More Vesalian Second Thoughts. The Annotations to the *Institutiones anatomicae secundum Galeni sententiam*, 1538

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Summary

In 1538 Andreas Vesalius published his unauthorised revision of Guinther von Andernach's little anatomical textbook, the *Institutiones anatomicae*. Immediately on publication he set to work on a further revision, making around 250 changes. This paper presents these changes for the first time, discussing them in the context of Vesalius as a reviser of his own work and as anatomist moving away from reliance on Galen towards the independence of the 1543 *Fabrica*. As well as simple proof corrections, the notes show corrections to Vesalius' earlier anatomical observations as well as page references to passages in Galen discussed at greater length in the *Fabrica*.

Keywords: anatomy, annotations, *Fabrica*, Galen, Guinther von Andernach, printing, Andreas Vesalius, Padua

Introduction

One of the most controversial of all the publications of Andreas Vesalius (1514–1568) was his unauthorised revision of the *Institutiones anatomicae secundum Galeni sententiam* by his Parisian master Johann Guinther von Andernach. The work had been published originally in Paris in 1536, and was followed immediately by a Basle printing.¹ As its title indicates, this was an attempt to present the principles of Galenic anatomy in a form that was easily accessible to medical students. It epitomized the revolution in anatomy

1 Guinther von Andernach 1536. For the Basle reprint, Balthasar Lasius and Thomas Platter, 1536, see Hieronymus 2005, no 134, Band I, pp. 284–286. Guinther's original text is cited from the Basle, 1536, edition, available online via the Basle University Library website.

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teaching that had taken place in Paris over the previous decade. The formal *elogia* of graduating students in the mid-1520s had made no mention of any anatomical interests, and referred to surgery only briefly (and far less frequently than medical astrology), but the arrival of the new Galen in Greek with the publication of the Aldine edition of 1525 changed all that.² It revealed for the first time that the ancient Roman doctor, Galen of Pergamum (129–ca. 216), had not only dissected himself, but regarded an understanding of the body based on frequent dissection as the very foundation of all medical practice. Paris embraced this new Galen with enthusiasm. Guinther himself brought out his Latin translation of *Anatomical Procedures*, Galen's manual of dissection, in 1531, while his junior colleague, Andreas Laguna, published his own *Anatomica methodus, seu de sectione humani corporis* in 1535. The young Vesalius also named as one of his teachers Jacobus Sylvius, whose lectures, according to one of his later audience, drew enthusiastic students from all over the university, eager to hear the great man expound anatomy with sketches and sometimes specimens of recently dissected animals.³

Although in the preface to the *Fabrica*, Vesalius speaks slightly of the anatomical teaching he had received (but without mentioning names), Guinther and Vesalius had enjoyed a good relationship in Paris between 1533 and 1536. Vesalius had assisted his teacher in the cutting up of the corpse while Guinther explained what was happening, and Guinther acknowledged his prowess as “a young man ... of great promise, possessing an extraordinary knowledge of medicine, learned in both languages and very skilled in the dissection of bodies”.⁴ Vesalius in his turn appreciated his master's ability as an expositor. Although he was later credited with dismissing such compendia as a waste of money, Vesalius praised the way in which in his little textbook Guinther had digested the enormous mass of Galenic anatomical learning into a small compass in a way that was both useful and necessary for students.⁵

It was the value of Guinther's text as a student manual that encouraged Vesalius to prepare a revision of his own to accompany his early lectures at the University of Padua. He did this without the knowledge of his teacher in a way that has seemed to modern scholars little short of unauthorised

² Nutton 2003.

³ O'Malley 1964, 49–57; for Sylvius and Vesalius' role in his dissections, see Vesalius 1543, fol. 3*r.

⁴ Vesalius 1543, fol. 3*r; O'Malley 1964, 53–56. For Guinther's praise, see Guinther 1536, 46.

⁵ Guinther, 1538, *Pref.* For his alleged dislike of compendia, see Hartmann et al. 1942–2010, vol. X.2, 1995, 641, quoting from Crato von Crafftheim 1555, *Ep. Dedicatoria*, describing how, when Wolfgang Herwart introduced Crato to Vesalius, the latter said that *compendia esse dispendia*. (The same comment is also attributed to the equally voluminous Conrad Gesner.)

plagiarism.⁶ His justification was two-fold. He had been often asked to carry out such a revision (at best an exaggeration given the short time he had been teaching); and the volume itself was full of typographical errors. But his changes go far beyond the correction of printers' errors or even the addition of words and phrases that make Guinther's intentions clearer and more precise. They include longer sections on the spleen, as well as a hint that he was planning to produce the account of the muscles of the neck and spine that was missing in Guinther's original.⁷

His hope that the "generous and learned" Guinther would not be offended by the liberties that his erstwhile pupil had taken with his book may have been justified, at least for the moment.⁸ Many of Vesalius' additions were taken over, sometimes verbatim, by Guinther in his own revision of 1539, which included a new description of the neck and spine muscles. But it cannot have entirely endeared Vesalius to the Paris Faculty, not least in its emphasis on Vesalius' superior skill in dissection. Gadaldino's reference to Vesalius' hesitation in taking on the job of revising Guinther's version of *Anatomical procedures* for the Giunta edition of Galen's complete works in 1541–2, implies that Vesalius was at least aware of the reputation it had given him for sharp practice.⁹

Although bibliographers have long been familiar with the complicated printing history of the *Institutiones*, in both Guinther's and Vesalius' revisions, the existence of Vesalius' own copy of the *Institutiones* became known only in 1991 with the publication of the catalogue of the Haskell Norman Collection. The cataloguers there scrupulously recorded their doubts about the Vesalian authorship of the many annotations in the volume, pointing to the fact that many of the corrections to the text were not included in the 1540 printing and inviting further work to confirm the attribution.¹⁰ However, at the 1998 sale of the Norman Collection, it was firmly described as being the author's own copy and bearing his annotations. This was undoubtedly

6 Such unauthorised republication of already printed works was common in the sixteenth century. Vesalius himself, as he complained, was often the victim of such copyings, and indeed the second printing of his revision, by the firm of Melchior Sessa, is just one such opportunistic publication.

