'Fish', fossil and fake: medicinal unicorn horn

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Abstract: Ctesias (fifth century BC) recounted contemporary Persian beliefs of white Indian animals which had a white horn, black in the centre and flaming red at the pointed tip, projecting from their forehead. Reinforced by classical and medieval writers, travellers, biblical warrant and trade in narwhal tusk, the unicorn became firmly established in European mythology. Increasing popularity as an alexipharmic, prophylactic and counter-poison through the fifteenth to seventeenth centuries led to rising demand and rapidly inflating prices. Debate raged as to which was the 'true unicorn' (*Unicornum Verum*), narwhal tusks or mammoth ivory (*Unicornu Fossile*); shavings and powders of both were incorporated into a bewildering array of medicinal mixtures while fraudulent alternatives flooding the markets required the employment of discriminatory tests. Further alternatives with supposedly similar properties included the (probably smectite) clays of *Terra Sigillata Strigoniensis* or *Terra Silesiaca* (*Unicornu Minerale*), and an alchemical preparation (*Unicornu Solare*). The supposed therapeutic application and wide range of delivery systems of all types of unicorn horn medicines are reviewed in detail for the first time. Particularly popular as an antidote in plague medicines, the use of alicorn (unicorn horn) simples declined to extinction with the increasingly empirical approach to pharmacy of the mid-eighteenth century.

Although several publications have touched on the medicinal use of unicorn horn (Robertson 1926; Humphreys 1951; Boullet 1959; Miller 1960; Savare 1972; Fotheringham 2000; Jackson 2004; Gerritsen 2007; Fischer & Fischer 2011), there has so far been no deeper consideration of its therapeutic application during early modern times. The objective of the present paper is to consider the range of applications and means of delivery of the various materials promoted as unicorn horn in the history of pharmacy.

The unicorn and its horn, often referred to as an alicorn, have an iconic association with the apothecarial tradition. English apothecaries were originally associated in the same guild with the Grocers and Pepperers. Then, in 1617, James I of England established the Society of Apothecaries by Royal Charter. An application for armorial bearings was subsequently made to the Heraldic College later in the same year (Dickinson 1929). William Camden (1551–1623), the Elizabethan chronicler and topographer, was then in post as Clarenceux King of Arms, the senior of two Kings of Arms responsible for armorial matters and heraldic records. Camden devised a coat of arms that comprised two unicorn supporters flanking a shield within which Apollo, 'the inventor of physique', stood astride a prostrate dragon, representing disease. The crest is an image of a rhinoceros (Fig. 1). It is interesting to note that a short spiral horn has been drawn between the shoulder blades of the rhinoceros, following an earlier image by Albrecht Dürer (1471–1528; Fig. 2). The rhinoceros made its first appearance since antiquity in Europe in 1515. It was a gift for King Manuel I of Lisbon, from the Gujarat Sultan Muzafar II and landed after a rapid 120-day journey on 20 May 1515. Having been examined by scholars, the animal was then kept in the royal menagerie. A letter of unknown authorship was sent from Lisbon to Nuremberg at around the same time, enclosing a sketch by an unknown artist. Dürer – who was acquainted with the Portuguese community of the trading post ('factory') at Antwerp – saw the letter. Without ever seeing the rhinoceros himself, Dürer executed two pen and ink drawings, from the second of which a woodcut was then produced (Clarke 1986). Since the horn of the Indian rhinoceros did not accord with the spiral specimens then accepted as belonging to the unicorn, Dürer reconstructed a short additional anteriorly directed horn embedded in the tissues of the dorsal midline of the animal, between the shoulders. This error was then propagated through innumerable published and painted derivative images (Cole 1953).

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First published online March 1, 2017, https://doi.org/10.1144/SP452.16

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Fig. 1. Coat of Arms of the Worshipful Society of Apothecaries (granted 1617). Note the two unicorn supporters and the rhinoceros crest, with a spiral horn placed between the shoulders. Reproduced by kind permission of the Wellcome Library London.

cultures (e.g. Ettinghausen 1950; Fernández 1999), with certain elements held in common. A case has been made for the initial roots to be found in the Indian legend of the hermit Gazelle Horn as recorded in the epic saga, the *Mahabharata*, whose origins probably date from the eighth or ninth century BCE (Brockington 1998; Gotfredsen 1999). Found in variants written in Sanskrit, Pali, Tibetan and Chinese, it is also related to the Babylonian epic (Gotfredsen 1999, p. 12).

The earliest European allusion to the unicorn is by the Greek physician, Ctesias (*fl.* fifth century BCE). Biographical details for this author are sketchy and heavily dependent on entries in the tenth-century Byzantine dictionary known as the *Souda*. Born at Cnidos in what is now SW Turkey, Ctesias probably trained as one of the asclepiads. Arriving in Persia as a prisoner of war, he became physician to Artaxerxes II Mnemon (*fl.* 404–358 BCE) from 404 to 398 BCE. Here, he compiled information for his later *History of Persia* and *History of India* (*Indica*), which he wrote on his return to Cnidos. The latter volume, now lost, but partially reconstructed from snippets incorporated into other writings, contains the first Western description of the unicorn, complete with contemporary medical applications:

> There are wild asses in India the size of horses and even bigger. They have a white body, crimson head, and deep blue eyes. They have a horn in the middle of their brow one and a half cubits in length. The bottom part of the horn for as much as two palms towards the brow is bright white. The tip of the horn is sharp and

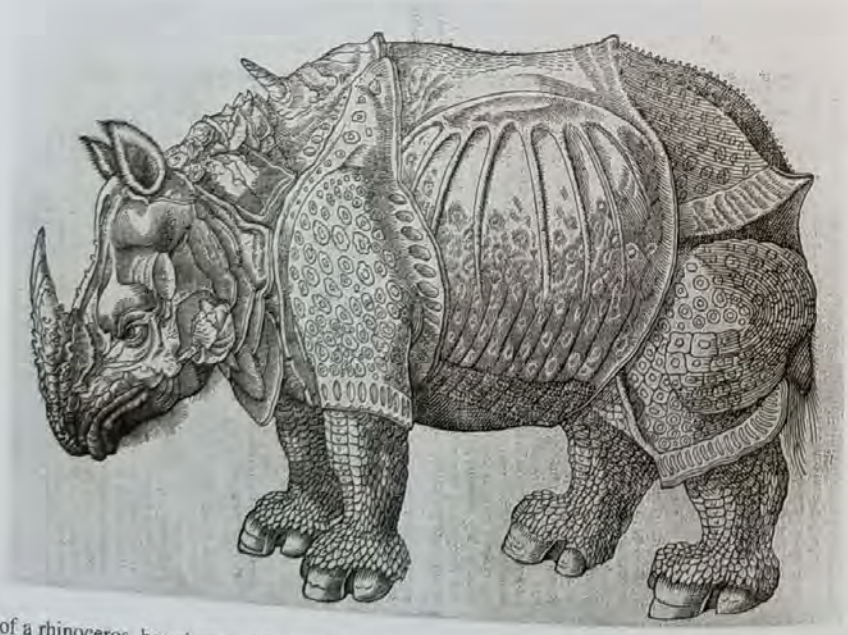

Fig. 2. Image of a rhinoceros, based upon Albrecht Dürer's lithograph, from Topsell (1658). Reproduced by kind permission of the Wellcome Library, London.

> crimson in colour while the rest in the middle is black. They say that whoever drinks from the horn (which they fashion into cups) is immune to seizures and the holy sickness [epilepsy] and suffers no effects from poison, whether they drink wine, water, or anything else from the cup either before or after ingesting the drug (Nichols 2008, p. 115).

It should be noted that, in the same work, Ctesias is also responsible for introducing such fabulous creatures as the Cynocephalus (mountain people with dog's heads), the river worm (a 3 m long nocturnal hunter of cattle) and the manticore (human-eating creature with a lion's body and a human head armed with three rows of teeth).

Seemingly reliant on Ctesias' account, Pliny the Elder (23–79) introduces the Monoceros in his *Historia Naturalis* (viii, 31; Bostock & Riley 1855, p. 281) as a very fierce Indian animal possessing the head of a stag, the feet of an elephant, the tail of a boar and the body of a horse. It has a single, long black horn projecting from the centre of its forehead and makes a deep bellowing cry. Pliny has a separate entry for the Rhinoceros (Pliny, viii, 29; Bostock & Riley 1855, p. 278), although Isidore (*c.* 560–636) indicates that they are the same beast (*Etymologiarum*, 12, 2: 12–13; Throop 2005, unpaginated). The Roman author Claudius Aelianus (*c.* 175 to *c.* 235) also refers to the unicorn (*De Natura Animalium*, 3, 41; 4, 52; Aelian 1958), reiterating therapeutic information from Ctesias.

Medieval references

In the bestiaries, beautifully produced illuminated manuscripts, mostly produced in Britain and France during the tenth to twelfth centuries, some sources suggest that the unicorn and the Monoceros are identical animals, while others deal with them as separate entities. The bestiaries were used as Latin, Norman and Anglo-Norman vernacular teaching tools, presenting various elements of natural history in terms of Christian allegory. Various themes from classical references to the unicorn were used to signify Jesus Christ; the wild and untameable nature of the animal typified the inability of Hell to hold Christ, while the single horn signified the unity of Christ with God the Father, for example. An entry for the unicorn also occurs in the *Physiologus*, a second or third century Greek work produced in Alexandria and translated into Latin around 400, and a forerunner of the works of the bestiary tradition (Curley 1979). These works relied heavily on biblical verses from the Old Testament translated into the Greek of the Septuagint. In this way the Assyrian word *remu* (Hebrew *re'em*) was rendered into the Greek *monoceros*. This, in turn, was later translated as *unicornis* when the Septuagint formed the basis of later Latin translations by St Jerome (*c.* 347–420) and others. In this way, the unicorn became firmly embedded in the Christian tradition, laying the groundwork for the medieval concept of the animal. This association between the unicorn and the church was reinforced in other ways; British processional staffs or candle-holders made from finely carved narwhal tusks are known from the second quarter of the twelfth century, for example (V & A A.79-1936 – Duffin 2015; National Museums Liverpool (World Museum) 1995.42). In addition to validating the concept of the existence of the unicorn, this association also added gravitas and credence to emerging notions of the potential medicinal use of unicorn horn.

A Syriac version of the *Physiologus* appears to give the earliest account of the virgin-capture story of the unicorn, picked up by Isidore in his influential *Etymologiarum*, and then propagated through subsequent medieval tales and imagery (Shepard 1930, pp. 47 ff.). Syncretized into Christian allegory, the image of the fierce unicorn being accessible to hunters only while it was calmed in the lap of a maiden became a staple of bestiaries, tapestries (such as the famous series at Cluny) and even Early Modern illustrations in such sources as the *Hortus Sanitatis* (de Cuba 1491; Fig. 3). A Greek version of the *Physiologus* seemingly

Fig. 3. Unicorn with its head in the lap of a maiden. *Hortus Sanitatis, De Animalibus* Cap. clv (de Cuba 1491). Countway Medical Library, New York.

provides the origins of a second component of unicorn legend – that of healing poisoned waters (Shepard 1930, p. 60). Not appearing in Western literature until the early sixteenth century (Shepard 1930, pp. 60, 282), in essence this mythical thread sees the animals unable to drink at a stream which, for various reasons according to different variants of the tale, has been poisoned. They therefore wait upon the unicorn. Stepping into the water, as the unicorn stoops to drink, the horn protruding from its forehead dips into the stream, rendering the poison harmless and making the now fresh water available for the patient animals. This is the source of belief in the alexipharmic properties of the horn, and is stunningly depicted, for example, in the famous engraving by the French goldsmith, Jean Duvet (1485 to after 1562), sometimes known as the 'Unicorn Master' (Eisler 1979, p. 309).

Born at Bermersheim, SW of Mainz, Germany, Hildegard von Bingen (1098–1179; Fig. 4) was the tenth child of a noble family (Flanagan 1998). Effectively tithed to the church at age 8, Hildegard was first enclosed to the cell of a Benedictine anchoress at the Disibodenberg Monastery, and then, in 1136, appointed Head of what had by now expanded to become a Convent. Establishing a new convent overlooking the Rhine at Rupertsberg around 1150, Hildegard continued her remarkably diverse Christian work; she served as a visionary, mystic, healer, linguist, poet, artist, musician, composer, biographer, theologian and preacher. *Physica* ('Medicine') is the earliest and more famous of her two medical works (Riethe 1997; Throop 1998). Her entry for the unicorn is interesting in that it contains a mixture of well-established lore derived from classical and other medieval sources together with novel observations regarding the medical applications of different parts of the beast. The purity of the animal is emphasized by its exclusive diet of 'clean plants', and its avoidance of other animals and humankind, with the exception of noble adolescent girls whom it knows to be 'gentle and sweet' (Throop 1998, p. 210). Indeed, it could be killed only by hunters sneaking up on it while it was distracted by these pure young females. The unicorn supposedly made annual excursions to Eden ('the land that has the water of paradise'; Throop 1998, p. 210) in order to feed on the unique plants from which it derived its various powers. The healing powers of the various parts of its body are given as follows (Throop 1998, p. 210):

> Pulverize the liver of a unicorn and put this powder in fat prepared from the yolk of an egg, making an ointment. There is no leprosy, of any kind, that will not be cured if you often anoint it with this ointment, unless death is present for the one who has it, or God does not wish to cure it. The liver of this animal has good heat and cleanliness in it, and the fat in the egg yolks is the most precious thing in an egg and is just like an unguent. Leprosy very often is from black bile, and from overabundant black blood. From unicorn skin, make a belt. Gird yourself with it against your skin, and no strong disease or fever will harm your insides. Also, make shoes from its skin and wear them. You will always have healthy feet, legs, and loins. No disease will harm you in these places.

A probable later addition supplements this information with (Throop 1998, p. 211):

> A person who fears being killed by poison should put unicorn hoof under the dish where his food is, or under the cup containing his drink. If they are hot and there is poison in them, it will make them boil in their vessel; if they are cold, it will make them smoke, and he will be able to tell there is poison in them.

Pharmaceutical applications of the horn are notable for their omission by Hildegard. Her only comment is that

> It has beneath its horn something as clear as glass, so that, in it, a person can look at his own face, as if looking in a mirror. Nevertheless, it is not very valuable (Throop 1998, p. 211).

Fig. 4. 'Hildegard receiving the light from Heaven' from the Wiesbaden Codex B folio 1 recto. Reproduced by kind permission of the Wellcome Library, London.

Identity crisis

The search for the unicorn of antiquity stimulated much debate, drawing suggestion upon suggestion and claim upon counterclaim, all, or at least mostly all, argued honestly from the classical descriptions of the beast and contemporary zoological observations. The details of the discussion are beyond the scope of the present paper, but it should be noted that a plethora of species were put forward as candidate unicorns, including the rhinoceros, the oryx, the Indian ox, the Indian horse, the bison, the Tibetan antelope and the rather more familiar construct of a white horse with a horn protruding from its forehead (e.g. Shepard 1930, pp. 34, 213 ff.; Lavers 2009). Even the latter, well-established icon was open to interpretation; the French druggist Pierre Pomet (1658–99) presented five different reconstructions of the animal based upon the identities and descriptions provided by several sources (Pomet 1694, Part 2, Book 1, p. 9; 1737, pl. 70; Fig. 5).

The various extant terrestrial tetrapods associated with the identity of the unicorn were somewhat eclipsed by the discovery of the narwhal (*Monodon monoceros* Linnaeus, 1758), a toothed whale found in Arctic seas (but exclusively referred to as a fish until the late eighteenth century; e.g. Pomet 1712, p. 233). The male (and occasionally also female) narwhal has a single 'tusk', which is an elongated, left-handed (sinistral) spirally coiled left canine which erupts through the tissues of the upper jaw. The canine grows forward continuously through life and may attain lengths of over 3 m. Long believed to function in inter-male rivalry, it is actually a sophisticated sense organ (Nweeia *et al.* 2014).

By the twelfth century, the trade in narwhal tusks between northern fishermen and Europeans was certainly established, and the tusks themselves, rare as they were, fetched astronomical prices – as much as 10 times their weight in gold – driven largely by their burgeoning association with the unicorn, and their perceived alexipharmic and wider therapeutic properties. The growing appreciation of the unicorn as a 'fish' was reflected in the *Hortus Sanitatis* (de Cuba 1491, *De Piscibus*, Cap. lxii) where the 'Monoceron' was depicted, albeit as a winged tetrapod, together with the monkfish inhabiting the water

Fig. 5. Five different reconstructions of unicorns from Pomet (1737, pl. 70; author's collection).

Fig. 6. 'Monoceron' and the Monkfish, *Hortus Sanitatis, De Piscibus* Cap. lxii (de Cuba 1491). Countway Medical Library, New York.

