The harmony of the brain

Although something of a parlour game, the question can reasonably be asked: ‘which, in history, is the most important medical book ever written?’ High on the list of answers, probably the outright winner, is De humani corporis fabrica libri septem famous for the woodcuts portraying accurate anatomical structures, the many historiated initials and the frontispiece, written by Andreas Vesalius (1514–64) and published in 1543. The bodies dissected in Padua for specimens portrayed in the Fabrica include the mistress of a monk, exhumed by students, and the oarsman of a papal trireme. Vesalius wrote the book in only 2 years. The identity of the artist responsible for the images engraved and printed on 73 plates has been much debated: the most likely candidate is Jan van Calcar (1499–1545); possibly, Domenico Campagnola (1500–64); perhaps, Vesalius himself; and, beyond reasonable doubt, all four. Many of the flayed subjects are depicted by their artist in soothing landscapes. When aligned side-by-side, the back-drop to the 14 muscle plates is one continuous panorama of the Euganean Hills a few miles to the south and west of Padua.

We know much of Vesalius and his work through several publications: for example, A bibliography of Andreas Vesalius, Harvey Cushing (1869–1939), 1943; A prelude to modern science being a discussion of the history, sources and circumstances of the Tabulae Anatomicae sex of Vesalius, Charles Singer (1876–1960) and C. Rabin (nk), 1946; The illustrations from the works of Andreas Vesalius of Brussels, J.B. deC M Saunders (1903–91) and C.D. O’Malley (1907–70), 1950; Vesalius four centuries later (Logan Glendening lectures on the history and philosophy of medicine), John Farquar Fulton (1899–1960), 1950; and Andreas Vesalius of Brussels 1514–1564, C.D. O’Malley, 1965.

Vesalius was known to Johannes Oporinus (1507–68), the printer of the Fabrica; and Vesalius communicated with him from Italy on 24 August 1542, indicating that the text and plates would arrive in Basel, carefully packed with the help of the engraver ‘and of Nicholas Stopius, the faithful manager of the firm of Bomberg’, and transported by the Milanese firm of Danoni. Since everything other than distribution through the booktrade was available to Vesalius in Italy, it is unclear why he chose to move all the material to Switzerland. Vesalius asks of Oporinus:

‘I must make of you, that in producing this work you imitate as closely as possible every mark which you will find made by the engraver, in


After a journey of several weeks, the material reached Basel over the Bernese Alps by the Splügen Pass. Vesalius arrived in January 1543 to supervise publication. The Fabrica was ready by June of that year. As is commonplace for publications of that period, the pagination was a mess. Vesalius had already published, from Venice, six anatomical plates depicted by van Calcar based on his dissections (the Tabulae sex, 1538). He produced, also in 1543, an Epitome of the Fabrica containing nine engraved woodcuts, each 6 cm larger than those in the main work, apart from two originally intended for the Epitome but eventually included, folded, in the Fabrica. A German edition of the Epitome appeared on 9 August 1543. After 1543, the Fabrica was published in a second edition from Lyon (1552) that lacked illustrations; and, in 1555, Oporinus was persuaded to produce a much more lavish and extravagant third edition. (Eroneously in our view, the publishers of the book under review describe the 1555 Fabrica as the second, and Vesalius’s intentions for a third that was never published. This is on larger and heavier paper, 49 instead of 57 lines to the page, with engraving of the wood-blocks somewhat altered and the historiated initial letters recut (Fig. 1). The elaborate frontispiece is redone with the figure at the upper left margin now clothed; the head of Vesalius more distinct; the scroll at the foot turned into the top of an animal operating table; the skeleton
carrying a scythe; and the servants bringing in a goat as well as a dog (Fig. 2). Others plagiarized the anatomical plates for their own publications; and authentic fourth and fifth editions, inferior in many respects to the 1543 and 1555 issues, appeared from Venice in 1568 and 1604, respectively.