7 O'Malley 1964, 90–2; Drizenko 2011.

8 Guinther 1539, sig. a 5r, is gracious, calling it a "remarkable work" (*egregiam operam*), and repeats his praise of Vesalius there, referring also to him as "no mean professor of purer medicine", and on p. 30.

9 O'Malley 1964, 92–94.

10 Hook and Norman 1991, vol. II, 778, no. 2135. Nothing is said there about provenance, save that it was sold to Haskell Norman by Arthur Lauria in Paris. Their reference to a second edition of 1540 is presumably to the Sessa, Venice, printing (which is dated by others to 1538); secure evidence for either date appears to be lacking.

correct, for several reasons. The hand is identical to that in the annotated copy of the 1555 *De humani corporis fabrica*, now on deposit at the Thomas Fisher Rare Book Library in Toronto; the method of annotation is the same; and there is at least one entry that only Vesalius could have written. But until the 2014 exhibition of Vesaliana at the Thomas Fisher Rare Book Library the book had not been exhibited in public, and the full extent of Vesalius's improvements remained unknown. Thanks to the generosity of the owner and the help of the staff of the Fisher Library, it was possible to examine the volume in detail there and to compare it with the notes to the 1555 *Fabrica*. This article presents the results of my investigations.¹¹

Authenticity

There can be no doubt that the notes are by Vesalius. The hand and the method of making changes are identical with those in the 1555 notes.¹² The same signs are used to indicate a repositioning, and an oblong shows where Vesalius wished to insert a space. Furthermore, the very first addition, p. iir, 4, adds to his praise of “the most learned (*doctissimo*)” Guinther a new piece of personal information: *cuique meam secand{o}i op[eram] publice & p[ri]uatim na[ua]/uerim* (“and for whom I devoted myself to dissecting in public and private”).¹³ That Vesalius acted as Guinther's assistant in his public dissections was already deduced from Guinther's own acknowledgment, but this is the only unambiguous statement that he had also done this at Guinther's private dissections for a small group of students and aficionados.¹⁴

11 In my transcriptions <...> indicates additions by Vesalius; {...} a deletion; {...} a gap left by cropping and sometimes filled by me; / a line break. I am planning a translation with a full listing of the annotations, of which only a selection can be discussed here. References to the notes are by page and line in the Bernardinus edition; the Sessa reprinting has a different pagination.

12 Nutton 2012. A comparison between the two hands can easily be found in the catalogue of the Toronto exhibition, Oldfield 2014, 38–3 and 62–63. As with the 1555 notes, the later cropping of the page in binding took little account of the annotations. Most of a line at the top of p. 71v (fig. 4) has been destroyed and several letters are missing from comments in the outer margins, although it has usually been possible to restore the missing wording and to identify many of the sources to which Vesalius refers.

13 Vesalius originally wrote the dative ‘*secando*’, the normal Latin usage with ‘*operam nauare*’, but changed it to the less familiar but equally correct genitive to avoid confusion with the earlier dative ‘*cuique*’.

14 O'Malley 1964, 61 and note 138. He had similarly acted as assistant to Sylvius.

Illustration 1: Guinther, Johann, *Institutiones anatomicae secundum Galeni sententiam ... ab Andrea Vesalio ... auctiores & emendatiores redditae* (Venice 1538), fol. 6v–7r. Vesalius corrects printing errors and inserts a comment and a Galenic reference. ©Stuart Rose.

Purpose

Vesalius, as both sets of notes amply demonstrate, was an obsessive corrector, keen to get everything right, from the placing of marginal notes and the spacing between words to the details of anatomy.¹⁵ But the use of printers' correction marks of itself cannot prove that Vesalius had a revised publication in mind when he began his notes. However, on three occasions Vesalius engages in a dialogue with an anonymous printer, each time asking for changes to be made in the margin "if there is space available", a major consideration in so small and concise a volume. In the first instance, p. 10, 10–13, Vesalius was amplifying his own revision. Whereas Guinther had simply pointed out that in some instances two or three tunics were thought to exist where, in fact, there were only one or two, Vesalius added examples and the

¹⁵ indicating a need for spaces are found at pp. 4, 10 and 17; 7, 5 and 12; 42v21; 48v12; 73, 25; signs transferring marginal notes from one line to another at pp. 15, 21; 43, 5; 52, 25; 65, 11; marks closing up sections at pp. iiv, 18; 45, 25.

adjective ‘appropriate’.¹⁶ He was obviously not satisfied that this would make it clear to the reader why this mistake had occurred, something explained by Galen but only hinted at by Guinther, a failure to distinguish the peritoneum from the other adjacent tunics. To this end he made a mark opposite lines 15–17, and wrote at the bottom of the page: *in margine hic locari non potuit. quorundam error in tunicis ob peritoneum* (“This could not be placed in the margin: “a mistake of certain people in relation to these tunics (sc. of the bladder or uterus) because of the peritoneum.” A few pages later, at p. 15v16, he commented: *in margine ponetur si locus sit in 7 admi anat pro ieiuo intestino vesica legitur*. (“If there is space, there may be put in the margin: in book 7 of *Anatomical Procedures* the word ‘*vesica*’, ‘bladder’, is used for the jejunum.”¹⁷ In the third note, at p. 69v13, he asked for a comment to be placed in the margin and marked with an asterisk to show that Galen was in error.¹⁸ There are also several places where Vesalius indicates new headings to go in the margins.¹⁹ None of these notes is found in any later edition of the *Institutiones*, and they may never have been handed over to a printer, whether Bernardinus or even Oporinus in Basle. At the very least, however, they show that Vesalius thought at first in terms of a published revision, even if he never proceeded far along that route.²⁰

Revisions of the kind that Vesalius had first made to Guinther’s book and that he was contemplating again here were extremely rare in medicine before 1550. Updating of legal and theological texts, especially those aimed at a student audience, was becoming more common, but even when medical texts were reissued by other printers, they appeared with little more than a few typographical changes. In a few instances, most notably in the reissues of the *Articella* and in the various editions of the *Epistulae medicales* of Giovanni Manardi, printers added new texts alongside the old, but they did not make substantial changes to what was already in print.²¹ Vesalius’ deci-

16 Guinther 1536, sig. 8v = Vesalius 1538, p.10,10–13: *vnde quibusdam duae, vt vesice et vtero tunicae attribuuntur, quibus vna **propria est**: quibusdam tres, **ut ventriculo**, quibus duae, **propriae sunt***. (Vesalius’ first revisions are given in bold.) The same point is made by Vesalius again in the *Fabrica*, 1543, 518, 533–534. Guinther accepted Vesalius’ original changes in his revision, 1539, 7.

