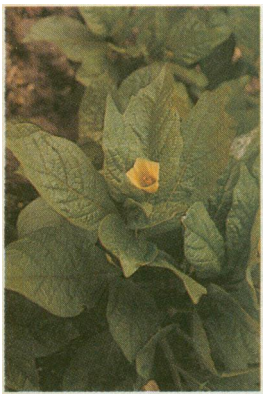
The arms of the Association of Anaesthetists, showing mandrake plants (at top) and opium poppy heads on shield (reproduced by permission of the Association of Anaesthetists of Great Britain and Ireland)

Today, when we think of plant based medicines, we tend to think of substances that are weak or homoeopathic, but in Shakespeare's day they would have known better. When Friar Lawrence chooses the plant from which he will make Juliet's sleeping potion, he tells us:

> Within the infant rind of this small flower,
> Poison hath residence, and medicine power.

I thank Dr Arthur Hollman, medical adviser to the Chelsea Physic Garden, for his invaluable advice and encouragement in the writing of this paper.

The physic garden is open to the public on Wednesday and Sunday afternoons from April to October.



A form of Scopolia carniolica (Blooms of Bressingham)

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