The fate of the blocks, made from pear-wood sawn parallel to the grain and cut with a knife with extreme skill and artistry so that even the edges of the cross-hatching are softened, is a story in its own right on which opinions on the details differ. After 1555, it seemed that there was little prospect that the heavy blocks of pear-tree would ever be used again. According to Cushing, on Oporinus’s death in 1568 they passed to Ambrose Froben (1537–1602: third in a dynasty of printers) who, because of their size, decided against using them in an anatomy published in 1583 for Felix Platter (1536–1614), who had himself declined to buy the blocks. These were in the possession of the König family when the Frobens went out of business in 1604, and eventually were purchased by Andreas Maschenbauer (1669–1727) late in the 17th century. He printed the plates from Augsburg in 1706 and 1723. But according to Dr Willie Wiebond, they were bought from the heirs of Vesalius by Platter and from there passed to the Welser family who issued scientific publications until they, too, went out of business in 1614. It is agreed that they did eventually come into the possession of Maschenbauer. Meanwhile the entire set had been re-engraved by Jan Wandelaar (1690–1759) for the luxurious Opera Omnia published by Joannes and Herman Verbeek at Lugduni Batavorum (Leyden) in [1724] 1725. These itinerant wood-blocks next surface in 1781 and 1783, used in a publication by Professor (Heinrich Palmaz) Leveling (1742–98) of Ingolstadt, but with a few newly engraved. When Ingolstadt fell to the French, the contents of its University Library, which had been in the care of Rath von Woltter (1709–89), were moved to Landshut.
Figure 2  Engraved frontispiece from *De humani corporis fabrica libri septem*, 1555.
in the Isar and from there to Munich where, in 1893, the librarian (Dr Hans Schnorr von Carolsfeld, nk) discovered 147 blocks (mainly small and with only six of the larger plates) in a cupboard. Brought to public attention by Professor Roth (nk) of Basel, they were again soon forgotten until the 1555 frontispiece was found in Antwerp, owned by a collector named Fires (nk). Later, after a search instigated by Dr Samuel Lambert (1859–1942) of New York, almost the entire set of blocks engraved for the Fabrica and the Epitome was discovered, free from worm-holes and in remarkably crisp condition, despite having been used for an estimated 3–4000 printings. Everything then available was printed, in 1934, by Dr Willy Wiegand at the celebrated Bremer Press in Munich.

‘From the estimated 277 original wood-blocks, only 50 were missing, including the portrait of Vesalius. For ease of comparison, the two frontispieces from the 1543 and 1555 editions are printed en face, the wood-block for the latter having been loaned for the purpose by the Louvain Library’.

Later, Dr Wiegand wrote about the blocks (see Three Vesalian essays to accompany the Icones anatomicae of 1934 by Samuel W. Lambert, Willy Wiegand and William M. Ivins, 1952). Disclaiming his credentials as mere printer and no scholar or historian, Dr Wiegand recalls that after receiving the enquiry from Dr Lambert, the director of the library, Dr Hilsenbeck (nk), recalled seeing a box in the attic marked ‘Vesalius’ which, on inspection, contained 230 wood blocks. By repute, few other such stashes from this period were known; and one, collected by Howard, Duke of Arundel (1585–1646), had been lost in the fire of London. History was about to repeat itself for, after surviving for 401 years, Vesalius’s pear-wood blocks were all destroyed in the Allied bombing of Munich on 13 July 1944. All that now remains other than the printed works are three drawings used in preparation of the frontispieces: one each in Los Angeles, Glasgow and Stockholm—the Los Angeles ‘Crummer’ variant being considered by Cushing to be closest to that from which the frontispiece was eventually engraved.