17 For the difficulty with this reference, see below, p. 111.

18 For Galen’s error, see below, p. 111. At p. 32,25 Vesalius also makes a direct address to his potential reader (“You will see”).

19 See below, p. 102.

20 He may have changed his mind a little later, for the references to pages in translations of Galen, see below, p. 110–113, seem to be personal aids to memory rather than marginal references to be included in a printed version.

21 I know of no study of the revisions of medical texts; some pharmaceutical works, like the *Luminare apothecariorum* of Joannes Jacobus de Manliis, which went through several editions, may have undergone updates as new drugs became available. The situation changes markedly after 1550.

sion to revise his master's book to incorporate corrections and new discoveries is thus unusual, and his apparent willingness to consider a further revision almost immediately after publication even more so.²² As with the *Tabulae anatomicae sex* he shows an awareness of the possibilities of the new print culture that was shared with few other contemporaries.²³

Date

As with the *Fabrica* annotations, there are no precise indications as to when the notes were written. Nonetheless, there are good grounds for supposing that they were made before 1542, if not in 1538–9. Some of the marginalia are obviously later than others because they are squeezed in to a space already largely occupied, but there is nothing to suggest that they were made over a long period, and the hand changes hardly at all. Vesalius may well have begun correcting his book immediately he received the proofs from the publisher in 1538, and continued for a little while. But his departure for Basle in 1542 and his subsequent decision to abandon a university career for service at the Spanish court meant that he had little or no interest in improving his manual of teaching further. Indeed, this copy could well have been among the books that he disposed of when he left Padua.²⁴

Three observations, all of which will be discussed further below, would support a date somewhat earlier, between 1538 and 1539 or 1540 at the latest. The first is that, at the end of the book, Vesalius resorts to deleting rather than commenting on passages, suggesting at least a change of emphasis. Secondly, his slightly later references to sections in Galen (all of which are discussed at greater length in the *Fabrica*) are not made to the Giunta edition of 1541–2, in which Vesalius participated, but to editions from the 1530s. Thirdly, he makes no clear mention of any of the anatomical discoveries first announced in 1543, although he does repeat some of his criticisms of Galen. Given also the amount of time and effort required in writing the *Fabrica* and

22 If the printing dates are correct, he must earlier have been revising his Louvain dissertation, *Paraphrasis in nonum libri Rhazae*, Louvain, R. Rescius, 1537, for a republication with a different publisher, Basle, Robert Winter, 1537, almost from the moment he delivered his original copy. The costs (and potential losses) involved in resetting a small volume like the *Institutiones* aimed at a constantly renewed student market were infinitely less than those of a large and illustrated work like the *Fabrica*, and such a proposition was more likely to find favour with the publisher.

23 For this aspect of the *Tabulae*, see Carlino 1999, 38–58.

24 Vesalius 1546, 196–197, referring in particular to the books of Galen he had studied in learning anatomy.

in carrying out the dissections that lie at its base, a date after 1540 seems unlikely, especially if, as will be argued, these notes demonstrate the growing emancipation of Vesalius from the authority of Galen.²⁵

The corrector's eye

The great majority of the roughly 250 corrections can be classed as proof corrections.²⁶ Although Vesalius had offered as justification for his revision the fact Guinther's original publication had contained many printing errors, Bernardinus' production was scarcely a model of accuracy, particularly in its printing of Greek words.²⁷ It was a typical student textbook, printed on poor quality paper, and still containing on p. 5v a block of meaningless text inserted by the compositor to fill the matrix while the top of the (otherwise blank) page was being set, but carelessly left in when the page was printed. This was not noted in the *Errata*, but deleted here by Vesalius.²⁸ He included almost all of the many corrections signalled in the *Errata*; the rest he either left out through inadvertence, or altered slightly.²⁹ He also corrected simple misprints not mentioned in the *Errata*, and there is little that escaped his eagle eye.³⁰

Helping the reader

There is one obvious contrast with the annotations to the 1555 edition of the *Fabrica*: in these revisions Vesalius rarely changes his text for purely stylistic reasons. At p. 23v19 the sentence structure is slightly altered by the deletion of *quae*, at p. 36v19 by the deletion of *qui*, and at p. 73v16 by the removal

25 See below, p. XXX.

26 My classification of the annotations is schematic; some notes could fit into more than one category.

27 The Sessa reprinting avoided the problem by transcribing the Greek into Latin characters.

28 And by Guinther in his own revision of the *Institutiones*.

29 Corrections signalled in the *Errata* but not placed in text are at p. 39v3 (although there is a caret mark); p. 46,14; p. 58v26. Vesalius adopts a slightly different solution: p. 69v13 *metum*.

30 Pp. 6,19 *cu<t>i*; 6v10 *in foetu*; 7,16 comma deleted after *concupiendum*; 10v13 comma transferred to follow *ventriculo*; 10v25 *<e> quo fit*; 15,23 *ileon*; 15v15 *mesenterii*; 22,20 *πορους χοληδοχους*; 32,24 *membrana<s>que*; 37v6 comma deleted; 50,3 comma deleted after *membranam*; 50,21 comma inserted before *ad*; 52v8 *nacta*; 68v1 *fastigiata*; 72,1 *acuminato*; 72,4 *pet{t}it*; 72v1 *periost<i>os*; 72v25 comma deleted after *est*; 73,3 *fusius*; 79,7 comma inserted after *est*; 79v16 *auditorio*; 80v21 *quaenam*; 87,5 comma inserted after *uenis*; 87v12 *scapulis*; 87v12 *totius*; 88,6 in mg. *exterioris*; 100,7 *intro*; 100,9 comma after *genu* transferred to follow *extendit*; 100,18 *concauitati*; 100,18 *tendines*; 100,22 *omnes*. None of these changes affects the sense of the passage.

of *quam*, all of which turn a relative clause into an independent sentence. At p. 89,4 *pergit* is replaced by the participle *pergens*, and two sentences are merged into one. Another alteration apparently for purely stylistic reasons changes a word but not the meaning of the sentence: p. 37,11 (*prouocet perueniat*). Style is probably also the reason for the addition of *et expolientes* (“and polishing”) at p. 76v2, adding a little more detail to a comparison with the actions of lapidaries in working precious stones. Too much should not be made of this, for the succinct nature of the work, and Guinther’s own precision, did not allow for the stylistic flourishes found in the *Fabrica* and its annotations.

