

## APPENDIX I

### THE DISSECTION\*

The above interpretation of Rembrandt's painting depends to some extent on a particular view of the dissection shown in the painting. Since the identification of the dissected muscles is a matter of dispute, this note is appended to justify the view we have adopted on pp. 7–8 above. Our illustration is Pl. 9.<sup>202</sup>

The currently favoured interpretations of the muscles are due to Jacob Meyer.<sup>203</sup> Meyer's interpretations depend on his view of the orientation of the limb. This view in turn depends on a certain observation which all writers on the subject have thought too obvious to be mentioned. The subject of this observation is the course of the muscle held in Dr. Tulp's forceps. It may be stated thus:

*A* The muscle, if followed up the limb from the hand to the elbow-joint, passes to the outer, or further, side of the limb after leaving the forceps.

This observation, which is also an interpretation, has invisibly governed almost all discussion of the matter since 1900, when it underlay the remarks by J. K. A. Wertheim-Salomons (hereafter W.-S.) which were published by E. van Biema.<sup>204</sup> From W.-S. to Meyer and after, scholars have assumed *A*, drawn various deductions from it, and presented their conclusion as "Rembrandt's anatomical error".

The argument of W.-S.,<sup>205</sup> for example, if reduced into its constituent parts, must have been as follows:

*A* The muscle arises on the further side of the limb [*observation*].

*B* The muscle must arise from an epicondyle [*normal anatomy*].

*C* On the further side, where the muscle arises [*A*] are two yellowish streaks [*observation*].

*D* Therefore these two streaks are an epicondyle [*deduction from ABC*].

*E* The hand is supinated [*observation*].

*F* Therefore the orientation of the limb is as in anatomical position [*deduction from E*].

*G* Therefore the further side of the limb is the lateral side [*deduction from F*].

*H* Therefore the two streaks are the lateral epicondyle [*deduction from DG*].

*I* The muscle is on the same side of the limb as the palm of the hand [*observation*].

\*Researched in collaboration with Dr. J. G. Bearn.

<sup>202</sup> The best published illustration is in J. Bolten and H. Bolten-Rempt, *The hidden Rembrandt*, Oxford, Phaidon, 1978, pp. 38–39.

<sup>203</sup> In Cetto, p. 309.

<sup>204</sup> E. van Biema, 'L'histoire d'un chef-d'oeuvre', *Revue de Belgique*, 32nd year, 1900, 2nd ser., 28: 367–373.

<sup>205</sup> *Ibid.* p. 370: "Tulp tient dans ses pinces le fléchisseur commun des doigts. La main du cadavre étant représentée en supination extrême, l'épitrôchlée doit se présenter à la face interne du bras collé au corps, l'épicondyle à la face externe. Or, la partie du coude montrée par le peintre est l'épicondyle. Rembrandt commet ainsi l'erreur d'insérer le fléchisseur commun des doigts dans l'épicondyle, alors que l'anatomie nous le montre ayant son insertion dans l'épitrôchlée." Here "épicondyle" means lateral epicondyle, "épitrôchlée" medial epicondyle.

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- J* Therefore a flexor muscle [normal anatomy].  
*K* Therefore the flexor muscle arises from the lateral epicondyle [deduction from *CHJ*].  
*L* The flexor muscles should arise from the medial epicondyle [normal anatomy].  
*M* Rembrandt's error: the muscle originates from the wrong epicondyle [deduction from *KL*].  
Meyer's argument starts *ABCD*, omits *EFGH* and goes straight into *IJL*, the absence of *K* being due to its dependence on the omitted *H*. Then:  
*M*<sup>1</sup> The two streaks are the medial epicondyle [deduction from *DJL*].  
*C* The two streaks are on the outer side of the limb [observation].  
*N* Therefore the medial epicondyle is on the outer side of the limb [deduction from *M*<sup>1</sup>*C*].  
*O* When the limb is in anatomical position, the medial epicondyle is on the inner side of the limb [definition].  
*P* Rembrandt's error: he has depicted a limb rotated sufficiently outwards from anatomical position to carry the medial epicondyle to the further side [deduction from *NO*].