Without doubt, the early editions of the Fabrica were never intended for idle curiosity; and contemporary copies were expensive. The market was wealthy intellectual connoisseurs and physicians. Oporinius sold the Epitome and Fabrica as a job lot for 5 florins and 3 batzen. John Caius (1510–73) had a copy valued at 6 shillings. Sir William Osler (1849–1919) listed Vesalius in a special category in his Bibliotheca prima (see Bibliotheca Osleriana, 1929)—boasting 55 items including six copies (at one time) of the Fabrica which he had bought for £10–£20, and 16 other publications representing almost everything listed above other than the 1552 second edition. Harvey Cushing listed 48 items including at least one of every edition of the Fabrica and the Epitome but he does not record the cost of these purchases (see The Harvey Cushing collection of books and manuscripts, 1943). Now, they are distinctly pricey. At the Haskell Norman sale of books on 18 March 1998, the copy of the Fabrica (1543) dedicated to Charles V (1500–58), Holy Roman Emperor, who granted Vesalius privileges that prevented others immediately plagiarizing his work, printed on vellum and with woodcuts and initial letters in contemporary colour and highlighted in liquid gold and silver, sold for $1 652 500; and the 1552 (unillustrated) and 1555 editions fetched $85 000 and $59 700. At the time of writing, readers of Brain may, if they wish, purchase the 1543, 1555 and 1568 editions for $330 000, $80 000 and $30 000, respectively.

Harvey Cushing was of the opinion that the Fabrica was much admired but little read. That so many copies of the early editions survive argues against that view; and there is evidence that does not support his conclusion. But, until recently, those without Latin struggled to read Vesalius for themselves. Book VII of the Fabrica dealing with the brain was first translated into English from the original Renaissance Latin by Charles Singer (1952). Between 1998 and 2009, the antiquarian bookseller and publisher, Jeremy Norman, published the first complete translation into English of the Fabrica, by William Frank Richardson and John Burd Carman (from the departments of Classics and Anatomy, Auckland, New Zealand): The Bones and Cartilages (Book I: 1998); The Ligaments and Muscles (Book II: 1999); The Veins and Arteries, and The Nerves (Books III and IV: 2002); The Organs of Nutrition and Generation (Book V: 2007); and The Heart and Associated Organs and The Brain (Books VI and VII: 2009). Sachiko Kusukawa (Picturing the book of nature, 2012) describes annotations made by Thomas Lorkyn (1528–91) in his 1555 copy of the Fabrica, valued for probate at 13s 4d. And in a note to that account she mentions another heavily annotated copy, now in private hands, that was read carefully, including its index, with book and chapter numbers added at the head of each page for easy referencing and so as to follow more easily the instructions in the internal margins from which to consult other images. This copy, previously owned by Walter Pagel (1896–1983) and B.E.J. Pagel (1930–2007) has an interesting provenance. The contemporary blind stamped pigskin binding over wooden boards, with panels made up of five different rolls, initialled FL and dated 1545, is the work of Franz Lindener of Wittenberg (nk) with the initials ‘ITE’ and ‘1568’ stamped on the binding. Internally, the contemporary owner and annotator is identifiable as J[ohannes] Thali of Erfurt (1542–83: hence ITE), the son of a Protestant pastor who studied medicine in Jena and then worked as a doctor first in Stendal, then Stolberg where he was Stadtphysicus and, from 1581, town physician in Nordhausen: there, on the way to visit a patient, his horse and cart overturned and Thal died of his injuries, aged 41. As a student Thal had studied botany and he is now best remembered, as the father of floristry, for Sylva Hercynia: immersive catalogus plantarum sponte nascentium in montibus & locis plerisque hercyniae Sylvae quae respicit Saxonia (1577) a comprehensive listing not confined to medicinal plants. In his annotations to the 1555 Fabrica, Thal includes on the free end-paper, mention of an edition of the Fabrica and Epitome, Amsterdam, ‘apud Jos. Jansonii’, which is not known. Thal’s annotations make constant reference to the work of Galen of Pergamus (129–c216) in whose tradition Vesalius had been trained in Louvain and Paris and where the teaching was innovative and moving away from medieval doctrine. In his dissections, Vesalius observed and recorded faithfully, and he thought and interpreted what he saw free from a priori theory or slavish repetition of ancient dogma.