On the other hand, many of Vesalius’ additions either give extra assistance to the reader or make the original formulation clearer and more precise. In several places Vesalius adds new marginal headings which help to orientate the reader on the page.³¹ Many of the corrections in the text itself expand on what was already there but seemed a little too cryptic.³² Only one such change, at p. 77v24 *cerebri* <et cerebelli>, may depend on new information, but, even here, the inclusion of “and the cerebellum” could have been deduced from the context.³³

This type of annotation demonstrates well Vesalius’ concern with precision and accuracy. The format of this introductory text, however well written by Guinther, imposed constraints that might mislead the unwary beginner. Vesalius, not long from being a student himself, here shows sympathy with those trying to make sense of some very concise wording, amplifying or adding signposts to what might have been hard to understand.

The Paduan anatomist

Two groups of corrections, however, throw a more interesting light on Vesalius’s activity in and around 1538. One, which on the evidence of script and the placing of the notes comes later, comprises references to two ana-

31 Pp. 6v4 <De diuersis temperamentis>; 10,15 <usus>; 38v22 <Venae uteri>; 54,9 <ad vertebra[rum]/processus>; 57v1 <arteria venosa>; 72,14 <De superciliis>; 80,5 <plexus reticularis>; 82v1 <retina>. At p. 14v24 the marginal heading is changed from visus to connexus usus.

32 Pp. 6,25 *traductu*<membranae>; 7,6 *haberi* <falso> *affirmant*; 7,10 <a cute> *abscedet*; 9,4 *in* <vulnerum> *ventris suturis*; 10,20 *septo* <transuerso>; 14v2 *primum* <in ventrem inferiore>; 21,6 *aeque* <in omnibus>; 33v12 *musculus*...<cr>*jeatus est*; 35,24 <subter cutem> *soluitur*; 43,14 <in abdomine> *detrahitur*; 45v17 *simul* <eius partes> *tendantur*; 47,8 *brachium*<pectori>; 72v25 *suturae* *replaces illae*.

33 For the addition at p. 72v1, see the following section.

tomical works by Galen, and will be discussed below; the other represents the result of dissections carried out by Vesalius while in Padua and possibly earlier elsewhere. Conclusive evidence for the date of these dissections is difficult to find, and one cannot always tell if a change, as, for example the deletion of *oris*, “the mouth” (sc. of the uterus) at p. 38,22 in favour of the less precise “uterus”, has been made as a result of new anatomical knowledge or for stylistic reasons.³⁴ But the addition at p. 32,25 of: *et illam naturam intueberis* (“and you will see that nature” sc. of the seminal vesicles), an unusual direct address to the reader-anatomist, certainly reflects Vesalius’ own experience as going beyond what Guinther (and Galen) had written: seeing what is there in the body is an essential step towards the truth.

All the anatomical additions are relatively brief. At p. 37,9, the covering of the female testes is now described as a slender membrane, while at p. 72v9 Vesalius adds “ligaments” (“*vasa <et ligamenta>*”) to the vessels that pass through the skull to help form the pericranium. On the previous page, line 13, Guinther had briefly noted the different muscular structures of the forehead and cheeks, and compared the latter with the lips. Vesalius added that there were also nerves there, but also cautioned that they were not all formed in the same way: *in illa (sc. fronte) <enim> musculosa compago est, [in his] <ex> musculorum <et neruorum> fibris, vt in labris, <non tamen eodem modo>*. To the slightly misleading description of the heart at p. 59v8, Vesalius first added after ‘*vena*’ the words *ingreditur et venosa*, next deleted them, and finally rewrote the sentence more clearly at the bottom of the page: *caua vena ingreditur, vena vero arteriosa egreditur* (“The vena cava enters, and the artery-like vein leaves”). In the discussion of the leg at p. 96v21 and 23, Guinther’s description of the tendon drawing the tibia upwards (“*sursum trahens*” is altered to “turning it forwards” (“*in] anteriora vertens*”).³⁵

There are also passages where Vesalius’ additions indicate a movement away from Galen towards a different position visible more clearly in the *Fabrica*. At p. 46v26–47,1. Vesalius’, in a section he had added to Guinther’s original, described the seventh muscle moving the scapula as having its origin near the extensions of the lambdoid suture (*iuxta suturae labdoeidis addita-*

34 A stylistic explanation is also more likely for the removal at p. 31,16 of *magno*, characterising the seminal vesicles as “big”: *quantumuis [magno] sint vasa seminaria*. It goes without saying that the smaller the length of time presumed to have elapsed between publication and the writing of the notes, the more likely it is that the comments reflect earlier work rather than a new dissection.

35 At p. 96v23 Vesalius also corrects the grammatically wrong *anteriore* to *anteriori*. Dan Garrison reminds me that the confusion between “upwards” and “forwards” is found elsewhere in Vesalius, and is the result of imagining the body as sometimes lying on the dissection table and sometimes as suspended.

menta enatus). This was then changed to “near the sides of the lambdoid bone” (*iuxta ossis labdoeidis latera enatus*), which, at the very least, suggests some dissatisfaction with his original wording. By the time Vesalius came to write the *Fabrica* he had not only altered completely the way he classified the muscles of the scapula, but also had come to discover many mistakes by Galen in his description of them. There is no mention of this seventh muscle as such, and it is likely that the new formulation reflects the development of Vesalius’ increasing awareness of Galen’s fallibility.³⁶

A second example concerns the existence of fluid in the pericardium. Galen and Guinther, p. 51v7, had argued that this occurred naturally and that, when in excess, it brought about the condition called palpitation. Vesalius inserted a note of caution: *excitet <licet nonnulli in viuis eam esse negant>* (“although some deny that this (sc. fluid) occurs in living beings”). What he meant by this he explained at greater length in the *Fabrica*, emphasising his experiences in dissecting both humans and animals.³⁷ He had found various amounts of water in the pericardium of those who had recently died, but his vivisection experiments on dogs and pigs had not proved conclusively that some water was already present in living humans. In Bologna he had also examined a human heart that had been removed from someone on the point of death, “not a pleasant experience”, and at Padua managed to dissect a human heart he had removed so recently that it was still beating. On both occasions he found water in the pericardium, but he was still loth to pronounce definitely on the question. All he would say was that there was some water in living bodies, and that those who claimed that any water found in the body after death had been converted from spirit were definitely wrong. Beyond that, he would not go, warning that it might lead to a tricky involvement in deep theological questions.