In the latter argument one finds several flaws: for example, *E* therefore not-*P*, and *P* itself would rule out the observation of *I*. But both arguments overlook a more important point: if *J* is true, *A* itself would be an anatomical error. In other words, if the muscle is a flexor muscle, as all agree, then it should proceed from the forceps to the elbow in a medial direction, and approach the viewer, whereas according to *A* it is observed to proceed laterally and recede into depth. However the limb may be orientated, the proximal end of the muscle should be medial to any more distal part of it. The error is therefore what is silently assumed (the original axiom *A*, that the muscle is misdirected), not what is actually alleged (the misattachment of the muscle *M* or the rotation of the limb *P*). It is not surprising that different anatomists have differently identified "Rembrandt's error", for the "errors" are merely deductions from the real, unnoticed error, and many such deductions could be made.

Hence, "Rembrandt's error" (*A*) would not be absolved if it were shown that *BCD* ... *NOP* were all false. Recently, Drs. Carpentier Alting and Waterbolk (hereafter C.A. and W.) of the University of Groningen challenged *D*: of the many structures on the lateral side of the elbow-joint, the two yellowish streaks are less likely, in their opinion, to be an epicondyle, and more likely to be a characteristic broad double strip of tendon that runs into the cubital fossa.<sup>206</sup> We agree, but whether as tendons or as epicondyle this structure would still be lateral to the muscle in the forceps, the muscle would still have to recede from the viewer in order to approach it (according to *A*), and "Rembrandt's error", the misdirection of the muscle, would remain.

However, just as the real charge against Rembrandt (*A*) was unwittingly concealed behind the unjust charges (*M*, *P*), so the real reason for acquitting him was unwittingly

<sup>206</sup> M. P. Carpentier Alting and Tj. W. Waterbolk, 'Nieuw licht op de ontleedkundige fouten in Rembrandt's "Anatomische les van Dr. Nicolaas Tulp"', *Nederlands Tijdschrift voor Geneeskunde*, 1976, **120**: 1900–1902; and 'Nieuw licht op de anatomie van de "Anatomische les van Dr. Nicolaas Tulp"', *Oud Holland*, 1978, **92**: 43–48.

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concealed by an unneeded defence. C.A. and W. thought they were absolving Rembrandt by amending *D*, but they actually did so by assuming not-*A*. Their argument against *D* rests on their silent assumption that the muscle, far from receding as it leaves the forceps (as W.-S., Meyer, and others assumed), instead veers sharply towards the medial side of the elbow, that is, towards the viewer.<sup>207</sup> The same observation is interpreted in the opposite sense.

The reason for this difference seems to be that Rembrandt's painting is ambiguous. As the muscle leaves the forceps and proceeds to the elbow, it tapers and darkens. It seems to a first impression that both these changes are due to recession in perspective. The tapering, however, does not imply recession, for the local shape of the muscle tapers between the belly and the tendon: the tapering is physical, and not, as the layman assumes, optical. The line of the muscle therefore supports the view of C.A. and W. The shading, however, implies otherwise. For if the muscle on the left of the forceps veers towards the viewer, as C.A. and W. suppose, it must face in the same direction as the phalanges of Dr. Tulp's left hand. The latter are illuminated, therefore the muscle on the left of the forceps should be illuminated also, but it is actually dark, whereas the muscle on the right of the forceps should be dark but is actually pale, and even throws off a highlight (brilliant-white, in contrast to the yellowish colour of the tendons). The lighting therefore goes against the interpretation of C.A. and W. The proof of this is the fact that, in the diagram which illustrates their interpretation, Rembrandt's lighting is reversed: the left side is lit, the right side shaded.<sup>208</sup>

It appears that "Rembrandt's error" is simply to have painted part of a muscle slightly darker than the lighting in the picture would require. Since so many trivial causes for this anomaly can easily be imagined, and since there is no other ground for suspecting the orientation, it would surely be a mistake to see in this dark red patch either a wrong claim about the normal direction of a muscle (*M*) or a reason for thinking that the model was wrongly posed (*P*). We therefore accept the conclusion of C.A. and W. on the orientation of the limb: in relation to its own axis, the limb is in anatomical position; in relation to the rest of the body, it is out of anatomical position only in the unimportant sense that the hand rests on the groin instead of beside the trunk.