(Fig. 6). One of the earliest scientific citations of the narwhal was made by Olaus Magnus (1490–1557). Fascinated by all aspects of the northern European and arctic regions, Magnus began working on a map in 1527, eventually publishing the *Carta Marina* in 1535 (Haft 2003). He included images of creatures believed to inhabit the cold northern waters, one of which sports the spiral tusk of the narwhal. In his definitive commentary on the map, Magnus remarks:

Fig. 7. Imaginary portrait of the 'Hornvall', redrawn from Magnus's 1535 map, *Carta Marina*, and published in Gessner (1670, p. 125) (author's collection).

Fig. 8. Portrait of Ole Worm (1588–1654). Reproduced by kind permission of the Wellcome Library, London.

> The Unicorn is a Sea-Beast having in his Fore-head a very great Horn, wherewith he can penetrate and destroy the ship, in his way, and drown multitudes of men. But divine goodnesse hath provided for the safety of Marriners herein; for though he be a very fierce Creature, yet is he very slow, that such as fear his coming may fly from him (Magnus 1555, p. 743; 1658, p. 228).

Olaus Magnus's image was used by Conrad Gessner to illustrate the 'Hornvall' in his *Fischbuch*, first published in 1563, but reissued in numerous later editions (Gessner 1563, 1670, p. 125; Fig. 7). Professor of Chemistry at Copenhagen University, Ole Worm (1588–1654; Fig. 8) was later presented with a narwhal skull by Chancellor Christian Friis of Kragerup (1581–1639). The specimen entered Worm's collection and was duly considered in the catalogue which he produced (Worm 1655, pp. 282 ff.; Fig. 9). Probably the most detailed descriptions appeared a few years later when Caspar Bartholin the Elder (1585–1629; Fig. 10), Professor of Medicine at Copenhagen University, published his *De unicornu ejusque affinibus et succedaneis*

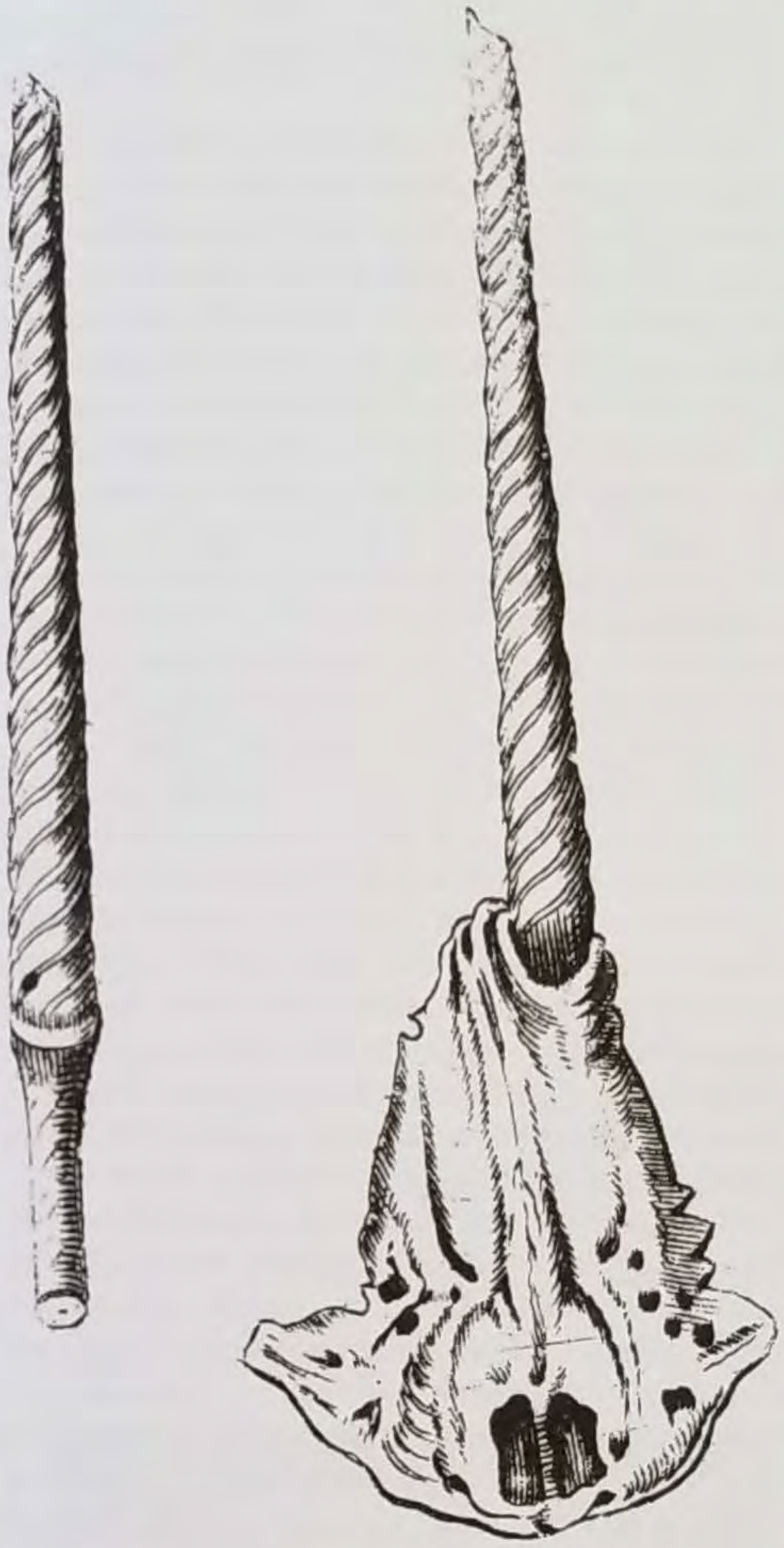

Fig. 9. Skull of the narwhal (*Monodon monoceros*) from Worm (1655). Reproduced by kind permission of the Wellcome Library, London.

Fig. 10. Portrait of Caspar Bartholin the Elder (1585–1629). Reproduced by kind permission of the Wellcome Library, London.

(Bartholin 1628). Caspar sired an entire dynasty of unicorn enthusiasts, his son Thomas Bartholin (Professor of Anatomy at Copenhagen University; 1616–80; Fig. 11) publishing possibly the most influential early modern work on the animal (Bartholin 1645; see also Bartholin 1654), for which his grandson Caspar Bartholin the Younger (1655–1738; Fig. 12; Professor of Philosophy at Copenhagen) published an enlarged second edition (Bartholin 1678).

Considering the dates of the earliest descriptions of narwhal teeth, specimens identified as unicorn horns have a surprisingly ancient pedigree. It has been suggested that two specimens were sent in 1095 by Conrad, Bishop of Utrecht, to his brother Wolfram of Bettingen, who served as Abbot at the

Fig. 11. Portrait of Thomas Bartholin (1616–80). Reproduced by kind permission of the Wellcome Library, London.

Fig. 12. Portrait of Caspar Bartholin the Younger (1655–1738). Reproduced by kind permission of the Wellcome Library, London.

Benedictine Abbey at Prüm in Lorraine from 1077 to 1103 (Einhorn 1988, p. 343). The gifts are recorded in the *Chronicon Sancti Huberti Andaginensis* (Chronicle of the Benedictine abbey of St Hubert, situated at Andage in the Ardennes), probably written by the Abbey's cantor and scholaster, Lambertus Junior, around the year 1100 (Dierkens 2010). The use of the term '*cornua eburnea*' to describe these gifts (Migne 1881, p. 1428), however, suggests that they were actually oliphants (carved elephant tusks) rather than narwhal teeth (see Salem 2004 for a general account of oliphants).

A rather more confident identification can be ascribed to the unicorn horn cited by the Dominican priest Thomas of Cantimpré (Thomas Cantimpratensis; 1201–72) while he was Professor of Philosophy and Theology at Louvain. In the notes to his allegorical work on the conduct and duties of superiors and subjects, told by reference to communities of bees (*Bonum universale de apibus*), Thomas mentions the presence of a 7 foot long unicorn horn at a church in Bruges (Thomas Cantimpratensis 1627, p. 86).

Possibly the most celebrated example of a medieval ecclesiastical unicorn horn is that which formed part of the treasure of Saint Denis Cathedral in Paris. The horn was supposedly given to Charlemagne (Charles the Great; died 814) by 'Aaron, King of Persia', about the year 807 (Félibien 1706; Conway 1915). Charlemagne's grandson, Charles the Bald (823–877), gave a specimen to the cathedral and it was hung above the Matutinal altar during the time of Abbot Suger (*c.* 1081–1151), who was responsible for the rebuilding and enlargement of the Abbey in 1135. Gerolamo Cardano (1501–76) studied the specimen quite closely when he visited the cathedral, and it was also seen by the famous diarist and traveller, John Evelyn (1620–1706) (Shepard 1930, p. 106; see also Topsell 1658, p. 554). It is unclear whether or not this is the same horn that was kept in a dark vault with one end resting in a bowl of water; Johnston (1657, p. 238) states that 'this water is given to drink to those that go under the hollow arch; and so soon as they have drunk they suddenly fall into a great sweat'. The specimen is no longer available, being a casualty of the looting associated with the Revolution in 1793 (Shepard 1930, p. 106).

As trade with northern fishermen blossomed, narwhal tusks increasingly became sought after by merchants, apothecaries, the church, royalty and nobility for a variety of purposes – their supposed therapeutic properties, as status symbols and representatives of exotica for curiosity cabinets. An interesting contemporary perspective is given by Johnston (1678, p. 19), but otherwise see Shepard (1930), Beer (1977), Gotfredsen (1999) and Gerritsen (2011) for further details.

Unicorn horn goblets and épreuves

Healing cups fashioned from unicorn horn were mentioned in classical times by Ctesias and Aelian (see above). The Greek sophist Philostratus (*c.* 170/172 to 247/250) writes about 'wild asses-...which have a horn in their foreheads with which they fight like bulls, and not badly'. Drinking cups made from these horns (almost certainly from the rhinoceros) (Eells 1923, p. 64):

> have such virtue that the man who drinks from one will for one whole day neither fall ill, nor feel pain if wounded, nor be burned by passing through fire, nor even be affected by poisons which he could not swallow at any other time without harm. These cups are reserved for the king, and only the king may hunt these animals. Apollonius writes that he saw this beast and admired its appearance, and that when Damis asked him if he believed that story about the

horn cups, he said: 'I will believe it when I find that the king who rules this country never dies' (*Life of Apollonius of Tyana* III, ii).

The supposed antitoxic and alexipharmic qualities of the horn were exploited by pouring wine or other beverages directly into goblets carved from the horn itself. Rhinoceros horn cups are known from the collections of various noblemen and Renaissance collectors, and are well represented in modern museum collections (Fig. 13; Chapman 1999; Gschwend 2000; Mordhorst 2003). This is probably the horn to which Johnston refers when he writes:

> The ancient Indian Kings, who first arrived at the knowledge of this horne, made cups of it for themselves, that drinking out of them, they might fence themselves against poyson, drunkennesse, cramp, falling sicknesse, and other malignant diseases (Johnston 1678, p. 20).

Goblets carved from short lengths of narwhal incisors are currently known on the basis of around 20 specimens (Schönberger 1935, 1951) but, on the evidence of various inventories and artistic representations, were obviously highly sought after as *probae* or *épreuves* (testing agents to detect the presence of poisons and neutralize them) from the fourteenth century onwards, reaching the height of their popularity during the seventeenth century (e.g. Laborde 1849, p. 109; 1852, pp. 362 ff.; Novoa 2012). A unicorn horn goblet is, for example, featured in a miniature by Loyset Liédet (*c.* 1420–79); the miniature (dated 1470) shows Vasque de Lucène making a presentation of a book to Charles le Téméraire (Charles the Bold; 1433–77). A unicorn horn goblet is standing on the credenza behind and between the two title characters (Quinte-Curce, fifteenth century ms, Folio 1). A further, so far as I am aware, unrecorded depiction of a unicorn horn goblet is to be found in the Tapestry Collection of the Metropolitan Chapterhouse (Museo de Tapices de la Seo), which is associated with the Cathedral of Zaragoza, Spain. The tapestry is entitled 'Esher and Ahasuerus' and presents an image related to the Old Testament Book of Esther. Fashioned in the southern Netherlands around 1490, the tapestry was one of three executed in wool and silk which were presented to the cathedral by Archbishop Don Alonso de Aragon (1479–1520) in 1520 (Delmarcel 1999). The unicorn horn goblet and a bezoar are located at the centre top of the tapestry (Fig. 14).

Fig. 13. Assay cups made of silver and rhinoceros horn, 1551–1600; the horn was said to change colour and sweat if poison was placed in it. Reproduced by kind permission of the Wellcome Library, London.

Unfortunately, no examples have survived of the special healing pots which consisted of a bowl, usually made of gold, to which a fragment of unicorn horn was attached by means of a gold chain. The chain insured against accidental loss of the horn fragment, which was dipped into the bowl in order to test the food for poison, in much the same way as similar bowls with bezoar stone attachments (Barroso 2013, Fig. 13). Bowls of this type are known from the inventories of Charles the Bold (1433–77) and Louis, the Duke of Savoy (1413–65) – 'avec une chesnette, ou pend une rouelle de lycorne' (Gay 1928, p. 77; Schönberger 1935, p. 218).

Goblets were not the only kind of unicorn horn *épreuve*; it is reported that Tomás de Torquemada (1420–98), the Spanish Dominican friar and first Grand Inquisitor, in fear for his life, habitually kept a sample of unicorn horn on his table in order to detect and neutralize poisons (Mérat & de Lens 1832, p. 448). Also, the physician John Swan (dates unknown, but died 1671) wrote:

> This horne hath many sovereign virtues, insomuch that being put on a table furnished with many junkets and banqueting dishes, it will quickly descrie whether there be any poyson or venime among them, for if there be the horne is presently covered with a kind of sweat or dew (Swan 1635, p. 235).

Similarly, Edward Topsell (1658, p. 555) comments that

> the horn of this Beast being put upon the Table of Kings, and set amongst their junkets and bankets doth bewray the venom if there be any such therein, by a certain sweat which cometh over it.

Fig. 14. 'Feast of Ahasuerus and downfall of Queen Vashti (Astin)'. Image of the left-hand half of a tapestry (height 4.191m) in wool and silk (*c.* 1490) gifted by Archbishop D. Alonso de Aragón (Inventory of 1521) and now in the collection of the Metropolitan Chapterhouse (Museo de Tapices de la Seo), associated with the Cathedral of Zaragoza, Spain. Two 'unicorn horn' goblets are depicted and framed by white rectangles; one is on the far left of the banqueting table, while the other is located on the stepped stand of tableware behind and to the right of the table and participants in the feast. Both goblets are lidded and have the characteristic spiral ornament of segments of narwhal tusk. Digital image courtesy of the Getty's Open Content Program.

The inventories of the Dukes of Burgundy record in 1391 a unicorn *épreuve* which was mounted in gold and attached by chain and ring; in 1405 a specimen of unicorn horn to put into a pot of wine; in 1416 a touching piece (*tousche*) which held a piece of unicorn horn for touching against the nobleman's meat; and in 1467 an *aiguière* (water jug of unicorn horn, set in gold) (Wright 1857, p. 26).

In a very early account, Mahmūd al-Kāšgari (dates unknown; Dankoff 1975) wrote of unicorn

horn (Turkish – *čatuq*) in his study (*c.* 1075) of the folk-beliefs of the Turks (*Dīwān Luġāt al-Turk*, III, 164, 9–12), stating that it is:

> The horn of a deep-sea fish, which is imported from China. Some say, it is the root of a tree, from which knife-handles are made. By it poison is tested, when it is in food. The broth or whatever it may be is stirred with it in a wooden bowl, and the food boils without fire; or this horn is placed on a bowl, and it sweats without steam (Sprengling 1939, p. 297).

Prophylactic gems

A wide variety of jewels were believed to act prophylactically by preventing the wearer from catching certain, often specific, diseases (Blaen 2016). Amber, for example was believed to protect against various diseases of the head and throat, plague, cramp, soreness of the eyes and various elements of witchcraft (Duffin 2013*c*), while emeralds were carried against epilepsy. Bezoar stones, rich in calcium and phosphate like the various materials proposed as unicorn horn, were mounted as cabochons in rings and were encased in fine gold filigree to be worn as pendants in order to counteract the effects of poisons (Duffin 2013*a*). Fragments of unicorn horn were also worn because of their supposed antitoxic qualities, although few actual specimens survive to this day (Clifford Smith 1914; Victoria & Albert Museum 1925; Duffin 2015). The Inventory of Graf Eberhards III von Württemberg (died 1417) records the presence of four gold rings with toadstones and 'ainhúrn' in the collection (Molitor 2008, p. 323). Laurent Catelan (1567–1642), a Catalan apothecary in Montpellier, states that unicorn horn was sometimes employed amuletically by either carrying a fragment in the mouth or tying it in ribbon so that it rested against the chest, the effect being 'merveilleux & utile' (Catelan 1624, p. 22).