But it was not only theologians who might disagree with Guinther’s formulation. The most famous (or at least best paid) professor of medicine in Italy, Matteo Corti (1475–1544) argued strongly that even if after death the spirits were changed into water and the spirits within the heart appeared in the dissected pericardium as water, it did not follow that water was also found there normally.³⁸ Indeed, he used Galen’s comments in *Affected Parts*

36 See the discussion of the muscles moving the scapula at *Fabrica*, 1543, 272–275, and especially the comment on Galen’s errors at 274–275.

37 Vesalius 1543, 585–586. For the major changes made to this passage in the second edition, see the translation of Garrison and Hast 2013, 1183–1184.

38 Corti 1551, 408–409, ironically dedicated by Jean Canappe to the *celebratissimus*’ anatomist Andreas Vaselius (sic). This was a reissue of the earlier edition, Pavia, F. Moschennus and G. B. Niger, 1550. For Corti see Nutton 1987.

V.1 (VIII, 306 K.), and his apparent silence elsewhere, to suggest (correctly) that the presence of water was the result of some illness or malfunction of the body. He delivered this verdict during his lectures on Mondino, one of which, on January 24, 1540, Vesalius may well have heard, since he had been invited to Bologna to perform the anatomical demonstration that followed on.³⁹ While showing the water that had collected in the pericardium he had dissected, he strongly denied Corti's theory that the fluid derived from dissolved spirits, and reiterated his own belief that it was present in healthy individuals and not only the sick. Corti could easily have been included among those opponents alluded to by Vesalius in his note, for to judge from the student transcript of Vesalius' lectures, his views were already known to Vesalius before he came to Bologna, although perhaps not in Paris in the 1530s.⁴⁰

One anatomical comment, however, deserves a more extended discussion. At the beginning of Book III Guinther discussed the skull, declaring that beneath the fleshy, muscular layer of the scalp, there was a membrane called the *pericranios* and the *periostios* that enclosed the skull on both sides and originated in the *dura mater*. After a parenthesis saying that an identical membrane around the eye was given a different name, he ended with the statement that once this layer had been scraped away, the skull itself clearly seen beneath. In his revision Vesalius deleted the first mention of the *periostios* and began page 72v with the observation that a second membrane could be found below the *pericranios*, the *periostios*, which is a covering common to all bones: *Sub ea periost{r}<i>ios omnibus ossibus corporis commune tegumentum est.*⁴¹

At this point, in a somewhat cramped note in the upper margin, he added that up until now this had never been noticed by anyone: *hactenus non est ab aliquo animaduversa*, making even more explicit the claim that this underlying layer was his own discovery. When he came to discuss the skull in the *Fabrica* he repeated his belief that the pericranium and periosteum were two different things at p. 627, but in a somewhat more flowery form of words.⁴² But since in modern medicine the pericranium is merely another term for the periosteum of the skull, one must ask what the term meant in the sixteenth

39 Eriksson 1959, 234–235 (Corti) and 236–237 (Vesalius).

40 Manuscript copies of these lectures exist from the 1530s. Colombo 1559, 176, identified Corti as a non-believer in fluid in the living body, but without noticing Corti's qualification that this could occur as a result of illness. The present note could, however, have been added after the Bologna dissection.

41 Guinther 1536, 106; Vesalius 1538, 72r–v.

42 Vesalius 1543, p. 627.

Illustration 2: Guinther, Johann, *Institutiones antomicae secundum Galeni sententiam ... ab Andrea Vesalio ... auctiores & emendatiores redditi* (Venice 1538), fol. 72v–73r. Vesalius emphasises his own discovery of the true pericranium. ©Stuart Rose.

century, and what it was that Vesalius believed that he had identified for the first time.

The medieval view, clearly articulated by Mondino de' Liuzzi, was that beneath the skin of the scalp was a membrane covering the cranium with three separate functions: to be a buffer between brain and scalp, provide the skull with sensitivity, and act as a sort of ceiling from which fibres and nerves coming from the *dura mater* and passing through pores in the skull could suspend the *dura mater*.⁴³ This was a notion deriving ultimately from Galen's *On the Use of Parts, De usu partium*, where the Greek anatomist talked at length about the relationship between the *dura mater* and the inner surface of the skull.⁴⁴ By contrast with his extensive and far-reaching investigations into the brain, Galen had devoted only a few lines to the external skull, emphasising its role in assisting the brain in its functions, and positing a single layer between the skull itself and the hair and flesh of the scalp.

43 Mondino de' Liuzzi 1992, 380–383. Slightly earlier medieval *'Anatomies of Galen'* spoke of a division into hair, skin (or muscle) and cranium, Hartwig, 2004, 37–38, 105, 130, 184.

44 Rocca 2003, 89–93.

When Galen's anatomical writings finally became available in their original Greek at the end of the fifteenth century, they added little or nothing to what had been available earlier.⁴⁵ The first renaissance anatomist to use material in the original Greek, Alessandro Benedetti, merely repeated Mondino's assertion that there was a single membrane between the scalp and the cranium, and others.⁴⁶ Others, such as Berengario da Carpi, did the same.⁴⁷ Even Niccolò Massa and Johannes Dryander, both of whom had considerable experience of dissecting skulls, and who were investigating the brain at the same time as Vesalius was beginning his lectures in Padua, continued to refer to a single membrane (*panniculus*).⁴⁸ Guinther, who had himself translated Galen's *Anatomical Procedures*, had thus little reason to dissent from the traditional view that the pericranium was an easily visible layer between the cranium itself and the flesh of the scalp, and from the assertion of the Hellenists that the pericranium was the same as the periosteum of the skull. Vesalius' claim to priority for his discovery can thus be accepted.⁴⁹

But precisely what he had discovered or, to put it another way, what his predecessors understood by the pericranium is not easy to determine. Charles Singer in his study of Vesalius' dissection of the brain in the *Fabrica* argued that the two membranes were the (true) pericranium on the outside of the skull and the periosteal membrane on the inside.⁵⁰ But this runs contrary to what is said in the *Institutiones*, as well as to the evidence of Galen (and others); Vesalius' periosteal membrane is on the upper surface of the skull, and Galen wrote often about the lower periosteum. Given that Vesalius emphasised that he had found something beneath the 'pericranium' that was like the periosteum of other bones, he almost certainly was referring to the modern pericranium.