Pleasant as may be this discovery of provenance for the current owner of Thal’s 1555 Fabrica, it pales into insignificance when compared to an event that occurred in 2007. Vesalius had burned his books, including those with marginal comments, in
1546. (Haskall Norman had what was then considered to be the only surviving item annotated by Vesalius: *Institutionem anatomicae secundum Galeni sententiam ad candidatos medicinae libri quatuor* by Johannes Guinierius, 1538: this sold for $156 500). Clearly, Vesalius worked with Oporinus to make alterations from the 1543 edition in preparation for the 1555 *Fabrica*. Charles O’Malley (borrowing the analyses of Fielding Garrison (1870–1935)) interpreted these mainly as ruminations on the earlier work rather than based on any new anatomical dissections:

‘He added further observations and corrected others, but perhaps the most valuable addition was the extension of the chapter on his physiological experiments which now included his report on the effects of nerve section [p 810 lines 22/34], on laryngeal paralysis following section of the recurrent nerve [p 823, line 11], on collapse of the lung after opening the pleural cavity [p 821, lines 25/31], on artificial respiration by intracheal intubation, and the continuance of life after removal of the spleen [p 820; lines 26/31].

What happened in 2007 is that a Canadian pathologist, Gerard Vogrincic, purchased at auction in Germany for $36 000, a defective copy of the 1555 *Fabrica*. There was not much interest in the item, partly through its extensive annotations extending from front to back, and because it lacked pages 669–72 and the final leaves, at Bb–Ee, containing the errata, index, list of gatherings, colophon and printer’s mark. A 19th century binder had cropped the book shaving away some lettering from the annotations, and with the inner margins tight so that text was buried in the sewing. It seemed odd to Dr Vogrincic that the annotator had crossed out whole paragraphs and re-written these in the margins, corrected spellings and punctuation, and deleted the name of Vesalius’s father, also Andreas, in the introduction. The truth began to dawn and, after obtaining copies of letters in Vesalius’s handwriting, it became clear that this was Vesalius’s copy annotated and corrected presumably in preparation of a further edition that never appeared (see above with respect to Thal). It then remained for Gerard Vogrincic to contact Vivian Nutton, professor emeritus in the former Wellcome Trust Centre for the History of Medicine, London, who authenticated the provenance of this bargain find. All that is known of the wanderings of the book between the late 1550s and 2007 is that it once belonged to an Institution which left traces of a shelf mark on the binding and lettering on the spine ‘A. WESALE DE HUMANI CORPORIS FABRICA’ suggesting a Dutch / Flemish ownership. Subsequent to this discovery, Dan Harrison and Malcolm Hast (professors emeriti in the Departments of Classics and Otolaryngology, respectively, at Northwestern University, USA) have, with Vivian Nutton and Nancy Siraisi (professor emerita in the Department of History at Hunter College, New York, USA) produced translations and a comparison of the 1543 and 1555 editions with Vesalius’s additional annotations fully documented. Appropriately, this is now published by Karger from Basel, Oporinus’s hometown, in two massive volumes contained in a plastic slip case. The diligence, meticulous attention to detail and scholarship are outstanding; and the contribution to the history of medicine without parallel in modern publishing.

The book is printed in Basel Antiqua font created for the purpose by Christian Mengelt with typeface, characters and ligatures that he describes in an appendix to Volume 2. In the 15th century Nicolas Jenson (1420–80) introduced a new roman font based on the Carolingian miniscule of the 8th–10th century that was designated ‘lettera Antica’. Jenson’s ‘Venetian antiqua’ led to the development of roman typefaces used in Basel by Johan Amerbach (1440–1514), Johannes Froben (1460–1527) and Johann Petri (1497–1550). This was the tradition inherited by Johannes Oporinus from 1537 through which now emerges ‘Basel antiqua’. For italics, Mengelt offers design features of ‘old face italic’ developed by Aldus Manutius (1449–1515: of the Aldine press) and cut in 1500 by Francesco Griffo (1450–1518). Pages LXV to CXIX of the preliminaries contain much valuable information. Daniel Garrison is critical of Vesalius’s Latin and his verbosity making for difficulties both in reading and in translating; but the style is retained since ‘the rhetoric and language of the *Fabrica* are essential, not incidental elements in the book’; and Garrison has gone for coherence rather than ‘masking the gassy prolixity and strong flavor of his Latin’ on the basis that Vesalius, who may have dictated to an amanuensis, meant what he said even if some of it is plainly wrong. Nor does the anatomical expert, Malcolm Hast, put straight Vesalius’s errors. Throughout, Vesalius adhered to three doctrines: ‘nature is continuous with justice’; ‘nature is the primary form of beauty’; and ‘nature does nothing in vain’. In having available a comparison of two texts and also accommodating Vesalius’s further emendations to the 1555 edition, the reader could get badly lost; but a page explaining how to use this book, decode the typefaces and use of colour printing, so as thereby to sort one source from another, is provided—the anatomy of an anatomy.