The Danny Jewel (Fig. 15) is named from Danny Park, an Elizabethan estate in Sussex, England. The jewel itself consists of a semi-circular, boat-like half-section of a narwhal's tusk, set in an enamelled gold mount and suspended from a ring by three gold chains. The top, straight, cut edge of the tusk is secured in a shallow band with a central circular boss at the front. The enamel covering over the gold is of champlevé type, a technique which involved filling troughs carved into the mount with vitreous enamel, followed by firing, cooling and polishing. The enamel decoration on the upper part of the mount consists of scrolls of arabesque foliage on a black ground, while the front band and its central boss are ornamented with an interlacing strapwork pattern of blue and white with a central foliage motif. The band covering the cut surface of the tusk arches over the top half of the boss, bearing a

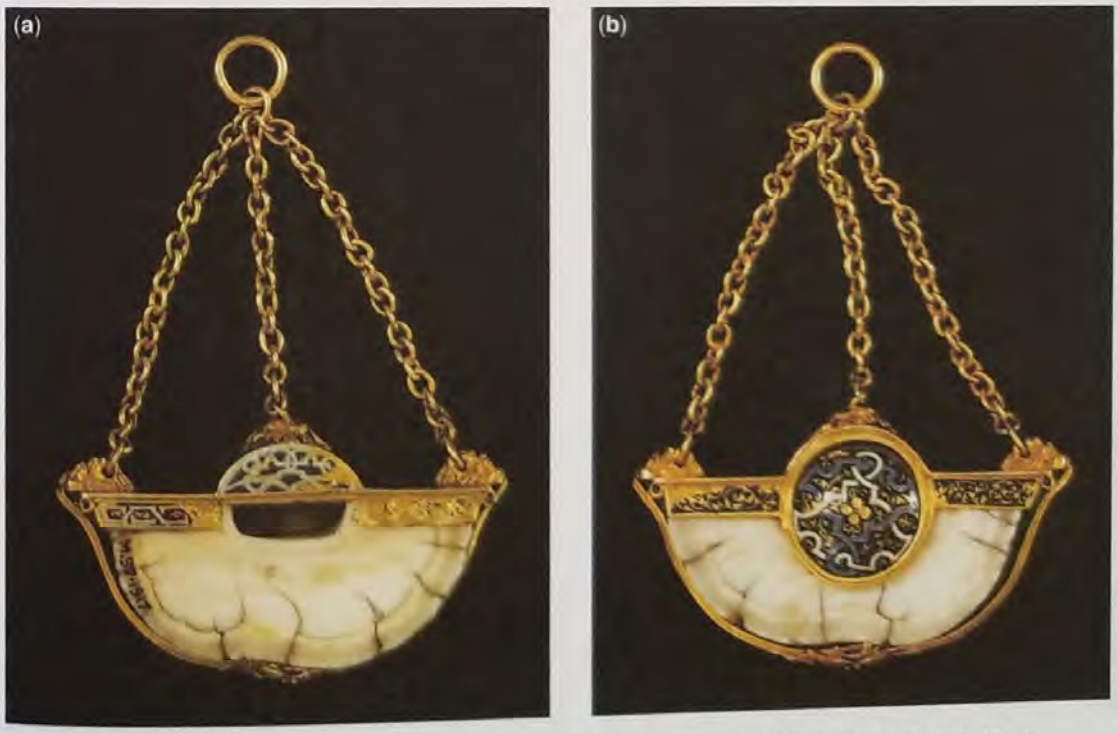

Fig. 15. The Danny Jewel, an Elizabethan unicorn horn pendant; V&A M.97–1917 © The Victoria & Albert Museum, London. Reproduced by kind permission of the Victoria and Albert Museum, London.

Fig. 16. Portrait of Otto von Guericke (1602–86). Line engraving by C. Galle, 1649, after A. von Hulle. Reproduced by kind permission of the Wellcome Library, London.

Fig. 17. Portrait of Gottfried Wilhelm von Leibniz (1646–1716). Reproduced by kind permission of the Wellcome Library, London.

(1875–1946; Fig. 21), the Austrian palaeontologist who effectively founded the discipline of palaeobiology (Rieppel 2013*a*, *b*), wrote his groundbreaking work on the folklore of fossils (Abel 1939), he gave close consideration to the reconstructions given by Leibniz and Valentini, since the fossil material from Quedlinberg was, by then, lost. Abel concluded that the bones used as the basis of the reconstruction must have come from at least two different taxa. The skull belonged to a woolly rhinoceros (probably *Coelodonta antiquitatis*), while the teeth, scapula and vertebrae (including the circular structure at the base of the reconstructed spine – an atlas, or first cervical vertebra) all came from a mammoth (*Mammuthus primigenius*). The reconstructed horn may be the tusk of a juvenile mammoth, or perhaps even a different fossil elephant genus, perhaps *Palaeoloxodon*.

Baumann's Cave in the Devonian limestone at Rübeland near Elbingerode was rich in cave bear (*Ursus spelaeus*), cave hyaena (*Crocuta crocuta spelaea*) and associated bone deposits which were extensively mined in the early seventeenth century for medicinal material (Kempe 2006). Johann Daniel Horst (1616–85), one of a familial dynasty of medical doctors and Court Physician to the Landgrave of Hessen-Darmstadt, visited the cave while he was a guest at Castle Scharzfels, citing the bones which he saw both there and at the relatively nearby Einhornhöhle (1.5 km NW of Scharzfeld) as being similar to those of bears, lions and humans. By 1703, Behrens reported that local peasants, working the cave floor deposits for 'fossile unicorn' to sell to apothecaries and druggists, had almost exhausted workable stocks in the cavern (Behrens 1703, 1764, p. 332). He further indicates that 'the whitest and mellowest' is reckoned the best and esteemed as 'a medicine of extraordinary efficacy' as an absorbent, astringent and sudorific, and used topically to 'serve in pustulary eruptions and erosions about the pudendum and fundament in children, and in eye waters' (Behrens 1764, p. 334).

It was records like these that established the idea of fossil unicorn simples or *Unicornu Fossile*. Fossil ivory recognized as *Unicornu Fossile* was, for example, relatively well known from Moravia

gold floral rosette to which is attached the central member of the three chains used to suspend the jewel; the other two chains attach to a pair of lion-faces, one at either end of the top mount. The band which encloses the lower, convex border of the tusk has a central rosette bearing the remains of a gold ring from which a pearl may have originally been suspended.

The back of the Danny Jewel is marked by numerous scratch marks, probably made for the production of protective powder to be suspended in various drinks. Alternatively, the jewel might have been worn as a protective amulet, affording a protective prophylactic against poison or the plague. Its shape also suggests that it could have been dipped into liquids in order to cleanse them of impurities, much as some types of bezoar were (Duffin 2013*a*, *b*).

In an echo of Hildegard von Bingen's comments, Williams (1660, pp. 1–2) states that

> The Hoof of the Unicorn is better than his Horn, and being worn about a man in any place, no infection can have power on him; yet the Horn is very pretious also, and being so worn, it cureth the Falling sickness.

I have found no further references to unicorn hoof, which may be conflated by Williams with Elk's Claw (*Ungula alcis* or *Magna Bestia* – the 'Great Beast'), an item commonly used at the time both amuletically and taken internally against epilepsy. Schröder (1659, p. 2), for example, writes:

> The hoof [of the Elk] is famous for its specificall vertue against the falling sicknesse, both by preventing and also curing it, and that as well inwardly taken, as outwardly used: Inwardly is given its powder, and the preparations subjoyned. Outwardly a piece of it is inclosed in a Ring, and is worn on the fourth finger, so that it look towards the palm of the hand. In like manner it is 1. held in the hand; 2. is applyed to the pulse; 3. is put into the left ear; 4. is hanged about the neck that it touch the skin.

Anthoinette de Saveuses (dates unknown), a nun at a convent in Dunkirk, was a regular correspondent of Honor Grenville (*c.* 1493/5–1566), daughter of Sir Thomas Grenville (died 1513), and later as Honor Plantagenet, Viscountess Lisle, second wife of Arthur Plantaganet, an illegitimate son of King Edward IV (1442–83) and half-brother to Queen Elizabeth of York (1466–1503). Writing to Honor on 31 August 1537, while she was residing at the Staple Inn in Calais on account of her husband's appointment as Lord Deputy, a royal official for the town, Anthoinette said,

> I had formerly a fine piece of the point of a unicorn's horn, which had been given me by a great lady, of which I was very careful on account of its properties. I lent it to a sick person, and on asking for it again was told that it had been stolen. This little piece was given to me to be set, and there is no goldsmith here. I beg you to have it done for me (Gairdner 1891, p. 226).

In addition, 6–48 grain doses (approximately 360 mg to 2.8 g) of unicorn horn powder were apparently suspended in amulets worn about the neck, or set into a finger ring in order to afford personal protection (Mérat & de Lens 1832, p. 448). It was also judicious to have a utilitarian jewel; Monardes (1580, folio 138) states that,

> It is good to have a peece of a right Unicornes horne in a small cheyne of golde, that it may bee swilled continually the water that shalbee dranke. It would doe well, for not onely it taketh away the suspition of the venom, but doeth put to the drinke a marvellous cordiall vertue.

Such was the value of unicorn horn, in monetary, prophylactic and therapeutic terms, that unicorn horn jewels became family heirlooms. Sir Nathaniel Bacon (1546?–1622), half-brother to Sir Francis Bacon (1561–1626) and a politician who worked in county government, bequeathed to his three daughters in his will (Bacon 1614 in Lemon & Green 1872, p. 541)

> the jewel of unicorn's horn, according their mother's direction, that each one may challenge the use thereof when needs require, and my wife may have the use thereof when she needs, but my daughter [Anne] Townshend is to have the custody thereof for life.

True, false and fossil horns

In 1663, while being worked for lime, a quarry in the gypsum karst (Kempe 1996) near Quedlinberg, a town just north of the Harz mountains in north central Germany, yielded bones which looked as though they belonged to a single terrestrial animal. The physicist, inventor and Mayor of Magdeburg, Otto von Guericke (1602–86; Fig. 16), was present at the time of the discovery and mentioned the find in his pioneering work on the physics of vacuums, *Experimenta Nova* (von Guericke 1672, p. 155). The bones were excavated and taken to the abbess of the town, and also reported to Gottfried Wilhelm von Leibniz (1646–1716; Fig. 17), the famous German mathematician and philosopher. He included a reconstruction of the animal in his *Protogea* (Fig. 18; Leibniz 1749, p. 64; Cohen & Wakefield 2008, p. 101; Ariew 1998; for the relations between von Guericke and Leibniz, see Krafft 2013). Another reconstruction (Fig. 19), clearly related to the image published by Leibniz, was provided by Michael Bernhard Valentini (1657–1729; Fig. 20), Professor of Medicine at Giessen (Valentini 1704–14, p. 481). Valentini indicated that the reconstruction was based upon on a sketch sent to him by Johann Mäyern, an astronomer and town chamberlain ('Camerario') at Quedlinberg (Valentini 1704–14, p. 483). When Othenio Abel

Fig. 18. Reconstruction of the Quedlinberg unicorn, from Leibniz (1749, p. 64). Reproduced by kind permission of the Wellcome Library, London.

(Gregorová 2006), being described by the German physician and alchemist, Johann Ferdinand Hertodt von Todtenfeld (1645–1724) (Hertodt 1669, p. 30), and also Thomas John Pesina of Čechorod (Jan Tomáš Pešina z Čechorodu; 1629–80), a Czech Catholic priest who served as titular Bishop of Smederevo (now in Serbia) from 1674 onwards. A passionate student of the historigraphy of Moravia, his *Mars Moravia* (Pesina 1677 – see p. 58) is a fundamental work on Moravian provincial history. Pesina quotes Oswald Croll's *De signaturis internis rerum*, a work first published in Latin in 1609, and then in German translation in 1623. In it, Croll (1563–1609), a champion of paracelsianism, alchemist and Professor of Medicine who spent his final years under the patronage of Rudolph II at Prague, 'reconciled the theory of signatures to medical goals. The treatise aimed at teaching physicians to read the book of nature with inner eyes' (Moran 1998, p. 326). Croll (1609, p. 4) remarked on the discovery of fossil bones and teeth at the base of a rocky cliff a short distance from Brno. The bones of this huge unknown animal (*Magnitudinis Animalium Incognitorum*) surely dated from the time of the Deluge (Kirchmaier 1660, Cap. I Sec. 3). Similar discoveries in Switzerland were summarized by Scheuchzer (1707, p. 188) (Fig. 22) and Johann Lorenz Bausch (also Johann Laurentius Bausch, 1605–65; Schott 2008; Fig. 23), *Stadtphysicus* of Schweinfurt in Bavaria and founder of the *Academia Naturae Curiosorum*, who collected records of fossil bones from many towns and cities, especially in Germany (Bausch 1666, p. 189 ff.). The Parisian

Fig. 19. Reconstruction of the Quedlinberg unicorn, from Valentini (1704–14, p. 481). Reproduced by kind permission of the Wellcome Library, London.

Fig. 20. Portrait of Michael Bernhard Valentini (1657–1729). Reproduced by kind permission of the Wellcome Library, London.

Fig. 21. Photographic portrait of Othenio Abel (1875–1946), by kind permission of Dr Klaus Taschwer.

Fig. 22. Portrait of Johann Jacob Scheuchzer (1672–1733). Reproduced by kind permission of the Wellcome Library, London.

apothecary, physician and Professor of Chemistry at the Jardin du Roi, Etienne-François Geoffroy (1672–1731), even included the wide diversity of Eocene fossil mammal remains yielded by the gypsum deposits quarried in Lutetian limestones at Montmartre, then a hill outside the city limits of Paris. The fossil fauna was later described by the likes of Robert de Paul de Lamanon (1752–87) and Georges Cuvier (1769–1832) (Lamanon 1782; Cuvier 1798 *in* Rudwick 1997, p. 35 ff.).

These records prompted a flurry of relatively short dissertations and disquisitions towards the end of the seventeenth century, mostly made by medical candidates at various German and Dutch universities (e.g. Berens 1667; Vater 1679; Beyer 1680; Anonymous 1696, 1794; Stalpart van der Wiel 1727). The main foci of most of these enquiries are generally the possible identity of the unicorn as described in classical texts, interpretations of the unicorn in Christian imagery and allegory through biblical exegesis, and summaries of the fossil material, usually with only occasional passing reference to any perceived therapeutic properties. There was also discussion as to whether the fossil bones from Tonna, a town near Gotha in Thuringia, belonged

Fig. 23. Portrait of Johann Laurentius Bausch (1605–65). Reproduced by kind permission of the Wellcome Library, London.

Fig. 24. Portrait of Daniel Sennert (1572–1637). Reproduced by kind permission of the Wellcome Library, London.

to an elephant or not (Anonymous 1696; Tentzel 1697). The material began to be referred to as 'Gegrabenen Einhorn' ('dug' or 'excavated unicorn'), and 'Gegrabenen Helffenbein' ('dug ivory') (e.g. Hertodt 1669, p. 51). Certainly, Johann Jacob Scheuchzer (1672–1733), Senior Town Physician of Zürich at the time of his death, noted that many types of fossil bone seemed to be represented under this titular umbrella (Scheuchzer 1707), a comment which typified the conclusions of many of the aforementioned authors of dissertations about unicorns. Daniel Sennert (1572–1637; Fig. 24), prolific author, alchemist and Professor of Medicine at Wittenberg University, stated, for example, that

> such [fossil] horns are found, and not only horns but other bones which have the name of being good for healing wounds and broken bones, and for curing sores...These horns, experience has taught us, possess great power, especially in curing epilepsy, malignant fevers, plague, bowel complaints in children and other diseases. From this cirumstance they are commonly sold as unicorn's horn (Sennert 1651, p. 403; Kirchmaier 1660, Cap. I, Sect. 3; 1661, Cap I, Sect. 3; 1736, p. 24; Goldsmid 1886, p. 54).