Having established that the orientation of the limb is practically normal, we proceed to the identification of the muscles. According to the interpretation of C.A. and W., and limiting our discussion to matters which affect the larger interpretation of the picture, the muscles in the forceps are *mm. flexores digitorum superficialis et profundus*; the long, straight muscle that runs underneath them is *m. flexor carpi ulnaris*; and the short muscle which slopes down on the medial or inner side of the incision is *m. palmaris longus*. The nerve which passes to the little finger is regarded as an abnormal form of *n. ulnaris r. dorsalis manus*.<sup>209</sup>

This interpretation can be challenged on three counts. (1) It rests on the assumption *P* that "the entire left arm has been rotated about 75° outwards",<sup>210</sup> but C.A. and W.

<sup>207</sup> Ibid., 1976 p. 1900, and 1978 p. 46.

<sup>208</sup> Ibid., 1976 p. 1901, and 1978 p. 44.

<sup>209</sup> Ibid.

<sup>210</sup> Meyer, loc. cit., note 203 above.

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had already undermined this assumption through their withdrawal of *A*. The postero-lateral view implied by *P* must therefore be rejected. (2) It has numerous intrinsic weaknesses. What is called “*m. flexor digitorum profundus*” appears in the diagram of C.A. and W. in a place which is void in the painting.<sup>211</sup> “*M. flexor carpi ulnaris*” is aligned too far laterally for that muscle, and issues an inapt aponeurosis at its distal end. “*M. palmaris longus*” should be very slender and tendinous, whereas here it is a thick muscle-belly. Finally, the variation in the course of the nerve is undesirable. (3) The dissection is irrational. It would mean that Dr. Tulp is distinguishing both of the finger-flexors (together, according to C.A. and W., with one of the wrist-flexors) from the palmar muscle together with the other wrist-flexor. This grotesque arrangement does not distinguish finger- from wrist-muscles, radial from ulnar, or superficial from deep. It teaches nothing to the surgeons or to the viewer. Such a dissection could not have been obtained accidentally, yet it is hard to imagine what reason there could be for bringing it about on purpose.

The interpretation which we propose is simple and unoriginal. It assumes an ordinary right antero-lateral view of the limb, according to which the medial epicondyle is buried behind the triangle of undissected skin at the proximal end of the medial side of the incision.<sup>212</sup> We identify the muscles as follows.

1. *M. palmaris longus* is not shown in the picture. It is absent in many humans,<sup>213</sup> and in dissection, when present, it often comes off with the skin. A comment on this muscle by a surgeon who often worked with Dr. Tulp is relevant here:

The first flexor is the palm-muscle [*palmaris longus*], which has a nerve-like texture, and is so intimately attached to the skin that, however closely one looks for it, it often cannot be found at all, much less separated cleanly. For we can testify that Mathijs Calkoen, an eminent surgeon of his day, in a certain anatomy conducted very successfully by the physician Mr. Nicolaes Tulp, worked continuously for more than eight hours before he could distinguish the aforesaid muscle from the skin and underparts, and even then only roughly.<sup>214</sup>

Moreover, functionally *m. palmaris longus* would have added nothing to Tulp's demonstration.

2. The sloping muscle previously identified with *m. palmaris longus* is *m. flexor carpi ulnaris*.

3. The long straight muscle previously identified with *m. flexor carpi ulnaris* is *m. flexor digitorum profundus*. Hence the distal aponeurosis and the central alignment in the limb.