Vivian Nutton writes an historical introduction. Here, the reader will learn many biographical details relating to Vesalius and the intellectual climate in which he wrought so much change. For Professor Nutton, the 1555 edition is in every respect an improvement on its 1543 predecessor. The typography and space given to illustrations are more aesthetic; the Latin is more harmonious; names are dropped; extra chapters are added and their order changed; Vesalius distances himself further from Galenism; and there is more of female anatomy including pregnancy. Only now, with comparisons available from English translations can the extent of the revisions be appreciated by the common reader. And the chance discovery of Vesalius’s annotated copy of the 1555 edition indicates just as many changes planned for another. That this was the intention is clear from the extensive use of printer’s devices to indicate alterations. There are more improvements in the Latin—changing participial to relative clauses, and offering synonyms. Vesalius discusses circumcision in males and females based on Jewish customs observed in Venice and from his reading of practices in Ethiopia. The main anatomical considerations relate to bones and the skull; again, these are reflections on previous work not new anatomical studies. But it is thought that Vesalius did continue occasionally to dissect and this got him into trouble in 1564 when a ‘corpse’ proved still to be alive. That, or a hardening of attitudes over the anatomical seat of the soul, started to erode his influence and, when good connections saved him from the possibility of capital punishment, Vesalius slipped away with his family, from whom he later parted acrimoniously in France, and from there to Venice before heading for Jerusalem. Vesalius died on the island of Zante in the Ionian Sea.
on his return from the Middle East. Nutton credits Vesalius with four traits: technical skill with the knife; complete faith in his empirical observations even if these led to radical views; abundant learning; and obsessive concern to get things right—as the newly discovered annotations make clear.

Professor Nutton has previously published a scholarly account of Vesalius’s annotations (‘Vesalius revised. His annotations to the 1555 Fabrica’, Medical History 2012; 56: 415–43). There, he authenticates the provenance based on letters in the Erik Waller (1875–1955) collection in Uppsala and accepts that the variations in script, and any differences from the Haskell Norman annotations, are explained by where on the page Vesalius was writing and the 20-year gap between these two examples of his handwriting. Particularly influential is the reference to circumcision in which he alters the tense from ‘still possible to observe’ to ‘have observed’; and gives a first account of genital mutilation in females as practiced by ‘the Scveni of Ethiopia, subjects of Prester John who cut off the fleshy processes from new-born girls’. The many errata in the 1555 edition that may not have had the close supervision Vesalius intended after 1543 are now mostly corrected in the annotations, sometimes expanding on the reasons for change and not always resolving each and every ambiguity. Nutton argues that the missing signature Bb-Ee may never have been included with the sheets that Vesalius received in Brussels from Oporinus. He documents in much detail, and to any close reader’s eternal advantage, the many alterations in categories of stylistic, non-anatomical and anatomical detail. In particular, Vesalius is keen to improve on the clarity through better shading of the engraved illustrations, and correct mistakes that occurred in cutting the original pear-wood blocks. In places, such as in dealing with the organ of smell, Vesalius works and reworks his corrections and appears not satisfied with the position he reaches on the nature of connection between the nose and the brain. One at least of the textual deletions is incomplete and has left the passage relating to cartilage in the jaw-bone incoherent. Perhaps Vesalius grew weary—or died before finalizing his revisions—such that, at page 515–9, the indications in Book IV for changes to be made in Book VII, do not all materialize. Self-evidently, these are the two books in the Fabrica of most interest to neurologists.