His predecessors, then, will have seen an undifferentiated layer between the flesh of the scalp and the cranium itself, as depicted in Dryander's illus-

45 Vesalius did not know the further discussion of these structures in Galen's *Administrationes anatomicae* IX 11–12:15–16 tr. Duckworth *et al.*, since the relevant part of this treatise was not available in Greek and the Arabic version did not become accessible until the twentieth century, but this added nothing to the point at issue here.

46 Benedetti 1502, p. IV.7 = 1998, 242.

47 Berengario da Carpi 1523, 52 = 1959, 38; Achillini, 1521 = Lind 1975, p. 57; Laguna 1535, 61–62; = Lind 1975, 292

48 Massa 1536, 76r–82r = Lind 1975, 232–233; Dryander 1536, sig. A 3v = Lind 1975, 299, talks of a 'certain rather mucous viscosity' between the skin and the flesh above the 'pericranium', but his plate, sig. B 1r, shows an undivided layer.

49 The only scholar to have discussed the question of priority, Barcia Goyanes 1983, 328–332, gives the priority to Guinther in his *Institutiones*, without realising that the relevant passage was inserted by Vesalius. It was included by Guinther in his own revision, 1539, 80.

50 Singer 1952, 17. Both W.F. Richardson 2009, 173, and Dan Garrison 2013, 1266, in their English versions of this passage rightly concur in taking Vesalius' *sub ea* to refer to the (medieval) pericranium.

tration of the skull. Its most prominent feature is the epicranial aponeurosis or galea aponeurotica, so-called because, in the words of a medieval Latin translator of Galen, “the skull has a hard covering like a helmet, *galea*, which goes round the head.”⁵¹ This broad tendinous sheet, visible beneath the fleshy layer of the scalp, thus appeared sufficiently hard to be termed the periosteum of the skull, i.e. the pericranium, and, unlike Vesalius, his predecessors and competitors seem not to have investigated further.⁵²

In general it is impossible to tell the extent to which these additions reflect anatomical information gained only since publication.⁵³ Of potentially greater significance for our understanding of the development of Vesalius and his ideas are his deletions. At the very least they indicate passages where Vesalius had changed his mind or felt dissatisfied since 1538, either because of what he had discovered or because he had found parts of the book less effective as a student guide than he had hoped. Not only was Vesalius a good teacher, to judge from reports by his audience, but he was also particularly interested in the best way of presenting his message. Some of the smaller deletions have already been mentioned, and it would be unwise to speculate as to whether they derive from new knowledge. But the larger deletions cannot be ascribed to Vesalius’ sense of style, but are far more likely to reflect his own growing understanding of the limitations of a Galenic anatomy.⁵⁴

The earliest such deletion comes at 39,6–10 with the removal of four words *ipsiusque ... disperguntur* referring to the existence of veins in the cervix, but most are to be found at the end of the book dealing with the muscles of the hand and arm.⁵⁵ The section dealing with the muscles of the hand and foot contains a whole series of corrections and crossings out. At p. 88,3 an inser-

51 Galen, *De iuuamento membrorum* IX,5: *testa continet coopertorium durum sicut galea que continet caput*, *Galen Opera Omnia*, Venice, F. Pincius, 1490, sig. ff viiv. a variant of the Greek *De usu partium* IX,1 : II,4 ed. Helmreich = III.685 ed. Kühn (henceforth = K). Cf. Dryander 1536 pl. fol. B 8r.

52 Laguna 1535, 61–62 = Lind 1975, 292–293, offers a reason for this neglect: “The skull itself is covered by a twofold tunic. The one closest to the skull is sinewy and quite hard and arises of course from the thick membrane of the brain which has fallen forward through the sutures as if into certain filaments. The other tunic is fleshy so that with its blood and kindly warmth it may check the hardness and dryness of the skull by moistening it. But so closely joined are these two tunics to each other that you can scarcely ever separate them. Thus Galen everywhere calls both tunics by the names perikranion and periostion, that is, the tunic which surrounds the bones. Lest they should remain naked at any time and thus be injured because of the inclemency of the air these tunics are fortified on all sides by a very abundant growth of hair.”

53 At p. 10,14 Vesalius intended to include another section (*adde aliam sectionem*) on how to dissect the perineum, but did not do so.

54 The bracketing of p. 67,12–14, *licet non inepte ... dissecueris*, emphasises that this is a parenthesis, and does not indicate a deletion. And, of course, the earlier the notes are dated, the less chance of new material being added.

tion mark refers to an addition at the top of the page: *praeter alios exiles* (“as well as other slender ones”). Six lines further on, the last two words relating to the muscles moving the fingers sideways are deleted and replaced by “*quatuor exiles*” (“four slender ones”), a correction of Guinther’s “seven”. On p. 89, 6–10, a comment about the muscles of the fingers and thumb is crossed out and replaced by a reference to Galen’s comments on their difference in *Anatomical procedures*, Book I, which is then itself deleted, while in the margin at p. 89,11 a pointer referring to the inwards movement of the thumb is first added and then deleted. Two pages later, p. 90,7, Vesalius corrects Guinther’s description of a muscle that moves the finger bones “up and down” to *ad dextrum sinistrumque* “to right and left”, words originally in the margin but then transferred for clarity to the foot of the page.⁵⁶ At the same place on the following page, p. 90v7–10 a description of four bones of the palm of the hand and their tendons is struck through, but the relevant correction appears to have been lost in the cropping of the margin, unless it was a simple deletion mark.⁵⁷ The longest deletion occurs at pp. 91,18–91v6, dealing with the muscles of the upper arm. As originally revised by Vesalius, the text reads as follows:

Internis alii duo externi respondent. Prior sub cute iuxta posterioris axille musculi extremum caput habet. Huius finis membrosus tenuis in interiorem brachii nodum insertus, cubitum ad exteriora oblique tendit. Alter duo habet principia vnum ab humili costa scapularum ex ipsius ossis superiori parte, alterum vero ex postrema brachii regione subter caput. Haec iam procedentia in brachio coeunt, & cubiti tuberculo implantata articulum paulatim ad interiora deprimunt. Porro si ambo musculi tendantur, rectam dimissionem praestabunt.