<sup>211</sup> See note 208 above.

<sup>212</sup> Carpentier Alting and Walterbolk (1976), op. cit., note 206 above, p. 1900.

<sup>213</sup> *Gray's Anatomy*, 36th British edition, Edinburgh, Churchill Livingstone, 1980, pp. 574–575.

<sup>214</sup> J. J. van Meekeren, *Heel- en genees-konstige aanmerkkingen*, Amsterdam, 1668, c. 62, pp. 375–393, p. 385: “De eerste buyger is de *Palm-spier*, die van een zenuagtige vlies is t'zamen gewezen, en aande huyl zoo vast verknooigt, dat dikmaals, hoe nauw men snuffelt, die selve niet gevonden (wy laten staan) veel minder zuylver gescheyden kan worden: want wy moogen met de waarheyl seggen, dat *Matthijs Kalkoen*, in zylz leven aanzienlyk heelmeester, in zeeke' re ontleeding by de geneesheer, [p. 386] *de Heer Nicolaas Tulp* loffelyk afgeleyt, meer als agt uren over een boeg, schilden; eer hy de voornoemde spier, hoe wel oneffen genoeg, van de huylt en onderdeelen had afgeschilt.” On the additions in the Latin edition see note 96 above.

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4. The muscle that was previously identified with *m. flexor digitorum profundus* has no real equivalent in the painting: it is a swollen version of one of the bellies hanging from the bundle in the forceps. This belly is either part of *m. flexor digitorum superficialis* or, less likely, *m. flexor pollicis longus* glimpsed through the gap caused by the raising of *m. flexor digitorum superficialis*.
5. The clump of muscle in the forceps is *m. flexor digitorum superficialis*, probably with a slip of *m. flexor carpi radialis* (the latter suggested by C.A. and W.).
6. The nerve is merely *n. ulnaris r. superficialis manus* following its normal course.<sup>215</sup>

According to this interpretation, Dr. Tulp is lifting the belly of *m. flexor digitorum superficialis* off the belly of *m. flexor digitorum profundus*. This is the simplest interpretation, because it has always been agreed that the tendons which are portrayed in the fingers of the corpse are those which should derive from precisely these two flexor-muscles.<sup>216</sup> The muscles visible in the forearm are merely those which are connected with the tendons visible in the hand. This interpretation is unoriginal, because it was first proposed by W. Hastie in a little-read article published in 1891, nine years before Wertheim-Salomonsen's influential conversation with E. van Biema.<sup>217</sup> Finally, it seems to be the most rational interpretation: it gives us Dr. Tulp demonstrating the interaction of the two sets of finger-flexors, a point which had long been appreciated by anatomists;<sup>218</sup> which is illustrated by Tulp's own gesture with his left hand; and which provides a worthy object of Mathys Calkoen's otherwise unaccountable astonishment.<sup>219</sup>

In the experiments on which this note is based, attempts were made to recreate Dr. Tulp's dissection firstly in a limb attached to the cadaver, and secondly in a detached limb from another cadaver. But the most convincing likeness was obtained when a detached limb was placed over an attached limb, and Dr. Tulp also may have used this trick for Rembrandt's convenience.

<sup>215</sup> *Gray's Anatomy*, ed. cit., note 213 above, pp. 1099–1100.

<sup>216</sup> van Biema, op. cit., note 204 above, p. 370 "le peintre apporte un soin méticuleux à préciser le dessin des tendons fléchisseurs des doigts". G. A. Lindeboom, 'Medical aspects of Rembrandt's "Anatomy lesson of Doctor Tulp"', *Janus*, 1977, 64: 179–203, pp. 192–193.

<sup>217</sup> Hastie, op. cit., note 169 above.

<sup>218</sup> See Appendix II, pp. 57–64 below.

<sup>219</sup> See p. 23 above.