In the preface, Vesalius indicates that Book IV (‘Dedicated to the nerves showing figures peculiar in front of the chapters to which they are suited’) explains not only the distribution of the nerves that go to the muscles, but the branches of others as well. First Vesalius considers the nature and origins of nerve:

‘Long, smoothly rounded organs having no inner cavity in their middle that sense can detect. They come out of the skull or the spinal vertebrae and deliver animal spirit from the brain, which kindles the animal faculty, to the parts of the body...no nerve comes forth from the brain or from the dorsal medulla unpaired’.

Vesalius asks how many pairs of nerves take their origin from the brain and dorsal medulla: his answer is the apparatus that serves the sense of smell and seven others (these are the optic; oculomotor; trigeminal (mandibular and ophthalmic divisions); trigeminal (maxillary division); facial (including the vestibular and cochlear); a bundle that includes the vagus, accessory and glossopharyngeal nerves; and the hypoglossal). He uses two main dissections as the reference points for his description of the nerves. One shows the base of the brain (Fig. 3); the other presents a lateral view of the brain, intact, with the course of the cerebral nerves displayed (Fig. 4). Vesalius describes spinal nerve roots. Opinions differ on the number but he settles on 30 pairs: seven in the cervical region; 12 thoracic; five lumbar; and six sacral.

‘The end of the dorsal medulla descending out of the sacrum is not considered a nerve, nor does it end in small branches worth calling nerves. But sometimes I have seen it divided into three very short twigs as it descends from the sacrum’.

For each nerve, Vesalius traces its origin to a particular muscle. Later he makes an attempt at dissecting the passage of nerve roots through the brachial plexus. His view is that C5, 6, 7, 8 and T1 emerge as the axillary, musculocutaneous, median, ulnar and radial nerves, and a sixth structure that innervates the skin and bones. In dealing with the arm, Vesalius enters a debate on motor and sensory nerves that was not settled for several centuries:

‘Consider also how easy it is for movement to stop while sensation is still unaffected, and sensation to be lost while motion is still unaffected...suppose that the fourth nerve [radial] is severed by a wound...will not extension of the little and ring fingers be lost while their sensation remains. For the fifth nerve [ulnar] providing sensation, is undamaged and in the opposite situation ‘will not the little and ring fingers go numb while their motion is unharmed...it is not necessary to be distracted by the fact that greater animal power is required for motion than for sensation. More ridiculous still is the reasoning of the prince of Anatomists [Galen] by which he imagines that certain nerve twigs are responsible only for motion, while others are in charge of sensation, as if any nerve twig lacked the sense of touch’.

Prepared for the Epitome but in the event added to complete Book IV of the main work, is an illustration intended to form the base of a female manikin onto which other figures (which appear at the end of Book III and in Book V) are to be pasted (Fig. 5). Students might buy the montage already assembled or as a separate set of printed figures. Instructions in the Epitome read:

‘We wish to advise those who obtain unprepared copies...on the method of cutting each from the superfluous paper and pasting them on and then of colouring according to their ability and desire...it will be useful to glue a piece of parchment to the back of the entire sheet so that it may not in vain be divided into as many pieces as there are figures comprising it...I shall add a number to the figures so that I may explain in what place each is to be attached’.

Book VII is ‘dedicated to the brain, seat of the animal faculty, and to the organs of the senses, showing at the beginning virtually all its figures as in the preceding two books’. Vesalius points out that this ‘examines the harmony of the brain and the organs of sense in such a way that the series of nerves taking their origin from the brain, explained in the fourth book, is not repeated’.

There are 13 main figures showing serial removal of the coverings of the brain and its substance and some subsidiary images of selected parts. First, ‘the human head prepared as if freed for
...making it ready to display the brain' showing the meninges, sinuses and superficial vessels. The next emphasizes in more detail the sagittal sinus, falx cerebri and meninges. The third figure begins to explore the contours of the brain on its lateral and medial surfaces, and the corpus callosum. There follows a series of three figures created by sagittal slicing of the cerebral hemispheres to reveal the ventricles and surrounding brain parenchyma.