In his earliest attempt at correction Vesalius replaced *costa* (“ridge/rib”) with the vaguer *latere* (“side”) to avoid any confusion with the normal meaning of *costa* “rib”, when he explained that the muscle took its origin in the lower part of the scapula. He next deleted most of the second sentence and the opening word of the third, so that the new sentence began *Prior duo* (“The first has two heads”), before finally deleting the whole paragraph entirely.⁵⁸ These are substantive corrections to or amplifications of what Guinther had written and Vesalius himself had allowed, and must reflect some of the dissections he had carried out in or around 1538. The relevant chapter in the *Fabrica* strongly criticises Galen’s anatomy of the arm (and by implication

55 Cf. Vesalius 1543, 290 [390], where nothing is said about these veins. A badly cropped and now illegible sentence at the top of p. 71v may also contain criticism of Galen and Guinther’s anatomy of the skull (cf. fig. 4).

56 Cf. Vesalius 1543, 312–313, for these muscles.

57 Cf. *ibid.*, p. 120.

58 The small change at p. 100,7 describing a movement of the femur as *intro* (“inwards”) instead of *ultro* (“to the outside”) may also reflect new or better anatomical knowledge on the part of Vesalius.

that of his followers), showing not only the differences between humans and animals that were elided by Galen, but also the sources of confusion that could only be eliminated by precise dissection and careful visual examination.⁵⁹ Guinther's summary of Galenic anatomy was thus defective on many counts.

Galen revisited

Although the title of the work announces that it is a modern interpretation of Galenic anatomy, it contains relatively few references to Galen's actual writings. By contrast, several of the new notes refer to specific passages in Galen usually by a simple page and section reference in the margin. So, for example, at the foot of p. 71v a reference to a parallel passage in Galen's *Art of Medicine* is added to illustrate the opening sentence of the section in the skull.⁶⁰ This reference is unusual (and for that reason may be relatively early) in that most take the form simply of a page and section reference without naming the actual Galenic work. At p. 7,23 for instance, a section talking of the eight muscles of the abdomen, the marginal annotation is simply 33c, which corresponds exactly to the discussion of these muscles on fol. 33c of Guinther's translation of *De anatomicis administrationibus*, Paris, S. De Colines, 1531. Earlier on the same page, which describes how to see the muscles of the abdomen, Vesalius wrote the number 37 in the margin. This is probably an error for 35, where the appropriate passage can be found in Guinther's translation.

In addition to these page references, Vesalius cites this Galenic treatise four times somewhat more explicitly. At the end of the book, p. 89,6–10, he makes a reference to the first book of *De anatomicis administrationibus* describing the articulation of the fingers and thumb, but then changes his mind and deletes it. A little earlier, at p. 69v13, he gives instruction to the printer to include a marginal note: *in margine aliquanto ponendum hoc est: cum parua stellula* Gal. in 4 de adminis ana. quatuor labrorum musculos praeteriit, in li. vero ii de usu par. duos*. ("This should be placed somewhere in the margin and marked with an asterisk: Gal(en) in *Anatomical procedures*, Book 4, left out four of the muscles of the lips, but in *On the Use of Parts* only two") (cf. fig. 2). Vesalius appended another comment on his reading from

⁵⁹ Vesalius, 1543, 262–8.

⁶⁰ *VJI cap. artis / medicinalis* Galen, *Ars medica* 6: I,319–24 K. The opening words are hard to make out, but the reference to the treatise is clear. I am grateful to Michael Reeve for his help in deciphering.

this treatise in the last annotation in the book, p. 101,18: *opinor et(??) in 20 de admi. Ana. mult[um??] esse* (“I think that there is a lot in Book 2 of *Anatomical procedures* about this” (sc. that the tendons are different in feet and hand). Vesalius’ memory was correct, for Galen made this point several times in his discussion of the leg muscles in chapter 7 of that book: II, 316–21 K. The fourth reference is harder to understand. At p. 15v16 there is an apparent instruction to the printer: *in margine ponetur si locus sit in 7 admi anat pro ieiuno intestino vesica legitur* (“If there is space, there may be put in the margin: in book 7 of *Anatomical procedures* the word ‘bladder’ is used for the jejunum.”) What Vesalius means here is difficult to establish. In Guinther’s version of Book 7 of *Anatomical procedures*, the word ‘*vesica*’ occurs three times, on each occasion translating the Greek κύστις. All three references are to the bladder, not the jejunum. There are, however, two references to ‘*vesica*’ as the gall-bladder, but in a different place, Book 6. It is hard to see why Vesalius should have suggested that either the Greek or its Latin translation was an error for or a variation on the jejunum, either by itself or as a receptacle for bile, especially as he later retained the word in his revision of Guinther’s Latin.

The last third of the volume also includes some twenty references by number and letter to an unspecified work that was consulted in a similar folio edition. Identification is made difficult by the cropping that has removed some of figures and letters, but enough remains to show that they refer to sections in Galen’s *On the Use of Parts*, *De usu partium* (= *DUP*) in the Basle edition of 1533.⁶¹

Except for the final two entries, p. 87,24: 15D = *DUP* II,8: III.125 K, and p. 89v20: a general reference to *DUP* II, both referring to the hand, seen by Galen as the greatest example of the purposefulness of the Creator, all indicate passages clustered together in Books VII, VIII and IX of *On the Use of Parts* that deal with the anatomy of the head and neck, and particularly with the brain and nerves.⁶² These were of considerable interest to Vesalius for

61 *Claudii Galeni Pergameni...de usu partium corporis humani libri XVII*, Basle, A. Cratander and J. Bebel, 1533. The earlier Paris edition, by S. De Colines, 1528, is not a folio edition and lacks the marginal divisions, which are also missing from the slightly later edition, *Claudii Galeni De usu partium corporis humani libri XVII*, Paris, C. Wechel, 1537, which also has a different pagination. I am grateful to Francesca Baseby for checking the latter copy for me in the Edinburgh University Library.