The discoveries also prompted a debate as to what constituted the 'true' unicorn horn or *Unicornum Verum*. For German authors, the retrospective view is that mammoth tusks and other fossil bones were supposedly identified as *Unicornum Verum* and narwhal tusks were downgraded to the status of *Unicornum Falsum* (Abel 1919, p. 142; Wendt 1970, p. 35; Gruber 1980, p. 240; Rosendahl *et al.* 2005, p. 204; Brauckmann & Gröning 2011, p. 64). Christoph Vielheuer (dates unknown; Hein 1969), an apothecary in Landeshut, Silesia (now Kamienna Gora, Poland), was keen to explain that the *Unicornum Verum* was a terrestrial animal, as distinct from *Unicornu Marinum*, the narwhal; he illustrated the first volume of his work describing exotic materials used in the drug trade with images of both unicorn candidates, each sporting a spiral horn (Vielheuer 1676, p. 195; Fig. 25). The situation as summarized by twentieth-century authors is by no means straightforward, however, and requires more careful analysis than current space allows. There were clearly differences of opinion as to the identity of *Unicornum Verum*: Hubners (1736, col. 2212) and Ernstingium (1770, p. 1459), for example, both identify *Unicornu Marinum* as *Unicornu Verum* (see also Woyt 1737, p. 979). König (1698, suppl.), however, lists rhino horn, *Unicornum Marinum* and *Unicornum Verum* as three separate simples in his list of diaphoretic drugs. Johann Heinrich Zedler (1706–51), a bookseller and publisher in Lepizig, produced an enormous comprehensive encyclopaedia running to 68 volumes over

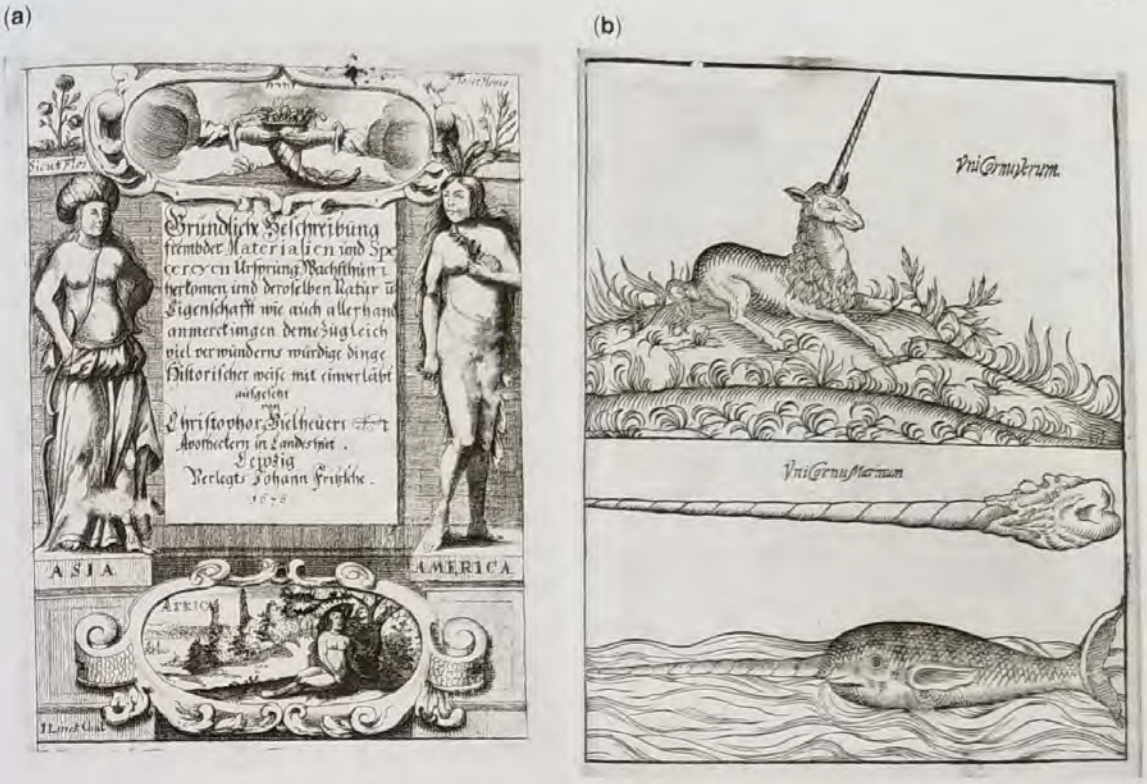

Fig. 25. Title page of Vielheuer (1676) and his images of true and false unicorn (p. 195). *Unicornu Verum* refers to true unicorn horn obtained from a terrestrial quadruped, and *Unicornu Marinum* is the marine or false unicorn horn obtained from the narwhal. Reproduced by kind permission of the Wellcome Library, London.

a 22-year period from 1732 to 1754 (Blühm 1962); it was entitled the *Grosses vollständiges Universal-Lexicon aller Wissenschafften und Künste* (Great Complete Encyclopedia of All Sciences and Arts). In one section on Bezoar stones alone, Zedler adds to the confusion by using all the following terms as if they each mean something different: *Unicornu Verum*, *Unicornu Veri Marini*, *Unicornu Mineralis*, *Unicornu Animalis*, *Unicornu Solaris*, *Unicornu Fossilis*, *Unicornu Fossilis Albissimus* and *Unicornu Marinus* (Zedler 1732–54, vol. 3, cols 1666–82). From elsewhere in the encyclopaedia it is clear that he considered *Unicornu Marinum* to be *Unicornu Verum*, and *Unicornu Minerale* and *Unicornu Fossilis* both to represent fossil material (*Dens Elephantis Petrefactus*, but see below; Zedler 1732–54, vol. 7 col. 576; vol. 8 col. 560; vol. 49, col. 1636). Whatever the position, it is certainly true that, in terms of material culture, glass apothecary jars labelled *Unicornu Fossile* and *Unicornu Verum* survive in continental museum collections (Gregorová 2006, p. 93; Fig. 26).

The spiral coiling of the horn, besides being so characteristic of the narwhal tusk, was also described for *Ceratites lapis*, another fossil candidate for the unicorn horn (Mercati 1717, p. 323; Fig. 27). Anselm Boetius de Boodt (1550–1632; Fig. 28), Court Physician and one of the founders of mineralogy, attempted a classification of minerals in his *Gemmarum et Lapidum Historia* (History of

Fig. 26. Glass apothecary jar for storing *Unicornu Fossile*. By kind permission of Museu da Farmácia, Lisbon.

Fig. 27. *Ceratites lapis* from Mercati (1717, p. 323). Reproduced by kind permission of the Wellcome Library, London.

Fig. 28. Portrait of Anselm Boetius de Boodt (1550–1632). Reproduced by kind permission of the Wellcome Library, London.

Fig. 29. Sir Thomas Browne (1605–82). Line engraving by R. White, 1686. Reproduced by kind permission of the Wellcome Library, London.

Gems and Stones; de Boodt 1609, 1636, 1644, 1647; Duffin 2013*d*). De Boodt found that a wide variety of petrified materials was included under *Ceratites*. In the assessment of Sir Thomas Browne (Fig. 29) (1672, Lib. 3, Cap. 23, p. 183):

> Although there be many *Unicorns*, and consequently many Horns, yet many there are which bear that name, and currantly pass among us, which are no Horns at all. Such are those fragments and pieces of *Lapis Ceratites*, commonly termed *Cornu fossile*, whereof *Bætius* had no less then twenty several sorts presented him for *Unicorns* Horn. Hereof in subterraneous cavities, and under the earth there are many to be found in several parts of *Germany*; which are but the lapidescencies and petrifactive mutations of hard bodies; sometimes of Horn, of teeth, of bones, and branches of trees, whereof there are some so imperfectly converted, as to retaine the odor and qualities of their originals: as he relateth of pieces of Ash and Walnut. Again, in most if not all which pass amongst us, and are extolled for precious Horns, we discover not an affection common unto other Horns; that is, they mollifie not with fire, they soften not upon decoction or infusion, nor will they afford a jelly, or mucilaginous concretion in either; which notwithstanding we may effect in Goats horns, Sheeps, Cows and Hartshorn, in the Horn of the *Rhinoceros*, the horn of the Pristis or Sword-fish. Nor do they become friable or easily powderable by Philosophical calcination, that is, from the vapor or steam of water, but split and rift

> contrary to other horns. Briefly, many of those commonly received, and whereof there be so many fragments preserved in *England*, are not only no Horn, but a substance harder then a bone, that is, parts of the tooth of a Morse or Sea-horse; in the midst of the solider part containing a curdled grain, which is not to be found in Ivory. This in Northern Regions is of frequent use for hafts of knives or hilts of swords, and being burnt becomes a good remedy for fluxes: but Antidotally used, and exposed for *Unicorns* Horn, it is an insufferable delusion; and with more veniable deceit, it might have beene practised in Harts-horn.

Far from being accepted as proof that these specimens could not belong to the unicorn, the list of properties was embraced as typifying *Unicornu Fossilis*!

Andrea Cesalpino (1519–1603; Fig. 30), Director of the botanical garden at Pisa, was the first to suggest that *Lapis arabicus*, as described by Pedanius Dioscorides (*c.* AD 40–90) in his famous forerunner of the pharmacopoeia, *De Materia Medica*, constituted an early description of the fossil ivory subsequently ascribed to the unicorn (Cesalpino 1596, p. 141). The full text of Dioscorides' short entry for *Lapis arabicus* is as follows (Lib. V, cap. 131; Beck 2011, p. 398): 'The stone called Arabian resembles flawless ivory. This stone dried up haemorrhoids when applied ground up, and after it is burned it becomes dentifrice'.

Subsequent authors incorporated *Lapis arabicus* into the list of synonyms for *Unicornu Fossile*, and Dioscorides' entry is presumed to be the original source for later indications that it was used in the treatment of haemorrhoids (see below for further details).

Another name used in reference to *Unicornu Fossile* was *Spodium Eboris* (e.g. Geoffroy 1757, 1736, p. 375; he also uses the term *Ebur Ustum*). In older texts, spodium usually referred to bone charcoal, although in alchemical literature it often refers to any material which has been calcined to produce an oxide. Numerous other texts seem to apply *spodium eboris* to calcined ivory from extant species.

The final synonym for *Unicornu Fossile* is *Lithomarga Alba*. *Lithomarga* (literally 'stone marl'), a name which was applied to a wide range of materials, often weathering products found in crevices and cavities. Colour seems to have been an important distinction in this case.

Schröder (1698, p. 355; Fig. 31) recognized two sorts of fossil unicorn – true and false. The latter consisted of structures exactly like animal bones which he believed had been naturally calcined within the earth through the action of hot and humid exhalations. True *Unicornu Fossile*, he explained, was so named because of its resemblance to narwhal tusk and ivory. Thus, effectively, true fossil unicorn embraced *Cornua Lapis* and fossil

Fig. 30. Portrait of Andrea Cesalpino (1519–1603), Italian physician, philosopher and botanist. Line engraving by Giuseppe Zocchi (1765) after F. Allegrini. Reproduced by kind permission of the Wellcome Library, London.

elephant remains, while false fossil unicorn was any other fossil vertebrate material.

Woolly mammoth (*M. primigenius*) remains are, of course, famously found in the Russian permafrost; Siberian mammoth ivory began to reach Europe from the eleventh century onwards, largely traded through China. Pfizenmayer (1939, p. 4) records the Manchu version of Yakut folklore, probably brought back by Chinese merchants from Siberia, which tells of Fen-Schü (the digging mole of the north), Yn-Schü (hidden mouse), Schü-Mu (Mother of mice), Ice Rat or Mountain-stream Rat. Part of his account reads as follows:

> Far in the north, in the land of the Russians, these rats, as large as elephants, live in the ground. When air or sunlight touches them, they die immediately. The flesh of this animal is ice-cold, and very efficacious in fevers.

The accompanying description of the carcasses makes it clear that examples of frozen mammoths are being considered. Sir Hans Sloane (1660–1753) was the first European scientist to study

Fig. 31. Portrait of Johann Schröder (1600–64). Line engraving by S. Furck. Reproduced by kind permission of the Wellcome Library, London.

mammoth remains from Siberia (see also Tatischow 1729). Noting them to be fossil elephants, he also refers to the folklore history of the species:

> The Russians believe them to be the Teeth and Bones of an Animal living under Ground, larger than any one of those above Ground. They use it in Physick in Lieu, and for the same Purposes with the Unicorn's Horn. (Sloane 1727, p. 457)

Part of Sloane's fossil collection, including a mammoth tooth from the Pleistocene of Siberia, is still available in the Natural History Museum, London (Sendino 2016, p. 14, fig. 4).

Sir John Hill commented that *Unicornu Fossile* was 'no other than a terrene or debased Spar' which he recognized as diagenetic minerals occupying the pore space of fossil bones, but also fossil wood and other materials, thereby accounting for the wide range of fossils to which the name has been applied (Hill 1751, p. 260). Hill goes on to give an idea of the range of morphologies, different degrees of fossilization, geographical distribution and properties of the material.

Medicinal use of fossil unicorn horn

The link between fossil ivory and *Unicornu Fossile* is strengthened by the survival of actual specimens, duly labelled, in historical collections. A fairly large fragment of mammoth tusk labelled *Unicornu Fossile* is present in the collections of the Naturhistorisches Museum in Karlsruhe, for example (Gregorová 2006, p. 94). The specimen was apparently donated in 1760 by the apothecary to Princess Caroline Louise of Bavaria. Figure 32 shows a weathered mammoth tusk 'unicorn horn' fragment in the historical collections of the Pharmazie-Historisches Museum of Basel University.

Edward Topsell (1658, p. 556) records the experience of landowner, Joannes Frikasz, whose

Fig. 32. *Unicornu Fossile*, Pharmacy Museum of the University of Basel, Switzerland. Author's photograph.

workmen struck bones 'found under the earth (not deeper then a foot)' while digging the foundations for a house 2 miles from Krakow. A complete skeleton was found and, suspecting its import, Frikasz assiduously collected all the chips of fossil ivory he could find. Topsell states that:

> The strength of this horn a penny weight thereof being put in Wine or water of Borage, healeth old Fevers, as also tertian or quartern Agues [types of malaria] of three years continuance, and cureth many diseases in mens bodies, as asswaging the pain of the belly, and making of those to vomit, who can by no means ease their stomachs.

Caspar Bartholin the Elder, in his summary paper of 1628, gathers together notices about fossil horns from earlier authors (Bartholin 1628, cap. X), recording citations of specimens from Italy, Thuringia, Switzerland, Saxony, Silesia, Misnia (Meissen) and Moravia. He notes that the application of the horn is recommended in any cases of poisoning, including bites from venomous animals. It is also good against all types of fever, but particularly those that are malignant. If administered, it strengthens the effects of other medicines with similar properties, such as Lemnian Earth. Doses of a drachm (3.89 g) to a scruple (1.296 g) could be administered in any appropriate liquid vehicle; if no fever was present, it could even be taken in wine. The alexipharmic properties of this medicinal simple also led to strengthening of the heart. Bartholin makes the point that not all fossil horns are equally efficacious; their power depends on factors such as their overall morphology and origins. He suggests that the specimens which can easily be reduced to a powder and stick firmly to the tongue are likely to be the most effective. In addition to the general alexipharmic properties of fossil unicorn horn, he indicates that it can be used to treat, either as a powder or in the form of small pills, syncope (temporary loss of consciousness), heartburn ('cardiac passion'), palpitations of the heart (*cordis tremorem*), epilepsy (particularly in children), worms, gonorrhoea, leucorrhea and bleeding ('fluxes' from the nose, thorax, haemorrhoids and wounds). When dropped into the eyes as a powder dispersed in milk it could also hold back tears, and by virtue of its drying properties, it was useful in the cicatrization (healing) of open sores and ulcers, as well as burns.

Some authorities recommend a straightforward preparation of unicorn horn powder. The Prague *Dispensatorium* (Anonymous 1739, p. 259), for example, advises levigating (i.e. grinding an otherwise insoluble substance to a fine powder) *Unicornu Fossile* and then mixing it with borage water in order to obtain a cordial medicine.

Bausch (1666) made a particular study of the therapeutic benefits of *Unicornu Fossile*, and many of his points concur with those made by Bartholin and others. He notes that the powdered horn was especially good for its drying, astringent and cicatrizing properties, as well as in cases of diarrhoea, gonorrheoa, leucorrhea, bleeding, haemorrhoids, wounds, 'bursting out of the chest' (*'thorace erumpentem'*) and drying lachrymal secretions when applied as a powder in milk (Bausch 1666, p. 195). He also adds that it is good against all fevers, as an antidote against plague and in the treatment of epilepsy, syncope, cardiac passion (heartburn) and heart tremors (Bausch 1666, p. 196 ff.). It would also correct looseness of the bowels, strengthen the liver and deal with worms. Applied topically, it was believed to ease chafing and be effective in cases of burns. Parr (1809, p. 686) also adds that fossil unicorn horn was used on the continent to treat 'tettery eruptions of children', possibly referring to dermatitis.

The Genevan physician and medical compiler, Jean-Jacques Manget (1652–1742; Fig. 33), gathered together a huge amount of information concerning *materia medica* from the writings of his medical colleagues and forerunners. He emphasizes that *Cornua Fossile* (Fossil horns) possessed astringent and drying properties, firmly stuck to the tongue and were good against all malignant

Fig. 33. Jean-Jacques Manget (1652–1742). Line engraving by J. G. Seiller after B. Guillibaud. Reproduced by kind permission of the Wellcome Library, London.

diseases ('*omnes morbos malignos*'; Manget 1703, Lib. XI, p. 57). He classified these fossils as belonging to the class of soft, less costly stones (*Lapidum Molliorum*).

In many other publications (e.g. de Boodt 1647, pp. 427–428; Lovell 1661, p. 96; Lémery 1721, col. 1200; 1760, p. 800), *Unicornu Fossile* or 'Unicornestone' was esteemed as an astringent and fortifier of the heart, and commended for stopping fluxes of the digestive system, gonorrhoea, blood loss owing to nose bleeds and haemorrhoids. Mixed with other ingredients it was used topically to cicatrize ulcers and, when incorporated into eye drops (collyries) supposedly helped to dry out weeping eyes (de Meuve 1689, pp. 633–634). It is often cited as a useful treatment for diarrhoeas and small pox (e.g. Etmuller 1702, p. 176), while Hoffmann (1728, p. 160) lists it (together with ivory, red coral, rock crystal, cinnabar and dragon's blood, amongst other ingredients) in a preparation designed to treat convulsions.