Perhaps, in identifying and naming discrete structures, Figures four, five and six from Book VII are the most significant advances in neuroanatomy, and related disciplines, ever made (Fig. 6). Figures seven and eight deal with the tentorium and gross appearance of the cerebellum, which is allowed to fall forwards revealing the basal meninges and foramen magnum in Figure nine. In the next two figures, Vesalius removes individual structures from the cranium and examines, in turn, the medulla and pons, and the cerebellum and its tonsils. Figure twelve moves aside the few remaining contents of the cranium to show the olfactory tract and some larger veins. Next we see the optic chiasm and carotid arteries displayed. The fourteenth figure is designed to demonstrate the cranial nerves. Figure fifteen is a dissection of the...
Figure 4 ‘Second of two figures that are considered common to the nine following chapters. This one portrays the right side of the entire cerebrum and cerebellum and of the part of the dorsal medulla mentioned in the previous figure [1543] shown with the exposed set of the seven cerebral nerve pairs. We have however also illustrated here the left nerves of the sixth and seventh pairs because the distribution of the sixth pair is different on each side [1555]. The proportions of this figure are set forth in such a scale that you can make an outline of a body whose bladder would stand at the lowest point of the present figure, and its thorax and abdomen could be seen in front with the face turned hard over to the left shoulder and viewed from the left side’ [1543]. The figure has 65 footnotes.
Figure 5 Plate at page 553 in the Fabrica, 1555. ‘Nervorum delineatio, quae septem parium nervorum qui à cerebro et dorsalis medullae initio pronascentur ortus proponit, et distributionem seriemque omnium parium quae à dorsali medulla in dorsi ossibus complexa originem ducunt, pulcherrime refer’ (‘Drawing of the nerves, which shows the origin of the seven pairs of nerves that arise from the brain and the beginning of the spinal cord, and superbly explains the ordering and succession of all the pairs that take their origin from the spinal cord that is contained in the bones of the back’). The plate has 44 footnotes. The accompanying text continues, translated in the book under review: ‘In the present figure we have drawn the cerebrum together with the cerebellum and origins from the cerebrum as if the brain were stripped out from the skull and viewed in it as it would appear if someone in an erect position bent the head as far as possible to the rear, directing the eyes upward and backward. To make it possible for the index of the characters to be well situated close to this chart, we have drawn the figure as if it lacked an arm and a leg, especially since the arrangement is the same on both sides’.
pituitary and neighbouring structures seen in the coronal plane. The sixteenth—a vestigial circle of Willis—shows the relationship of the pituitary to arteries at the base of the brain. But Vesalius then departs from accuracy in drawing the rete mirabilis (Figure seventeen) and the infundibulum into which drips the cerebral phlegm that reaches the pituitary (Figure eighteen).

The last part of Book VII concerns function and physiology: ‘the brain is constructed for the sake of the primary spirit, and for sensation and movement’. Simply stated, the brain forms animal spirits, made from vital spirit present in arteries and passing through holes in the cribiform plate and elsewhere in the skull, which it then distributes to the places where they are needed via the nerves. But although Vesalius introduces this discussion by stating that ‘it remains to give an account of the source of sensation, arbitrary motion, and the ruling spirit by means of which we form mental pictures, reason, and remember’ he knows he is on tricky ground:

‘I do not have a satisfactory grasp of how the brain performs its functions in imagination, reasoning, thought, or memory (or however you might like to subdivide or enumerate the powers of the chief spirit in accordance with anyone’s theories). If I can grasp something that is even

Figure 6 ‘Index of the fourth figure and its characters. In the fourth figure we have resected all parts of the hard and thin membranes that appeared in the previous figures. Next in the order of dissection, we removed left and right portions of the brain in such a way that the ventricles of the brain now begin to come into view. First, we made a long cut along the right side of the corpus callosum where the sinus marked by one of the M’s stood in this figure. This incision through the right ventricle of the brain removed the portion of the right side of the brain that was above the place where we cut around the skull with a saw. When we performed the operation on the left side we laid down part of the brain by the left side in such a way that it would show the upper side of the left ventricle on one side while still keeping the corpus callosum in the head’ [1543]. The figure has 15 footnotes.
likely by discovering a similarity, that would surely not be accomplished without staining the most sacred faith’.