62 The citations I transcribe as follows: p. 54,16: 7]3 (the jugular vein); p. 64v11: 68]A (the larynx); p. 70,22: 88]A (the nerves (of the tongue); p. 71 bottom: 82]A (the skull); p. 72,9: 89]B (the mixture of muscles and skin of the lips); p. 72v10–11: 8]9A, 8]9C (ligaments and sutures); p. 72v15: 8]5B & C (skull sutures); p. 72v24: 89D (the shape of the sutures); p. 73v21: 84C (coverings of the brain); p. 79v 20, 21, 24: 83]B, 8]4D, 83B (5th and 6th pairs of nerves coming from the brain); p. 81,19 8]5B; 85]C; 85]A (the reticular plexus); p. 82 bottom: 76D (the retina); p. 85,2: 89]B (the nerves in the nose); p. 85,25: 88B (the nose).

Illustration 3: Guinther, Johann, *Institutiones anatomicae secundum Galeni sententiam ... ab Andrea Vesalio ... auctiores & emendatiores redditi* (Venice 1538), fol. 69v–70r. Vesalius tells the printer where to place a comment about Galen. ©Stuart Rose.

two reasons. Not only did Galen regard his work on the brain and nerves as his most important achievement as a dissector, but it was also one that was coming to be challenged most fiercely by the new anatomists.⁶³ It was thus not surprising that Vesalius paid close attention to what Galen had said and to the methodology that he had employed. As well as a large part of Book I, he devoted Book VII of the *Fabrica* to the head and the brain, and revised them thoroughly for the second edition of 1555 and continued for some time to add detailed notes on them in the margins of his copy of that edition.⁶⁴

The fact that these Galenic references were to editions of the 1530s rather than to the Giunta edition of 1541–2, to which Vesalius contributed, is a strong

⁶³ Rocca 2003 provides the best overall survey of Galen's investigations.

⁶⁴ Cf. for his continued interest in the pathways of the nerves through the skull, his annotations to the 1555 *Fabrica*, pp. 515–9, with photograph of p. 515 in Nutton 2012, 430.

Illustration 4: Guinther, Johann, *Institutiones anatomicae secundum Galeni sententiam ... ab Andrea Vesalio ... auctiores & emendatiores redditi* (Venice 1538), fol. 71v–72r. Vesalius adds a reference at fol. 72,9 to a page in the 1533 edition of Galen's *De usu partium*. ©Stuart Rose.

indication that they were inserted before then. But some time had elapsed between them and Vesalius' first corrections, for often they are placed around existing notes. They are on the whole accurate, referring precisely to the sections in Galen on which the text was ultimately based and, on one occasion, detecting a potential mistranslation. They are personal, for their brevity would not have made sense to a printer or potential reader, but they are not casual jottings. Many of the passages they indicate were included and discussed in the *Fabrica*, and their abbreviated and cryptic form suggests that the references were to serve as private aids to memory as Vesalius contemplated his great work. They show, if one did not already know, the considerable extent to which Vesalius was indebted to his Greek predecessor, as well as some of the preliminary work that went into the book.⁶⁵

65 Barcia Goyanes 1994, 229–241, lists the citations of Galen in the *Fabrica*, and his whole book is devoted to indicating Vesalius' debts to Galen and his predecessors.

Conclusion: Vesalius' revisions in context

Vesalius made nearly 250 corrections to what he had originally published in 1538, a tiny number compared to the hundreds that he made to the 1555 *Fabrica*, but still significant for so small a book. Their importance in the context of Vesalius and his work is two-fold. Like the post-1555 notes, they bring us closer to the man himself, to his passion, if not obsession, with getting everything right. He was prepared to make changes not only to what Guinther had written and he himself had once approved, but also to material that he had written himself only a few months earlier. Even if by far the largest number of the notes can be categorised as simple tidying up, correcting printers' errors, avoiding ambiguity, and ensuring a greater precision, they reveal his powers of concentration and his remarkable eye. He had complained about the inadequacies of his first printer, with justice, and his second was no better, perhaps a painful discovery for one who was an expert proof reader himself. This would have encouraged him to prepare yet another edition, presumably to be based on the results of his Paduan teaching and of his further dissections. But he changed his mind. The later page references in the margin to Galen's writings seem more in the nature of private notes, while his failure at the end of the book to replace the deleted sections on the bones and muscles or to supply any new material for the intended section at p. 10,14 on how to cut close to the perineum also suggests that he had given up the idea of revising the book, or, at the very least, of using this copy as the basis for something to be given to the printer.

These notes also mark an important transition. The *Tabulae sex* and his original revision of Guinther both fit neatly into the new Hellenising Galenism. They accept a Galenic anatomy based on the Greek rather than on medieval Latin versions, but with qualifications. Galen was not infallible, but his errors were relatively few, and could be easily corrected within an existing Galenist framework. By 1542, when he left Padua, if not by 1540, Vesalius had become convinced that it was the overall framework also that required replacing.⁶⁶ Although following a Galenist empirical methodology in anatomy, he now rejected many of Galen's results as based on animals rather than humans. These annotations show that development taking place. There are a few corrections to the anatomical information he had accepted in 1538, and his deletion of sentences at the end of the books indicate a wider dissatisfaction with what Galen and Guinther, his faithful follower, had written. Vesalius' marginal

66 He was already writing the *Fabrica* in 1540, and probably in late 1539, when he lodged with John Caius, O'Malley 1964, 101, and, for the wider background, 94–103.

references to sections from *Anatomical Procedures* and *On the Use of Parts* that he was to discuss at greater length in the *Fabrica* also show a greater awareness of Galen's fallibility. A pocket-sized handbook for students, whatever its merits as a teaching tool, no longer fitted his purpose or his ambition. Its cramped and exiguous format could no longer contain all he wished to say. Indeed, this book and its annotations, it might be suggested, mark the point at which Vesalius decided to become his own master and to write the *Fabrica*. But even if this hypothesis is considered too fanciful in the absence of any precise means of dating, these annotations attest his determination, if not obsession, to present what he wished to say with the greatest of accuracy, clarity and conviction, all features that contributed to the success of his masterpiece.⁶⁷

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