Johann Heinrich Cohausen (1665–1750; Fig. 34) was a physician and author, probably best known for his medical satires. He was also a serious iatrochemist and provides what seems to be a case history of the use of *Unicornu Fossile* in the treatment of epilepsy (Cohausen 1757, p. 192). He administered the fossil ivory with Tincture of Peony flowers in a drink of beer, and reinforced the dosage the following day with the added ingredient of *Cranium Humanum* (skull of a man who, preferably, had met with a violent death); the convulsions supposedly never reappeared. Indeed, the Polish Jesuit, teacher of diverse subjects and Rector of Ostrog (a monastery now in Montenegro), Gabriel Rzaczynski (1664–1737), commented that it was difficult to find a better or more successful simple in the treatment of epilepsy (also worms and heart conditions; Rzaczynski 1721, p. 8).

Several recipes specifically utilizing fossil ivory are recorded by Hertodt (1669, pp. 54–56) and Bausch (1666, pp. 198–199). For the plague and 'diseases with malignity' (*morbis cum malignitate*) Hertodt recommended a drachm of *Unicornu Fossili*, mixed with diaphoretic antimony (antimony III oxide – Sb_2O_3), mineral bezoar, Contrayerva root, animal bezoar and Magistery of Pearls, to which was further added *Confectio Alkermes* (a complex electuary mixture containing the 'Kermes Berry' – the scale insect *Kermes vermilio*), tincture of bezoar, scorzonera root, tormentil, the rhizome of elecampane (*Inula helenium*), berries of herb Paris, juniper and citron peel. They also recommended that fossil unicorn should be mixed with *Terra Sigillata*, chalk and antimony trioxide, bound together with white tragacanth, scordium water (from Water Germander?) and scorzonera and then worked into beads. A dose of one to two drachms was given to patients suffering from malignant diseases and smallpox. Bausch (1666, p. 198) calls this preparation *Globulorum Bezoardicorum*. In a third receipt provided by Hertodt, deer horn, burnt ivory, ?crab's eyes, pearl, red coral, white amber and Maltese earth are pulverized together in a mortar before adding spirits of citron and raspberry and the kneading it all into a paste. This was dried and then, just before use, sulphur and gold were added; a dose of a scruple to a drachm was given in water of deer antler tips or scorzonera. It was also recommended to be mixed with milk and applied to the surface of the eyes in order to prevent the flow of tears.

Fig. 34. Portrait of Johann Heinrich Cohausen (1665–1750). Reproduced by kind permission of the Wellcome Library, London.

Bezoar stones, gastric concretions obtained from a variety of animals but especially the bezoar goat, were extremely popular in late sixteenth and seventeenth century alexipharmic medicines. Demand rapidly outstripped supply, stimulating a burst of creativity in the production of artificial substitutes whose therapeutic properties supposedly matched those of the bezoar stone to a greater or lesser extent (Duffin 2010*a*, *b*). These creations, collectively referred to as *Bezoardica*, often contained bezoar stone as one of their constituents, combined with

other geological, zoological and herbal ingredients, each of which was usually accredited independently with antitoxic properties; *Unicornu Fossili* featured in several of these preparations (as do other unicorn horn varieties – see below). *Bezoardicum Extractum Solare* (Solar Extract of Bezoar), ascribed to Adrianus von Mynsicht (Fig. 35), incorporates *Unicornu Mineralis*, *Unicornus Solaris* (see below) and *Unicornu Animalis*, together with a bewildering array of roots, gums, resins, horn, oils, geological materials (*Terra Sigillata* and cinnabar) and complex preparations (e.g. Mithridatium and Andromachus' Theriac; Zedler 1732–54, vol. 3, col. 1668). *Bezoardicus lapis* (bezoar stone), ascribed to Johann Zwelfer (1618–68), contained, in addition to *Unicornu Fossile*, bezoar stone, Contrayerva root, diaphoretic antimony, rue leaves and gum tragacanth as a binding agent (Zedler 1732–54, vol. 3, col. 1676). The comparatively straightforward *Bezoardicus Pulvis Albus* (white bezoar powder) consisted merely of powdered *Terra Sigillata* and *Unicornu Fossilis* (Zedler 1732–54, vol. 3, col. 1676), while golden bezoar powder (*Bezoardicus Pulvis Aureus*) combined white fossil unicorn with occidental bezoar and was prescribed in cases of plague and other infectious diseases (Zedler 1732–54, vol. 3 col. 1677). A further series of recipes for various forms of Bezoardic powders (*Bezoardicus Pulvis*) for unspecified alexipharmic use are given by Zedler (1732–54, vol. 3 cols 1680, 1682) and Jüngken (1732, pp. 817–819; at least four receipts).

Fig. 35. Portrait of Adrianus von Mynsicht (1603–38). Line engraving by D. Dirickson. Reproduced by kind permission of the Wellcome Library, London.

Zwelfer (1668, p. 115) was seemingly leaving little to chance with his cordial and alexipharmic mixture of fossil unicorn horn, narwhal tusk, three types of bezoar (including the synthetic golden bezoar, see below), coral, pearls and various herbal ingredients.

Philip Fraundorffer specified the use of *Unicornu Fossili* in several of his medicinal recipes. The *Magisterium Anodynum* (a painkiller), for example, also employs, amongst others, Oculi Cancrorum, *Terra Lemnia*, rock crystal, Bezoar Jovialis, Regulus of Antimony (pure antimony), opium and gold leaf (Fraundorffer 1741, p. 94). He also includes fossil unicorn in his recipe for Orvietanum (Fraundorffer 1741, p. 104). Orvietan was designed towards the end of the sixteenth century exclusively as a counter-poison which, together with Mithridatium and Theriac, enjoyed great popularity. Unlike the latter two, however, Orvietan had its root in the sales of itinerant vendors or 'charlatans', who kept their formulae secret (see Catellani & Console 2004, 2005 for a detailed history; Fig. 36). The compound made its way into mainstream medical publications towards the end of the seventeenth century; many different versions of the recipe existed, but this is the only one I have come across which includes *Unicornu Fossile* as a component. Fraundorffer also includes *Unicornu Fossile* in several powders – his version of *Pulvis Bezoardicus* and *Pulvis Epicerasticus*, which contains further geological ingredients (haematite, Armenian Bole, Maltese earth and rock crystal; Fraundorffer 1741, pp. 122, 126).

As late as the first two decades of the eighteenth century, *Unicornu Fossilis* was still being used in treatments for plague. Ulbrich (1793) gives details of a receipt for the 'Bezoardic sweating powder' (*Bezoardisches Schweißpulver*) used during the 1718–19 outbreak of plague in Kronstadt, a town on Kotlin Island in the administrative district of St Petersburg, Russia. The recipe called for a pound each of *Unicornu Verum*, deer antler, Armenian Bole, crab's eyes (astacid gastroliths), half a pound each of 'Schwefelblut' (literally, sulphur blood; perhaps red sulphur, a mixture of sulphur and mercury) and saltpetre (potassium nitrate – KNO_3), plus four 'lath' of camphor. The powder was to be taken either in vinegar or hot beer (Kubacska 1928, p. 43; Abel 1939, p. 131; Gruber 1980, p. 240).

Liberating the essential quality of an herbal, animal or mineral simple by a variety of alchemical means was one of the legacies of Paracelsus, and many subsequent 'chymical' physicians prepared a variety of liquids in this way, oils figuring amongst

LE MARCHAND D'ORVIETAN DE CAMPAGNE.

Fig. 36. A quack selling orvietan to a crowd in a village square. 'Le marchand d'orvietan de campagne', nineteenth century. Reproduced by kind permission of the Wellcome Library, London.

them. Rather surprisingly, I have been able to trace only a few accounts of the use of unicorn horn oil. David de Planis Campy (1589 to *c.* 1644) was a French physician, surgeon and alchemist to King Louis XIII. He commended an 'Antidote pestilentiel' which contained 'Huile de Licorne minerale', by which he probably meant fossil unicorn rather than *Terra Strigensis*, as part of his 'Bouquet of the finest chemical flowers' (*Bouquet composé des plus belles fleurs chimiques*; Campy 1646, p. 547). The mixture was meant to be prepared in the form of an electuary, and the other ingredients, some of which remain obscure, testified to his reputation as an alchemist: extract of juniper grains, carline thistle root extract, scordium leaves, Contrayerva root, stag's horn, sublimated sulphur ('Fleurs de Soulphre'), 'Bezoar caralin', animal bezoar, tinctures of sunflower and saffron, essence of anis, white sugar, oil of angelica root and 'Larme de Cerf preparée'. The latter, also known as *Lacrimae Cervinae*, Kenne or Stag's Tears, are stones which feature in the *Hortus Sanitatis* (de Cuba 1491; Book V, Cap. 69) (Fig. 37). Stags were believed to eat reptiles in order to renew their strength. After feeding they searched for water, dived in and remained submerged until all the snake venom had been removed. Once purification was complete, the stag was believed to sweat hazelnut-like drops which lithified, trapping their medicinal properties within. It is not entirely clear what geological components were used as stag's tears. The mixture also included Chrysobezoar, or golden bezoar, which was a complex alchemical preparation, fashioned into pills, and whose main ingredients were gold and 'mercurii martialis' (Thom 1693, p. 530).

As with all valuable medicines, the possibility of frauds and fakes was always a concern. The Kingston-on-Hull physician and opponent of William Harvey's theory of the circulation of the blood, James Primrose (died 1659), observed that:

> Elephants teeth, and Whale-bones, and Sea-Horse teeth, and common hornes burnt, and those which are digged out of the earth, which we have spoken of, and other counterfeit and artificiall hornes, are commonly sold for the true Unicornes Horn. (Primrose 1651, p. 369)

Other authorities list artificially straightened elephant tusks and walrus teeth, various clays, the bones of dogs and pigs, limestone and stalactites as commonly found substitutes for the horn (see Shepard 1930, p. 116; Bartholin 1628, cap 7). A wide range of tests was therefore invoked to verify the true nature of the horn. 'Common people' tested fossil unicorn by immersing it in cold water; if bubbles rose from the specimen as the air was displaced by water penetrating the porosity, it was esteemed as being both genuine and of superior quality (Behrens

Fig. 37. Kenne or stag's tears from the *Hortus Sanitatis* (de Cuba 1491; Book V, Cap. 69). Countway Medical Library, New York.

1764, p. 334). In a similar vein, Topsell (1658, p. 554) remarks that a Parisian horn 'would boil in the wine', but was not confident of the test since 'other horns being burnt' gave the same result. He adds that

> there are some wicked persons which do make a mingle mangle thereof, as I saw among the Venetians (being as I hear say, compounded with lime and sope) or peradventure with earth and some stone: (which things are wont to make bubbles arise) and afterwards sell it for the Unicorns horn.

The Portuguese Jewish physician João Rodrigues de Castelo Branco (Amato Lusitano or Amatus Lusitanus; 1511–68) also argued vociferously against the effectiveness of this test, however, as the same result could be obtained by immersing any bone in water (Primrose 1651, p. 369). Frederick Hoffman (1660–1742), medical counsellor to King Frederick of Prussia and teacher of medicine at Halle University, recommended that doses of fossil unicorn were tried upon dogs before giving them to human subjects in a bid to avoid poisoning by any mineral contaminants (Behrens 1764, p. 335; Hoffman 1681). James Primrose also recommended testing powdered horn on poisoned dogs or chickens (Primrose 1651, p. 369).

Basil Valentine, supposedly a fifteenth century Benedictine alchemist, but more likely the German salt manufacturer Johann Thölde (*c.* 1565–1624), made several observations in his famous *Triumphal Chariot of Antimony* (Valentine 1660):

> If a little piece of Silver, hollowed, be made swim in a vessel full of water (wherein put some poison) place the said Horn thereunto, and let there not be any bodily or corporal touch, and yet shall see it to repel the said piece far from it, which will fly upon the Water, even as a Duck forseeing the Fowler; But if it be placed, viz. the Horn nigh to a piece of pure unadulterated Bread, swimming upon the Water, it will presently attract the Bread unto itself, without any corporal touch, and the Bread will follow the Horn round about, according as you move it, which is most miraculously wonderful in nature (Valentine 1660, pp. 45–46).

He also suggested placing a spider inside a circle drawn with 'the true and inadulterate Unicorns horn'. Since the (poisonous) spider 'flies from what is contrary to him', it would never be able to leave the circle (Valentine 1660, p. 45). John Johnston (1678, p. 20) records how:

> A jew of Venice, made a circle on a table with that horn, and cast then a scorpion, and a Spider within it, who had not the power to passe that circle: after that they being pluckt by it a hand high, whether by the shadow of it, or the virtue flowing from it, they were both kill'd, within the space of an hour.

Edward Topsell (1658, p. 557) cautions great care when buying unicorn from apothecaries, writing:

> But both the same colour, as also the substance being put too much, and eaten, if it be easily crummed, and not stuft as other horns, doth signifie the same not to be good or perfect, but counterfeited and corrupted: as perhaps the horn of some other beast burnt in the fire, some certain sweet odors being thereunto added, and also imbrued in some delicious or aromatic perfume; peradventayre also Bay by this means, first burned, and afterward quenched or put out with certain sweet smelling liquors.

One of the most exhaustive experiments performed on unicorn horn in order to test its alexipharmic potential was performed by Ole Worm and his two friends, Drs Fincke and Scheel, in the house of an apothecary (Woldenberg) on 3 October 1636 (Worm 1655, p. 287). Poison was administered to two specimens each of doves and kittens. Powdered unicorn horn was then given to one member of each species, the other acting as a control. One of the cats survived for several hours, rendering the results rather inconclusive. Similar experiments were conducted on pigeons (Linocier 1584, p. 717). A writer quoted by Fuller (1662, p. 195) makes the incisive comment: 'I believe few mountebanks will be so daring as to poison themselves on the security of such an alexipharmacon'!

Reverend J. G. Wood (1870, p. 539) quotes Topsell (1658, p. 558) as follows:

> For experience of the unicorn's horn to know whether it be right or not; put silk upon a burning coal, and upon the silk the aforesaid horn, and if so be that it be true, the silk will not be a whit consumed.

Hill (1751, p. 261) (Fig. 38) summarizes the therapeutic use of *Unicornu Fossile* as follows:

> It is esteemed a powerful Sudorific, Alexipharmic, and Astringent. They give it in malignant Fevers, and in Diarrhoeas, Dysenteries, the Fluor Albus, and Haemorrhages of all Kinds. It is also with many a celebrated Medicine in Epileptic Cases. The Dose is from a Scruple to a Dram. Some prefer the meduallry Part of the natural concretions [i.e. the calcite-filled pulp cavities], and others the cortical; but this Distinction is of the less Consequence, because impregnated Sticks and Bones are what are principally used, and these are throughout alike. There are Stories of Mischeif being done by some of the Masses of this Fossil, from their having been impregnated with asenical and other poisonous Effluvia while in the Earth, and the Apothecaries are generally careful enough to try a Part of a large Mass on Dogs before they venture to give it to their Patients.

Fig. 38. Portrait of Sir John Hill (1714–75). Reproduced by kind permission of the Wellcome Library, London.

Mineral unicorn

A medicinal earth was discovered around 1550 by Johann Schulz (1531–1604; also known as Montanus or Johannes Scultetus Trimontanus), the son of a barber-surgeon from Striga. Schulz qualified with an MD from Bologna University (1557) and went on to become Physician-in-Ordinary to Emperor Rudolf II at Prague. Whilst practising medicine in the Striga area of Silesia, now part of western Poland, Schulz came across the medicinal earth on the weathered surfaces of local basalts flanking what is now appreciated as the copper-producing Polish Zechstein Basin. Contemporary mines worked for gold and silver exposed the earth, initially as thin deposits between 2 and 5 mm thick, although thicker deposits were later discovered (Hill 1751, p. 198). Georg Anton Volkmann (1664–1721) later described how, when dropped into a glass of wine, the earth sounded 'with a clang or small crackle just like when glass or a window-pane was cracked' (Volkmann 1720, p. 277 quoted in Dannenfeldt 1984, p. 177). This action suggests the explosive uptake of water into the crystal lattice of clay minerals belonging to the smectite group, such as bentonite and montmorillonite. The clay was worked, fashioned into troches, authenticated by stamps and referred to as *Terra Sigillata Strigoniensis*. Often called *Terra Silesiaca*, the clay tablets were heavily marketed (e.g. Berthold 1583), and the greasy feel of the raw material gave rise to another synonym – *Axungia Lunae*. A close similarity was noted between the properties of the earth and medicinal unicorn's horn, resulting in the *Terra Silesiaca* also going by the name of *Unicornu Minerale* – mineral unicorn. The cures claimed for the earth were manifold – it was one of a host of cure-all 'wonder drugs' popular in early modern Germany (Rankin 2009); an English version of the advertising literature (Berthold 1587) indicated its efficacy in all cases of poisoning, as well as being effective against plague, it 'comforteth the heart' and 'refresheth the brayne', as well as curing headaches, quinsy, general pain, ocular conditions, 'inflammation of the brayne and stones', staunched haemorrhages, cured dysentery and diarrhoea, burns and scalds, healed gangrene and was used topically against 'Itch and Skabs', sores and ulcers (see also Sennert 1651, pp. 372–373). It was seemingly still being sold in Britain under a wide range of synonyms as late as the 1750s. Emanuel Mendes da Costa (1717–91), a friend and rival of Sir John Hill (Rousseau 2012; Duffin in press), indicates that its therapeutic virtues were supposedly identical to those of silver, and that it was on sale in the shops as an astringent, cordial and sudorific (da Costa 1757, p. 3).