In prefacing his description of the functions of the brain, Vesalius starts with an acerbic dismantling of the ventricular theory on which he had been brought up, being especially dismissive of the teachings of Aristotle (De anima):

‘These are the fantasies of people who never look at the inventiveness of our Maker in the fabric of the body’; revised in 1555 to ‘such are the imaginings of those who nowhere look into the artifice of God, the maker of things, and who everywhere lay claim to free opinions thought up with great impiety’.

And later:

‘I have determined to attribute to the ventricles nothing except that they are the spaces or sinuses in which air attracted by inspiration and the vital spirit transmitted to them from the heart is converted into animal spirit by the power of the brain’s unique substance’.

Vesalius takes an anatomist’s stance in deciding that the function of the corpus callosum is to support the third ventricle and adjacent structures and connect the two sides of the brain, as does the fornix. Equally, the pineal (‘the cerebral gland resembling a pine nut’) is there to support the vena magna cerebri (great vein of Galen). The ‘testes and buttocks’ of the cerebrum (the colliculi) protect the aqueduct that connects the third and fourth ventricles. Vesalius considers the five special senses and dissects the organs of smell (but can advance matters no further than recognizing the importance of the olfactory bulbs), vision (he has 19 figures of the eye), hearing and taste (nothing to add from Book 1 and Books 2, 3 and 4, on the ear and tongue, respectively) and touch (‘smiling at the opinion of those that taught that one small portion of the same nerve was responsible for sensation and another for motion without sensation’). Book 7 ends with a manual on how to dissect the brain and associated organs.

Professor Nutton speculates on when Vesalius completed his annotations for the proposed further edition; and any relationship to the 1568 Venice edition—rather neglected by historians and not well known to collectors—that did eventually appear. The suggestion that the annotations were handed over to the publisher of that edition, Francesco de’Fancheschi (nk–1599) is refuted, the evidence being in favour of the publisher doing his own donkey-work; and not very well since the 1568 edition repeats deficiencies published in 1555. Nutton’s best guess, and he adduces much circumstantial evidence in support, is 1559—the annotated sheets remaining with Oporinus until his business was sold in 1567 when the residue of his Vesalian stock was claimed by his heir, Franciscus Maria Stella (nk).

How well known is the work of Andreas Vesalius? Back to parlour games. Shopping in Cambridge late in December 2013 brought to attention an ideal gift for the discerning family seeking intellectual relaxation after their Christmas lunch (Fig. 7). The local Kindersley workshop had produced a pack of playing cards entitled ‘Muscular Happy Families’ in which the aim is to collect...
all four muscles of each body part, the 52 cards taken from the *Fabrica*, being four each for the foot (card number two in the pack), lower leg (three), thigh (four), abdomen (five), hand (six), forearm (seven), upper arm (eight), shoulder (nine), lower back (ten), upper back (knave), thorax (queen), neck (king) and head (ace), with two skeletal jokers. After dealing, the first player asks one of the others for a particular card in the set, one example of which he/she must already have; if without success, the asking passes to the next player who may recall some of the strengths in the hands of those who have already revealed their holdings. Once formed a set of four muscles is placed face-down on the table. This version of an old game was inspired by Paul Lopes Cardoza (1913–2000), former professor of medicine in the University of Louvain, and developed by his daughter Lida using the Emilida typeface that she designed, and produced to celebrate the quincentenary of the birth of Vesalius in 2014. This reviewer was quickly defeated by his 13-year-old nephew but blames relaxation of the occasion rather than imperfect knowledge of Andreas Vesalius and his anatomical revelations.

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