The alicorn-containing cordial which probably enjoyed the greatest contemporary fame was the

Fig. 39. Portrait of Sir Walter Raleigh, author of 'The Great Cordial'. Reproduced by kind permission of the Wellcome Library, London.

Great Cordial of Sir Walter Raleigh (*c.* 1552–1618; Fig. 39), the famous Elizabethan courtier and explorer. In addition to *Unicornu Mineralis*, Raleigh's confection included a wide range of flowers, roots, herbs and woods, together with bezoar stone, magisteries of pearl and coral and a number of geological ingredients. Nicolas le Febure (1615–69), appointed Professor of Chemistry to Charles II in 1660, was commissioned by the King to write an account of Raleigh's Great Cordial (Le Febure 1664). Le Febure describes *Unicornu Minerale* or White Load-stone as

> the Concretion or Petrifaction of a fluid milky substance, which contains in it self the congealing and lapidifying ferment, which slides and insinuates it self in the Cavities of the Womb of the Earth (Le Febure 1664, p. 61).

Unicornu Minerale was also included in Fraundorffer's (1741, pp. 37–38, 169) alexipharmic *Bezoarticum viperinum*. This combined powdered viper with *Terra Sigillata Melitensis* (sealed earth from Malta) and *Oculi Cancorum*.

A series of experiments was completed in the presence of Prince William IV Landgrave of Hesse (1532–92), plus a retinue of physicians and apothecaries, in 1581. In one trial, eight dogs were chosen; four were given lethal doses of sublimated mercury (mercuric chloride, $HgCl_2$), *Aconitum* (monkshood or 'The Queen of Poisons', a plant containing the potent neurotoxin, aconitine), *Nerium oleander* (which contains a number of toxic cardiac glycosides including oleandrin) and *Apocynum* (dogbane), respectively. Another four were given similar doses, but mitigated with *Terra Silesiaca*; all four survived. In another instance, a prisoner (Wendel Thumblart), condemned to death for carrying out multiple robberies, volunteered to act as a guinea-pig. He was given a lethal dose of mercury sublimate mixed with Conserve of Roses, and then immediately drank a drachm of *Terra Silesiaca* suspended in old wine. After much suffering, 'the poore wretch was delivered, and being restored to his health was committed to his parents' (Berthold 1587, p. 35).

The German alchemist, Adrianus von Mynsicht (Adrian von Mynsicht; 1603–38), introduces a different material, this time an alchemical preparation or 'chymical medicine', which he calls *Unicornu Minerale* and says is a 'healthy and celestial comfortt' (von Mynsicht 1682, p. 1). Its starting materials are either Green Vitriol (ferrous sulphate) or Vitriol of Venus (copper sulphate), which is heated it until it yields a reddish oil. The remaining liquid in the vessel is then poured on 'an appropriate Menstruum' and cooled to allow crystals to form. The crystals and the oil are both then used in a complex alchemical process to produce 'an Universal Medicine, and such a Treasure that is able to cure all Diseases, by what name soever they are called, in all and every Creature' (von Mynsicht 1682, p. 4). It is interesting to note, in this context, that copper sulphate is known to have antimicrobial properties, and that copper, which has a long history of pharmaceutical use (Dollwet & Sorenson 2001), has potent biocidal properties, and is physiologically active; copper and copper compounds are effective antibacterial, antifungal and antiviral agents (Borkow & Gabbay 2005, 2009), and enhance the processes of wound healing (Borkow 2014).

Solar unicorn (*Unicornu Solare*)

Several authors introduce the idea of solar unicorn. Lentilius (1712, p. 109) explains that it is a cheaper alternative to the more expensive unicorn horn, and is a synonym for *Pulvis Bezoardicus Imperialis* (imperial bezoar powder) and *Manna Solaris*. This preparation consists of a mixture of magisteries of both pearls and coral. Magisteries were obtained by precipitating metals from acid solutions. Von Mynsicht (1682) explains that the coral or pearl is dissolved in vinegar to which is then added spirit of vitriol (sulphuric acid). The precipitate, in this case calcium sulphate, is then allowed to dry slowly in the shade. Schröder (1718, p. 560) indicates that it is a much more complex preparation, however.

In another recipe, von Mynsicht (1682, p. 6), using the somewhat inaccessible alchemical language of the day, explains the 'original Mineral of Gold' should be broken into pieces and distilled in a 'Spagyrick Vessel' until it yields 'a sweet celestial water' which should then be rectified eight or nine times to enhance its purity. Then 'the best Arabick Gold, with Antimony according to Art' is reduced to a powder and mixed with the liquid or 'Solar menstruum' prepared earlier, hermetically sealed in a glass container and heated so the solids are 'digested', 'as the Embryo is nourished by in the Mother's womb'. The mixture is then removed, dried and the whole process repeated 'till the Gold is changed into a reddish powder'. Von Mynsicht calls it 'the highest, most precious' preparation – 'truly that golden Fleece' – and indicates that it maintains health and strength, curing epilepsy, apoplexy, elephantiasis, morphew, melancholy, madness, quartan agues (malaria), sciatica, gout, dropsies, jaundice, pox, joint pain, asthma, phthisis (tuberculosis), pleurisy, 'Itch and Scurff', cancers, *Noli me tangere* ('touch me not' – a cancerous ulcer, usually of the face), otherwise incurable diseases, pestilence and carbuncles. It was said also to aid pain-free labour during difficult births, and for menopausal women it supposedly 'keeps them fresh, lusty and fair, and sometimes causes their Terms [menstrual periods] to come again, so that they are made capable of Child-bearing'! All of these marvellous effects it brought about by acting as a powerful diaphoretic (inducing strong perspiration), a corollary of it consuming 'the lethal humors', and renovating 'the very marrow in the Bones'.

Fig. 40. Portrait of Nicolas Culpeper (1616–54). Reproduced by kind permission of the Wellcome Library, London.

Unicorn horn simples

By the end of the fifteenth century, unicorn horn was beginning to appear as an entry in medical texts, such as the *Hortus Sanitatis* (de Cuba 1491); it had supporting it the authority of classical and medieval writers, a wealth of derivative folklore, biblical warrant and acceptance by the church (as an allegorical teaching tool, and a ritual object; e.g. van Vlierden 1989). Notwithstanding the subsequent debate concerning true and false unicorn horn, actual specimens were increasingly readily available, and various voyages and travels of discovery brought tales and sightings of the beast to Western Europe (see Shepard 1930). It is no wonder that, increasingly through the sixteenth and seventeenth centuries, unicorn horn made its way into national pharmacopoeia and became incorporated into a wide range of medicinal preparations.

The general therapeutic properties of unicorn horn were, in the words of Nicolas Culpeper (1616–54; Fig. 40), the famous English herbalist, that it 'resists poison and the pestilence, provokes urine, restores lost strength, brings forth both birth and after-birth' (1653, p. 31). In cases of post-partum retention of the placenta, the Italian physician Leonard Phioravant (1518–88) recommends that 'sneezing must be provoked, if it come not voluntarily, putting Ginger or some other sharp thing up into the nostrils'! His advice in case such sternutatory intervention proves unfruitful, is to give the patient a scruple of powdered unicorn horn in white wine (Phioravant 1659, p. 11). Jean de Renou (also known as Renodeus, 1568–1620), Physician to the Medical Faculty of Paris and a succession of French kings, explained that

> It is much commended against poison, and to exhilarate and roborate the Noble parts; and therefore it is given to the pestilent, and such as are infected with contagious and venenate diseases. (Renou 1657, p. 456)

Johnston (1678, p. 20) noted it was recommended against 'the bite of a mad dog, and other mischeivous beasts', which was reinforced by Topsell (1658, p. 558), who commended it against 'the bitings of ravenous Dogs, and the strokes or poysonsome stings of other creatures: and...against the

belly or maw worms'. In an interesting addition to the list of therapeutic qualities supposedly exerted by the horn, Spielmann (1783, I, p. 215) lists it as an antispasmodic. Numerous other publications, too many to mention, of this period express similar opinions.

In a therapeutic extension of the poison-testing and neutralizing qualities attributed to chips of unicorn horn immersed in drinks (see above), Topsell (1658, p. 558) indicates that:

> rich men do usually cast little pieces of this horn in their drinking cups, either for the preventing or curing of some certain disease. There are also some which inclose it in gold or silver, and so cast it in their drink, as though the force thereof could remain many years, notwithstanding the continual soaking in Wine.

Infusions

In some cases, the therapeutic virtues of the unicorn horn could be exploited by drinking water in which the horn had been steeped (Catelan 1624, p. 23). Diomedes Amico (1599, Cap. XLI), for example, recommended that an infusion of unicorn horn be given in cases of plague; the Dutch physician Levinus Lemnius (1505–68) wrote that 'the Unicorn horn put into wine or water dispels the poyson' (Lemnius 1658, p. 96). In 1605, Jean Héroard (1551–1628), pioneer of the veterinary care of horses and physician to the young Louis XIII, advocated in his meticulously maintained journal 'une bonne nourrice et l'eau de licorne nourrie du lait de la vierge' (Fischer & Fischer 2011, p. 270).

One London quack produced a sheet advertising 'A Most Excellent Drink made with a true Unicorn's Horn' (Oxford, Bodleian Library, Wood 534 (3b)). The list of diseases which it claimed to cure is impressive –

> Scurvy, Old Ulcers, Dropsie, Running Gout, Consumptions, Distillations, Coughs, Palpitations of the Heart, Fainting Fits, Convulsions, King's Evil, Rickets in Children, Melancholy or Sadness, The Green Sickness, Obstructions, And all Distempers proceeding from a Cold Cause.

It claims to preserve 'Vigour, Youth and Complexion to Old Age'. An image at the top left corner of the tract shows a spiral horn standing with its tip in a bowl of water. It seems that water was poured through the cored horn, thereby obtaining its therapeutic virtue which 'is of such force as to resist injury from an unsound Bedfellow', and 'doth wonderfully Corroborate and Cure' (Shepard 1930, pl. XI).

Topsell (1658, p. 558) records the example of a man

> worthy to be believed, that having eaten a poisoned cherry, and perceiving his belly to swell, he cured himself by the marrow of this horn being drunk in Wine, in very short space.

Powders

Kellwaye (1593, p. 18) recommends 'an excellent good pouder to expell the plague and prouoketh sweat' consisting of a variety of roots (gentian, butterbur, betony, tormentil, dittander or peppercress, zedoary), wood (red sandalwood), lemon rind, pearl, animal ingredients (ivory, stag's heart bone, red coral) and geological components (Armenian bole, *Terra Sigillata*, amber, gold and silver leaf, and 'the five pretious stones' – probably ruby, sapphire, emerald, jacinth and garnet – see components of the Gem Electuary; Duffin 2013*e*). The powder was administered as a suspension in sorrel water, scabious water or Carduus Benedictae water. The English plague doctor Nathanael Hodges (1629–88) was not impressed by claims as to the efficacy of unicorn horn, however, writing:

> The Powder also of an Unicorn's Horn, so much cried up for an Antidote, never answered any good Expectations, although I had several Dozes of it given me by a Merchant, on purpose to try its Virtues: But that which would cure Pidgeons, Fowls, Cats and Dogs, from Arsenical Poisons, as the worthy Gentleman assured me that did, had yet no Efficacy against the pestilential Virulence. (Hodges 1720, p. 167)

An alternative is provided by Wyllyam Warde in his (1562) translation of the highly popular book of secrets by Alessio Piemontese (also known as Alexius Pedemontanus; probably a pseudonym of Girolamo Ruscelli, 1500–66), first published in 1555, a reflection of the author's consuming interest in alchemy and the foundation of an entire genre of texts belonging to the scientific revolution (Eamon 1994). Here, unicorn horn was combined with gemstones (sapphire, hyacinth, smaragdus, pearls), Armenian bole, seeds of oxalis and sweet basil, lignum aloes, sanders, doronike root, cinnamon and saffron. Musk was an optional ingredient according to personal taste. The mixture produced provided 'a soveraigne pouder agaynst the venyme of the plague for ryche men and for prynces' (Warde 1562, p. 48; see also W.J. 1655, p. 17 and Anonymous 1665, p. 16 for closely similar recipes).

A third powder 'to expell Plague' consisted of various roots (gentian, bittany, tormentil, dittander, zedoary), red sanders, pearls, citron rind, red coral, stag's heart bone, 'fragments of the five precious stones', amber, and gold and silver leaf. After rendering each ingredient separately into a fine powder, they were then combined in scabious or *Carduus Benedictus* water, to which was then added syrup of lemons and Armenian bole (Anonymous 1652, p. 26).

Several powders are commended by de Meuve (1689), advisor and Doctor-in-Ordinary to Louis XIV. The *Pulvis contra abortum* (powder against abortion) combined pearls, ivory, white amber, red coral, Lemnian earth, mastic, red wood of *Santalum*

sp., kermes insects, roots of tormentil, mace, oil of cloves and unicorn horn mixed with six gold leaves. The preparation was said to strengthen the child while in the womb and prevent pre-term delivery, as well as conferring the additional benefits of acting against 'frailties' of the stomach, dysentery, diarrhoea and other intestinal problems (de Meuve 1689, p. 487). A powder of related interest was presented by the anonymous author of the very popular *The Ladies Cabinet Enlarged and Opened* (Anonymous 1654, p. 250). To make 'A medicine for a woman in travel to makes her have Throwes' (i.e. to increase muscular contractions during childbirth), coral, amber, pearl, peony seeds, saffron, date stones and 'commine' (cumin?) were beaten into powder and then added to malmsey, a sweet fortified wine. Unicorn horn was then put into a spoon, the warmed malmsey added and given as a draught to the patient.

The Pannonian Powder (*Pulvis Pannonicus* or Hungarian Powder) was purportedly used extensively in Germany against malignant fevers, all sorts of poison and small pox, eliminating all malignancies from the body and strengthening the heart; it was also taken early in the morning against 'bad air' (Charas 1678, p. 122; de Meuve 1689, p. 492; Schröder 1718, p. 375). The powder consisted of unicorn horn together with Armenian bole, Lemnian earth, pearls, precious stones (jacinth, emerald, sapphire, ruby), white and red coral, doronike root, citrine sandalwood, ivory, lemon rind, sorrel, cinnamon. When oil of cloves and sugar were added, a paste or electuary could be formed which was then cooked in rose water. Williams (1660, p. 16) recommended it as a reasonably gentle purge, and Charas (1678, p. 122) observed that the powder was usually dissolved 'in some Cordial-water, sween'd with Syrup of Gillow-flowers, Lemons or Granates [pomegranate]' and taken while fasting. It could also be administered in tablet form.

Culpeper (1653, p. 124) records the Royal College of Physicians' receipt for *Pulvis Bezoardicus Magistralis* (Magisterial Bezoar Powder). As its name suggests, this utilized the supposedly alexipharmic bezoar stone as its core ingredient, in addition to unicorn horn. To these were added a host of herbal simples (including saffron, zedoary and wood of aloes), animal derivatives (musk, ambergris, coral, pearls, stag's heart bone, kermes) and geological components (sapphire, ruby, jacinth, garnets, emeralds, *Terra Lemnia*, Armenian bole), all bound together with 'Chymical Oyl of Cinnamon and Nutmegs'. Culpeper's wonderfully sarcastic aside was

> Surely the Colledg laid all their heads together to invent a Cordial that should be so dear nobody should buy it. I am afraid to look upon it. 'Tis a great Cordial to revive the body, but it will bring the purse into consumption.

Although the recipe is for a powder, it is clear from Culpeper's comments that it should be used as the basis of a Cordial (see below). Merret (1670, p. 81) indicates that the apothecaries producing this powder, because of their 'immoderate thirst of lucre, and the sweet ease of laziness' omit the most expensive ingredient from the mixture – namely the unicorn horn. Further examples of *Pulvis Bezoardicus* utilizing either narwhal tusk ('Meer Einhorn') or fossil unicorn ('Gegraben Einhorn') are given by Schröder (1718, p. 363), who also incorporates unicorn horn into *Pulvis Confortans*, *Pulvis Cordialis* and three types of *Pulvis epilepticus* (Schröder 1718, pp. 366, 370, 371; see also Fraundorffer 1741, p. 127).

Charles le Breton (died 1677) commended a Bezoardic powder which incoporated unicorn horn with oriental and mineral bezoar, three large snakes' hearts and livers, various roots (Contrayerva, Virginian snake-root, angelica, zedoary), squinancy, sandalwood, kermes, saffron, camphor ambergris, musk, oil of nutmeg and mace. The dry ingredients were pulverized and the oil added gradually to the mixture, which was then dried and conserved. Clearly an expensive medicine on the basis of the component simples, it was prescribed for all maladies and malignancies, plague and smallpox (le Breton 1716, p. 310).

In spite of Gideon Harvey's (1636/7–1702; Fig. 41) criticism of the use of Unicorn Horn (see below), he was prepared to recommend it be included in a powder used to treat infant children suffering from smallpox and measles (Harvey 1696, pp. 177–178). His detailed instructions call for mixing the unicorn horn with garden cress and columbine seeds, hart's horn, red coral and pearls, all finely ground in rosemary water to form a paste, which was then dried. He suggests adding powdered gold so that 'the medicine would be render'd more precious'. Not exclusive to children, a larger dose could be given to adults in a glass of mead.

Jane Sharp was the first English woman to publish a book on midwifery; her *The Midwives Book: or the Whole Art of Midwifery Discovered* appeared in 1671. Like Harvey, she was concerned about the threat posed by smallpox, which she described as being 'dangerous to all, but most to those that are of an ill habit of body' (Sharp 1671, p. 409). She recommended administering powdered unicorn horn and oriental bezoar following a dose of cordial waters.

Culpeper (1657, p. 37) refers to *Pulvis Joelis*, also recommended for smallpox, which consisted of unicorn horn together with nasturtium or watercress seeds, brooklime, red coral and pearls.

Von Mynsicht (1682, p. 88) utilizes unicorn horn together with the alchemical Solar Unicorn in his *Species Diasolis or the Compound Species of the*

Fig. 41. Portrait of Gideon Harvey (1636/7–1702). Reproduced by kind permission of the Wellcome Library, London.

Sun. The other ingredients of this powder include 'Spagyrically calcined' hart's horn and elk's hoof, *Terra Sigillata*, oriental bezoar, magisteries of pearl and red coral, white amber, bone of stag's heart, 'true Gallia moschata' and oils of cinnamon and citron. The medicine was designed as 'an Arcanum in all Epidemical and Pestilential diseases, Erysipela's, poysonous draughts, and in the Asthma, or most dangerous straightness of the Breast'.

Von Mynsicht also uses unicorn horn in his *Confectio Opiata* (von Mynsicht 1682, p. 170), a more soluble alternative to *Laudanum Opiatum*. The recipe also calls for 'Opium spagyrically prepared', species Diamoschus and Diambre, Magistery of Pearls and red coral, saffron, 'Foreign Mummy', French musk, oriental Bezoar, bone of stag's heart, *Confectio Alkermes*, herbal oils (cinnamon, nutmeg, marjoram, sage, amber and cloves), and extract of wild poppy flowers.

The precious diaphoretic of Philip Fraundorffer (1741, p. 52) contained Magistery of Unicorn, a term which I have not come across elsewhere but presumably refers to the precipitate obtained after unicorn horn is dissolved in an acid. The author combines this material with Oxytartari crystals (potassium tartarate, $K_2C_4H_4O_6$?), and magisteries of both pearls and coral. Fraundorffer commended this supposedly delightfully tasting, sweat-provoking medicine as a cordial alexipharmic which cleansed the blood of impurities and eased anxiety, pestilential fevers, smallpox, diarrhoea, scurvy and pleurisy with attendant haemoptysis.

Rather amazingly, as late as 1840, unicorn horn was included in French pharmacopoeia as *Licorne de Mer* (Jourdan, 1840, p. 224). Here it was an active component in a number of therapeutic powders, all of which contained ground paeony root. Red epileptic powder (*Pulvis Epilepticus Ruber*) combined these ingredients with red coral, amber and native cinnabar and was prescribed in doses of between 0.6 and 2.0 g. Two recipes for red cephalic powder (*Pulvis Cephalicus Ruber*) required, variously, paeony seeds as well as the root, juice of the oak, deer horn, human skull, hippopotamus teeth, antelope hoof, red coral, oriental pearls and some geological ingredients – cinnabar, white amber, emerald, gold leaf and chrysolite (probably any green or yellow/green gemstone, including peridot, topaz, chrysoberyl, zircon, tourmaline and apatite). Similar recipes were recorded in 1729 by the *Collegii Pharmaceutici Viennensis* (1729, p. 158).

Cordials and waters

The recipe for bezoar water (*Aqua bezoartica*; original version not found) is ascribed to Johannes Lang (1485–1565), a German from Löwenberg who spent much of his life in Heidelberg (Mylius 1620, pp. 470, 522). Approved by the College at Bologna for use against plague, this medicine consisted of a mixture of herbal ingredients which were cut into sections and soaked in strong wine for 3 days before adding various popular antipestilential preparations including Alexandrian Theriac, Mithridatium, viper troches and unicorn horn.

A second plague water, *Aqua Vitae Cephalica et Cordialis*, incorporates unicorn horn mixed with another 66 ingredients, mostly herbal, but also including *Lapis Cancrorum* ('crab's eyes'), ivory, musk, pearls and red coral. The mixture was allowed to steep in alcohol for 40 days before being strained and mixed with sugar; it could then also be used in all cases of poison, to purge the breast and treat pleurisy (Mylius 1620, p. 508).

Philip Fraundorffer included unicorn horn as an ingredient in his *Aqua Apoplectica*, combining it with over 60 different flowers, leaves, seeds, roots, complex polypharmaceutical components such as Theriac, Mithridatium etc., and some exotic items such as oriental crocodile (Fraundorffer 1741, p. 28).

William Williams, 'an astrologer of inferior note' (Granger 1769, p. 91) incorporates unicorn horn in more medical receipts than any other work in English, so far as I am aware, and combines it

with numerous otherwise unusual ingredients. Despite Hodges' rejection of unicorn horn as being useful in cases of plague, Williams (1660, p. 60) recommends a special water which he states is an 'absolute cure' for the disease. He suggests treating suppurating lesions by binding a mixture of 'Green Bear's Foot' (*Helleborus foetidus*: dungwort or stinking hellebore), garlic, ground ivy and bay salt to the wound. Then the patient should drink a draught of sack which has been boiled with rosemary, rue, nutmeg, cloves, cinnamon and shavings of unicorn horn, and then strained. His 'Albanito' water 'against all poyson, and all fumes of the Head, and all other pains of the Head' (Williams 1660, p. 49) contained, in addition to unicorn, a range of seeds, ambergris, mussel shells and flesh, plus simples commonly associated with the horn in other recipes – pearls, coral, crab's eyes, angelica, etc. The finely powdered mixture was allowed to steep for 10 days, and then distilled. Two spoonfuls would supposedly cure the head pains. His 'most admirable water', a medicine 'For a Consumption of all parts of the body' begins with adding the yolks of 100 eggs to a quart each of rose water and honeysuckle water. After distillation, a fully grown cock, 'the flesh beaten in a Morter', has a range of spices added before boiling. Finally the unicorn horn, various herbal and aromatic materials are added before a second boiling and distillation (Williams 1660, p. 52). Details are given for preparing further unicorn horn-containing waters with which to treat poisoning, plague, syphilis (French Pox or Lues Venerea), agues, childbirth, impotence, dropsies and 'the knobs of the pox', to strengthen heart and liver and to act as a general cordial (Williams 1660, pp. 63, 64, 66, 68, 70, 74, 75, 82, 84, 92). The receipts are clearly of his own invention and are given quite fanciful names: Balzinatum, Aqua de Novo, Coelestial Cordial Water, The Comforter, My High Esteem, My Glove, Horn of the Buffant, Well-Spring of Health, Gilbers Cordial, The Wonder of this Time or Age, Little Page, The Fann, The Marigold. The claims are equally as outrageous; the Coelestial Water, for example (Williams 1660, p. 64): 'instantly cureth the wind Colick', 'restoreth Nature decayed', 'expelleth all poyson and all infectious diseases from the Heart', 'cureth all those that vomit up their meat', 'delivereth women with child ... and bringeth the Safter-birth away', 'staieth all issues of blood', 'helpeth digestion wonderfully', 'purgeth the blood', 'giveth Renovation to the Spirit of Life', 'cureth Small Pox ... yea, though they be speechless and sensless for death', 'is admirable for a weak young chils', 'is admirable for all swoonings and for burning fevers', 'it hath helped them that hath lain at death's door', 'stayeth all Fluxes of blood', 'is admirable for Rheumatick persons', 'always helpeth the Mother and Spleen' and 'is good for all diseases, and hurtful to none'. A wonder drug indeed! The Fann is reputed to 'deliver women in their greatest danger that may be, and give them life again' (Williams 1660, p. 84).

Paul Barbette (1620–66?) wrote an enormous amount during his relatively short career as a Dutch physician, practising both medicine and surgery at Amsterdam, having originally qualified in Leiden. An outspoken critic of the commonplace practice of bleeding patients as an early means of intervention in almost any illness, Barbette promoted the use of diaphoretics and sudorifics as an alternative approach, preferring to evacuate perceived humoral excess through the induction of sweating. To this end, one of his sudorific cordials consisted of unicorn horn combined with various candies (scorzonera root – black salsify, serpent's root or *Scorzonera hispanica*; citron, orange peel, *Saccharum Perlatum* or *Manus Christi*), conserves (rosemary flower, roses, violets, borage), confections (alchermes, hyacinthus), red currants, barberries, salt of coral, hart's horn and bezoar. These ingredients were mixed together with waters of roses, borage and bugloss (Barbette 1687, pp. 128–129).

Topsell (1658, p. 558) records that:

> I happily sometime made this Sugar of the horn, as they call it, mingling with the same Amber, Ivory dust, leaves of gold, coral, & certain other things, the horn being included in silk, and beaten in the decoction of Raisins and Cinamon, I cast them water, the rest of the reason of healing in the mean time not being neglected.

A manuscript in the Wellcome Collection (Egerton MS 1071) details a supposedly successful treatment of last resort (Knight 2002, p. 245):

> A raire watter, which hath restored severall out of deep consumptions.
>
> Take a red Cock, pluck him a live, then slit him down the back & take out all his entrells, cut him in quarters & bruse him in a mortar, then put him in a still with a pottle of Sacke, a quart of new red Cows milk, a pound of Currants, beaten, & a pound of reasons of the sun ston'd & beaten, of penney roiall, two handfulls, of wild time, roasmary, & burredge, one handful, one quart of red rose water, of Hartshorn & China [root] of eatch one handfull, & past up y[ou]r still & still it with a soft fire D[r]up in the Glass where in it stills one pound of sugar candey, beaten, twelve penceworth of Leafe Gold, 7 grains of musk, 10 graines of amber greece: 7 grains of unicornes horne. 7: graines of beasor stone, & when the Watter is all still'd mix these ingreadients with it & use it Thus. Every morning fasting, & every evening, when you goe to Bed, take 4 or 5 spoonfulls of it warme, for a month together. This hath cured a man whome the Physitions had given over. (MS 1071, 44)

Elsewhere in the same manuscript, unicorn horn was also used in a treatment for worms.

Tinctures

Tinctures are usually alcoholic extracts of various simples, mostly herbal. *Tinctura Apoplectica* was one of an array of medicines used to treat apoplexy, a term which literally means 'striking away'; nowadays, the condition is known as a stroke, where cranial haemorrhage often results in sudden loss of consciousness and/or the ability to feel or move certain parts of the body. According to Johann Daniel Mylius (*c.* 1583–1642; Fig. 42), a renowned composer for the lute as well as an alchemist, this particular tincture utilized a wide range of plant materials plus unicorn horn, musk, coral, pearls and precious stones steeped in Spirit of Wine (Mylius 1620, p. 590), a concentrated aqueous solution of ethanol produced by multiple distillations. A second tincture with far fewer ingredients (only 14, in addition to unicorn horn) and prepared using lavender wine, was used for the same purpose (Mylius 1620, p. 591).

A comforting tincture for use with patients suffering from melancholy included unicorn horn shavings plus ginger, paeony, musk, cinnamon, rhubarb and further herbal ingredients steeped in 'vini moschatellini' (Mylius 1620, p. 594) – probably derived from *Adoxa moschatellina*, the Muskroot.

A different tincture was employed in order to induce sleep, treat coughs, act as an anodyne (analgesic) and counter various fluxes. Mylius (1620, p. 597) hailed this medicine as highly praiseworthy; indeed, it incorporated numerous supposedly alexipharmic ingredients such as musk, ambergris, pearls, precious stones (emerald, garnet, ruby, amber) and bezoar into an alcoholic base which also contained opium. Another tincture containing unicorn horn shavings was designed to treat hangovers, fainting and cardiac palpitations (Mylius 1620, p. 597), while yet another was used in cases of colic and renal calculi (Mylius 1620, p. 607).

As might be expected, there were also tinctures designed to treat patients with plague or other pestilential diseases – *Tinctura pestilentialis* (Mylius 1620, p. 609). This preparation included not only unicorn horn, but ivory, flowers of sulphur (brimstone), Andromachus' Theriac, myrrh, bezoar stone, *Terra Sigillata* and camphor. Myrrh and camphor, like all 'aromatica', possess antimicrobial properties.

Fig. 42. Johannes Daniel Mylius (*c.* 1583–1642). Line engraving, 1620. Reproduced by kind permission of the Wellcome Library, London.

Oils

W.J. (1655, p. 9) recommends 'a very perfect oyl against the Plague and all manner of poyson', but whose contents and means preparation are somewhat extreme. He instructs the manufacturer to 'take of the oldest oyl you can get', boil it for an hour, and then add 50 scorpions per pound of oil. The oil is then reduced to two-thirds of its original volume by placing it in a kettle of boiling water. The scorpions are then removed, two ounces of unicorn horn, an ounce of Venice Treacle and three ounces of Aqua Vitae (Ethanol) added, the pot stoppered and 'set in the Sun three months'. Then, 'when any person feeleth himself infected with the plague or poyson let him annointed with the saoyl about the heart and pulses and he shall find a marvellous effect'.

Extracts

Mylius (1620, p. 628) commends a cordial extract to act as a general counterpoison. The extract contains many herbal ingredients together with unicorn horn, bezoar, coral, jacinth, ambergris and *Aqua Theriacalis*.

Opiates

Charles de St Germain (1689, p. 139) helpfully defines what was meant by an opiate in the seventeenth century:

> An Opiat is a Medicine made up of Conserves, Syrups, Electuaries, Confections, and Troches; to purge bad humours, and strengthen the Bowels. It is called Opiat, because the Ancients used to put into it

> principally Opium: Nevertheless, at present many Opiats are made in which there is no Opium, as in purging Opiats.

The latter is the case with the opiate designed to 'expell venome, and provoke sweat' and described in Anonymous (1652, p. 27). Here, unicorn horn shavings are mixed with various flowers (borage, bugloss, violet, bittany), roots (tormentil, angelica), Venice Treacle and Mithridatium, *Terra Lemnia* and *Terra Sigillata*, hart's horn, pearls and ebony. These were combined in 'Sirrup of the Juice of small Sorrell and Bugloss', before dissolving in scabious water and balm water. The advice is then to let the medicine do its work – 'go to bed and sweat'!

Simon Kellwaye was very much concerned about the plague epidemic which struck England in the 1590s, publishing his *Defensative against the Plague* (Kellwaye 1593) in response; one estimate of the number of deaths from plague in London alone during the year his book was published stands at 15 003 (Creighton 2014, p. 353). In the section of his book concerned with plague treatments, in addition to the powder described above, Kellwaye includes an opiate which is very similar to the one indicated in the previous paragraph (Kellwaye 1593, p. 19). In addition to shaving of unicorn horn, this contains herbal ingredients (conserve of flowers of borage, bugloss, violets, bittany, roots of tormentil and angelica, syrups of small sorrell and bugloss) and a series of commonly utilized alexipharmics ('Vennes Triacle', Mithridatium, *Terra Sigillata*, *Terra Lemnia*, ivory, hart's horn and pearls). The powder was then taken dispersed in either scabious water or balme water.

At least two opium and unicorn horn-containing opiates have been ascribed to the revolutionary Swiss alchemist, toxicologist and itinerant physician, Philippus Aureolus Theophrastus Bombastus von Hohenheim (Paracelsus; 1493–1541; Fig. 43). *Unicorni Animalis* and *Unicorni Mineralis* are interchangeable components in *Laudanum Paracelsi Laudatissimum* (Woodall 1655, p. 192). The other ingredients include the juice extracted from leaves of henbane (containing highly toxic tropane alkaloids), salts of coral and pearl, Mummy, white amber, bezoar stone and the oils distilled from a wide range of plant materials. The means of extraction of the various salts and tinctures used in this recipe are complex and beyond the scope of the present analysis. Woodall (1655) gives explanatory notes to accompany the recipe and states

> this Medicine though it would put many that possesse much knowledge in the Art of the Apothecarie to their trumps truly to prepare it, yet to an artist which is a true preparer of medicines it is plain and pleasant to be done.

Fig. 43. Portrait of Paracelsus (1493–1541). Reproduced by kind permission of the Wellcome Library, London.

emphasizing the contemporary divisions that were opening up between the more traditional Galenists, and the post-Paracelsian 'Chymists', who relied on the distilled 'essences' extracted from their chosen simples.

Laudanum Anodinum was hailed as being 'most excellent' in 'asswaging griefes and paines in diverse diseases' (Paracelsus 1596, p. 21). Similar in constitution to the previous example, it also contained *Aurum potabile* (potable gold) and was said to 'comforteth much against the chollicke, the frensie hot fevers, Arthritide Podagra, the weaknesse of the stomack, the yex, and comforteth against vomiting, provoketh sleep' (Paracelsus 1596, p. 21). Note that podagra is the name given to a particular type of gout in which uric acid crystals are deposited in the joint at the base of the great toe in people suffering from hyperuricemia; the region then suffers from acute inflammatory arthritis. Paracelsus' inclusion of gold in this preparation is interesting as various salts of gold are now known to have anti-inflammatory properties (Shaw 1999).

Von Mynsicht (1682, p. 82) includes 'animal unicorn' in his relatively straightforward *Laudanum Minerale*, an alchemical medicine designed as an anodyne (pain-reducing drug) for use in catarrhs, defluxions (discharges) from the eyes or nose, and coughs – effectively an early modern remedy for the symptoms of colds and influenza. The other ingredients included 'Anodyne Sulpur of Vitriol',

magistery of pearls, extract of lignum aloes, saffron, bezoar stone, oils of cloves and cinnamon, all mixed together in 'Juice of Wild Poppy flowers'.

An Italian dispensing pot in the Wellcome Collection (Fig. 44, dated to the 60-year period from 1770 to 1830, is labelled 'LAUD.NEP.QUERC' (see Manget 1693, p. 587). The opiate which it contained incorporated opium, gold, pearls, bezoar stone and unicorn horn and was used to encourage sleep and to ease pain.

Electuaries

Electuaries are medicinal pastes usually designed to be taken orally. Mylius (1620, pp. 722–723) lists unicorn horn amongst the ingredients of an electuary credited to Nicolai de Crassis. Having placed, amongst other things, pulverized camphor, musk, tincture of ruby, *Terra Sigillata*, Armenian bole, Theriac, Mithridatium and alcohol in a stoppered glass for a period of 24 hours, sugar and saffron were added to the mixture. This was reduced by boiling before a host of other ingredients, including the unicorn horn, gold and silver leaf, jacinth, garnets, pearls, emerald, sapphire and *Lapis Serpentinus* ('snakestone'), were added. Unicorn horn was also added to the paste-like 'Antidote against deadly poisons and plague' (*Antidotarium contra venena lethalia et pestem*); a total of 106 species were used altogether in this preparation (Mylius 1620, pp. 725–727).

Johann Schröder (1718) includes unicorn horn in a number of his recipes for electuaries, most of which contain far too many other ingredients, many prepared by alchemical means to release their respective quintessences, to warrant detailed analysis here. They include preservatives against the plague, as well as examples with grand titles, such as *Electuarium Pretiosum* (A 'Kingly' Confection), the self-explanatory *Electuarium ad vitam longam*, *Theriaca Andromachi*, *Theriaca coelestis* and *Manus Christi cum Gemmis* (Schröder 1718, pp. 223, 224, 228, 231, 292, 322).

Elizabeth Grey, Countess of Kent (1582–1651; Fig. 45) included unicorn horn in an electuary against the plague (Grey 1687, p. 140). Giving very detailed instructions as to its preparation, she explains how saffron should be mixed with the yolk of an egg, still in its shell (having removed the white), and then allowed to sit in the warm embers of a fire for 2 days. The egg and saffron are then ground with white mustard seed, sieved and pulverized further with dried dittany roots, tormentil, *Nux vomica* (seeds of the strychnine tree, *Strychnos nux-vomica*, from India and SE Asia), and the roots of angelica and pimpernel, before being added to treacle to achieve the paste-like consistency of an electuary.

Fig. 44. Italian dispensing pot (1770–1830) labelled 'LAUD.NEP.QUERC'. Reproduced by kind permission of the Wellcome Library, London.

Fig. 45. Elizabeth Grey, Countess of Kent (1582–1651). Reproduced by kind permission of the Wellcome Library, London.

Conserves

Conserves are drugs which contain finely chopped floral and other herbal ingredients. Amongst the medicaments used to treat plague (as an *Antidoto curativo*) during the 1630 and 1656 outbreaks in Italy (Muratori 1832, p. 238), was a conserve combining, in addition to *Unicorno Vero*, a wide variety of flowers (borage, rose, violets, citron and rosemary), roots (tormentil, angelica, bistort, scorzonera) and animal products (bezoar stone, deer antler). Very little was being left to chance, because the recipe also called for the incorporation of almost the whole available range of non-animal, artificially produced chemical bezoar material into the mixture: *Bezoarticum Solare*, a complex herbal mixture also containing Venice Treacle and Mithridatium, which are themselves historically important polypharmaceutical alexipharmics (see von Mynsicht 1682, pp. 59–60 for further details); *Bezoarticum Joviale*, a mixture of antimony and tin; *Bezoarticum Lunare*, a mixture of antimony and silver; and *Bezoarticum Minerale*, a name given both to various geodes (e.g. Woodward 1729, p. 72) and, more commonly, a chemical preparation also known as Calx of Antimony (antimony trioxide, Sb_2O_3).

Confections

Confections are syrupy drugs, often with honey as a base material. The *Antidotarium Bononien* (Anonymous 1615, p. 44; the original edition was compiled under the title *Antidotarii Bononiensis* by Ulisse Aldrovandi and published in 1574) employs unicorn horn together with 26 other ingredients (including Armenian bole, sapphires, rubies and ivory) as part of the *Confectio Cordialis*, designed to strengthen the heart against the plague. A similar confection for the heart (Mylius 1620, p. 770) was credited to Alessandro Benetti (*c.* 1455–1525), Professor of Anatomy and Surgery at Padua University and famously responsible for the construction of the first anatomy theatre. In addition to unicorn horn, it contained many of the usual ingredients (sapphire, Armenian bole, *Terra Sigillata*, ivory, jacinth, garnets, red coral, musk, ambergris) plus some distinctive herbal ingredients (e.g. cinnamon and valerian).

One confection for strengthening the heart (*Conditum ad cordis roborationem*; Mylius 1620, p. 972) had a complexity that belied the short list of ingredients; in addition to unicorn horn, coral, pearl, bezoar stone, ambergris, gold leaf and some herbal components, the recipe also required the use of gem electuary (34 ingredients; see Duffin 2013*e*), *confectio alkermes* (13 ingredients; Bauderon 1681, p. 335) and *confectio libertis* (37 ingredients; Zwelfer 1657, p. 184). Not only must this have made the preparation extremely expensive, since precious stones were used throughout, but it also involved multiplying the use of many of the ingredients. Another (Mylius 1620, p. 979) required only white amber, pearls, ambergris, sugar and unicorn horn dissolved in cinnamon water, oil of Anise and oil of amber.

A tragema (tragea or 'dessert'; Dunglison 1839, p. 614) was a strongly aromatic preparation which was powdered with sugar and often used to prevent flatulence (as a carminative). Mylius (1620, pp. 926–927) gives details of an antiepileptic tragema credited to the French paracelsian physician, Joseph Duchesne (Latin Josephus Quercetanus; *c.* 1544–1609), whose varied career included a period in attendance to Henry IV of France. In addition to unicorn horn, the preparation included essence of coral, pearl, bezoar stone, salt of the human skull, rue, cinnamon, paeony seeds, cardamon, ambergris and calendula.

Unicorn horn was also used in various treacles including a 'heavenly' variety (*Theriaca in coelestem et sublimiorem redactae essentiam*; Mylius 1620, p. 744), and also in opiates (Mylius 1620, p. 992, 995), one of which is described as being 'outstanding' and containing 'true' bezoar stone, *Terra Sigillata*, ambergris, red coral, jacinth and Magistery of Gems. The latter ingredient was a sovereign remedy based upon a precipitate; gemstones were beaten into a fine powder, calcined, mixed with potassium nitrate (saltpetre) and then dissolved in ethanol (aqua vitae). This was then evaporated in a furnace, leaving the Magistery of Gems behind (Porta 1658, p. 270). The *Laudanum Opiatum* ascribed to Paracelsus combined *Unicornu Mineralis* (mammoth tusk ivory) with mummy, bezoar stone, potable gold and a series of other ingredients (Mylius 1620, p. 997).

Critics

The widespread use of these different types of unicorn horn was not without its critics; we have seen above Nathanael Hodges' opinion, but others were equally vociferous. The iconoclastic London physician (to Charles II and 'physician of the tower' to William and Mary), Gideon Harvey (1636–1702), posed the rhetorical question:

> What Sympathy to the Heart can be breath'd from ... an Unicorns horn, a sort of an Ass, which the horn of an Oxe, or Goat may contend with in Vertue, though not in rarity. (Harvey 1689, p. 144; see also Stahl & Harvey 1730, p. 192)

The otherwise anonymous J.D. was suspicious of the fact that the unicorn horn preparations sold in the apothecary's shops were white in colour, 'whereas all agree, that have had a fight of that

Animal, that his horn is red' (J.D. 1686, p. 176), a rather confused line of argument to have pursued!

The most cogent argument came from Andrea Marini (1523–70), born in Trento, a well-respected author who promoted Latin translations of the Arabic Pharmacopoeia. He was highly critical of belief in the unicorn, accusing Arabic physicians of introducing the idea of medicinal simples which acted as cure-alls and catered to common superstitions. He highlighted the many contradictions concerning the unicorn horn found in earlier texts and concluded that any benefit that administration of the horn brought could be matched by the use of stag's horn or similar structures which were clearly not exotic, mythical or in any way controversial (Marini 1566; Shepard 1930, pp. 158–161). A riposte came in the form of a publication by Andrea Bacci (1524–1600), whose work was produced in the same year and city (Venice) as Marini's. In what Shepard (1930) called 'The Battle of the Books', Bacci answered Marini's contentions in a point-by-point argument, favouring the opinion that uncorns are rare animals whose horns do, indeed, have medicinal efficacy (Bacci 1573; Shepard 1930, pp. 161–165).

Ambroise Paré (*c.* 1510–90; Fig. 46) was a French barber surgeon who served a succession of French kings and undertook ground-breaking work in surgery, battlefield medicine and forensic pathology. He published a 'Discourse on the Unicorn' (Paré 1582; English translation Paré 1649, Lib. 21, Cap. 39, p. 533 ff.) which reinforced the arguments made by Marini in the previous century. Somewhat bound by his Christian faith, Paré found himself unable to deny the existence of the unicorn since it was named in the Bible, but felt free to critically assess the evidence for its supposed medicinal efficacy. Here, he remarks

> I can protest thus much, that I have often made trial thereof, yet could I never finde anie good success thereof in the use against poisons, in such as I have had in cure. (Paré 1649, p. 534)

Interestingly, he uses the example of Jean Chapelain, physician to both Henri II and Charles IX of France, who

> often used to say, that hee would verie willingly take away that custom of dipping a piece of Unicorn's Horn in the King's Cup, but that hee knew that opinion to bee so greatly ingraffed in the minds of men, that he feared, that it would scarce be impugned by reason. (Paré 1649, p. 534)

Paré concluded that the horn exerted no discernible therapeutic benefit.

One could normally look confidently to Sir Thomas Browne (1605–82) to expose what he termed 'vulgar errors'. In the case of the unicorn, however, he allowed that the animal might exist, but denied

Fig. 46. Portrait of Ambroise Paré (*c.* 1510–90). Reproduced by kind permission of the Wellcome Library, London.

the bulk of the therapeutic qualities ascribed to the horn (Browne 1672, Lib. 3, Cap. 23, quoted above). In an extensively argued rejoinder, Alexander Ross (as A.R. – 1652, p. 27) asserted that

> God out of His goodnesse to mankind, hath ordained as many remedies and antidotes as there be poisons, whereby their malignity is either prevented [or] expelled: Among all these Antidotes, there is none more wonderful then the Unicorns horn.

Although there were still apothecaries who used unicorn horn, by the early decades of the eighteenth century it was falling out of favour. John Quincy (1722, p. 185) wrote that

> the strange Conceits of the Medicinal Virtues of this Drug are both too numerous and too ridiculous to mention here; and both this and the following [the bone from a stag's heart] are now justly expelled from the present Practice.

A few decades later, John Hill related that, 'They were pretended to be Remedies against Poison, and to have a thousand other Virtues as imaginary as the Creatures supposed to wear them' but that advanced knowledge 'has long since exploded these erroneous accounts' such that 'the Virtues

ascribed to it are now no more regarded than its pretended Origin' (Hill 1751, pp. 841–842).

Conclusions

In a rather peculiar survival, much like the modification of the eaglestone belief noted by Podgorny (2017), powders 'popularly thought to be scrapings of a unicorn horn' are used to treat dysentery in Chile. In nearby western Venezuela, archaeological beads, known by the corruption *olicorno*, are worn as an amuletic bracelet to combat the evil eye. Therapeutic effectiveness is guaranteed only if the beads are excavated on a Maundy Thursday (Foster 1953, p. 207).

The history of the unicorn horn is thus a tale of extremes. From a mythical animal of Eastern legend it was embraced by Western classical writers and biblical scholars, and had its origins furiously debated. The trade in narwhal 'horn' lent credence to the supposed truth of unicorn legends; rarity and exoticism stimulated astronomical market values for sale specimens, increasing repute for its supposed prophylactic and therapeutic qualities and the need for reliable tests to distinguish true horns from the multitude of fraudulent materials that began to flood the market. Through the sixteenth and early seventeenth centuries, the unicorn horn enjoyed much pharmaceutical popularity, which began to wane, together with its price, towards the end of the seventeenth century; Frankfurt apothecary shops were able to sell unicorn by the half ounce at 64 florins in 1612, reducing to 4 florins in 1669 (Beer 1977, p. 120).

At its height, unicorn horn was an extremely popular medicinal ingredient which was incorporated into a wide range of preparations and delivery systems; its various therapeutic properties all related back to its believed efficacy as a counter-poison. By the mid-1700s, it was no longer prescribed.

The question could be raised as to whether unicorn horn, in any of its various contemporary guises, might actually have conferred some therapeutic benefit to those people treated with medicinal compounds of which it was a part. A detailed

Fig. 47. 'The Inspection', third painting in the series 'Marriage á-la-Mode' by William Hogarth. Reproduced by kind permission of the Wellcome Library, London.

discussion of this point based upon current pharmacological knowledge is beyond the scope of the present paper. However, it is interesting to note that, in a number of the recipes for anti-poison preparations indicated above, unicorn horn was combined with materials which have proven antimicrobial properties or other physiologically active roles: alchemically produced copper compounds and copper-containing minerals, gold and various 'aromatica' (such as myrrh). Furthermore, unicorn horn was often used to bolster or supplement the effects of a range of materials containing chemically absorbent and adsorbent components: bezoar stones, medicinal earths and calcium carbonate-containing items (e.g. coral, pearls; see Ahmad *et al.* 2012). Thus, unicorn horn might have exerted some alexipharmic effect either individually or when used in combination with other materials which themselves were historically esteemed for their supposed poison-counteracting properties. The alleged efficacy of unicorn horn in other medicinal contexts, such as in the treatment of epilepsy, malaria, gonorrhoea and syncope, was probably purely fanciful.

In a final ironic twist, the horn which was adopted as an accreditation symbol of so many medical, apothecarial and pharmaceutical societies and practitioners was employed as a visual emphasis of quackery in the series of satirical paintings by William Hogarth (1697–1764) entitled 'Marriage á-la-mode' (painted between 1743 and 1745; Foster 1944). In the third painting in the series of six, entitled 'The Inspection', the Viscount takes a child prostitute to the 'doctor' in order to complain that the mercury pills which he has been given are ineffectual against his syphilis, and to seek a refund. Amongst the paraphernalia littering the consulting room is a long narwhal tusk unicorn horn suspended prominently from the ceiling-high cupboard (Fig. 47).

My thanks are extended to the following institutions for access to the large number of volumes consulted during the course of this study: Geological Society of London Library, British Library, Victoria and Albert Museum, Warburg Institute, Wellcome Library. For permission to include images, I thank Dr K. Taschwer, the Wellcome Library and Drs João Neto and Paula Basso, both of The Museu da Farmácia, Lisbon. I am very grateful to Drs Maria do Sameiro Barroso (Lisbon) and Paul Taylor (NHMUK) for their helpful review comments.

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