ANDREAS VESALIUS BRUXELLENSIS:

The Bloodletting Letter of 1539

An Annotated Translation

AND

Study of the Evolution

OF

Vesalius's Scientific Development

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ACKNOWLEDGMENT

WHILE the manuscript of this translation was in the hands of the editor, we learned from Professor John Fulton that the Venesection Epistle had been translated many years ago (*c.* 1908) at the instigation of the late Dr. Harvey Cushing, by Professor Charles Upson Clark of Toronto, Canada. It was Dr. Cushing's intention to publish Professor Clark's version with annotations and a preface on its relationship to the *Tabulae Sex.* Professor Clark's translation is now in the Cushing Collection of the Yale Medical Library ("The Harvey Cushing Collection of Books and Manuscripts," New York, 1943, item v74) and through the generosity of the translator and Professor Fulton, has been made available to us. With great magnanimity, Professor Clark has given us permission to utilize his version in any way we thought fit. The two versions agree remarkably closely. Where we disagree (usually on technicalities), we have had the invaluable opportunity of rechecking the translation, and where we have felt that Professor Clark's rendering better expressed the meaning, we have not hesitated to adopt it. We should therefore like to express our great thanks to Professor Clark for his gracious gesture and we hope that he will feel a measure of personal interest in this translation.

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THE BLOODLETTING LETTER OF 1539

By John B. deC. M. Saunders and
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INTRODUCTION

THE letter on venesection of Andreas Vesalius of Brussels, although a minor work, completely overshadowed by the magnificence and power of his masterpiece, *De humani corporis Fabrica,* is never the less a valuable historical document. It should not be forgotten that despite his attacks and criticism, Vesalius was and remained intellectually a Galenist, fully conditioned by the structure and scholastic thought of his epoch, enmeshed in the difficulties which the lack of a clearly formulated scientific method had woven. In this letter we perceive the first steps in the slow and gradual loosening of traditional bonds whence eventually emerged the principle that the validity of a hypothesis rests solely upon facts established by observation. Here Vesalius asks a first tentative question "whether the method of an anatomy could corroborate speculation"; a question not without moment in a day when principles based solely upon the power of the intellect, were enshrined as truth. The venesection letter is therefore transitional, occupying the period of his scientific adolescence, bridging the interval between the frankly Galenical anatomy of his earlier recension of Guinter's *Institutiones Anatomicae*, 1538, and the observational method which made the *Fabrica* (1543) the first positive achievement of modern science.

Vesalius's fame rests upon his anatomical contributions, but he was as fully concerned with the problem of practical medicine. We believe that such statements that "he is the first real specialist, for with but little digression he devoted himself to one branch of medicine, to anatomy,"[1] tend to give a false impression of his development and ignore the source which provided both his impetus and his limitations. Indeed it was his ambition to master the whole of medical science, and the preface to the *Fabrica*[2] evidences his great

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1. D. Riesman. *The story of medicine in the Middle Ages* (New York, 1935), p. 196. 2. *Fabrica* (1543), "Preface," f. *2v.

concern over that separation of medicine and surgery which Arabian and theological influences made a characteristic of his age. For him, anatomy is but an essential preliminary which will serve to reunite all branches of the healing art. The relegation of manual procedures to the barber-surgeon calls forth his most acid condemnation. Medical practice and especially therapeutics he studied with passion as is everywhere apparent in his writings. Apart from the present letter, they form the subject of his first work, a recension of the treatises of Rhazes to the King Almansor, *De Singularum Corporis Partium Affectum Curatione*, 1537; make up a large part of his *Epistola rationem modumque propinandi radicis Chynae decocti* (1546) and constituted the bulk of those works which he destroyed in his anger resulting from the criticism of his erstwhile friends and colleagues.[3]

The venesection letter strongly suggests that it was Vesalius's preoccupation with such clinical problems which provided the insight that enabled him to shake off the dead hand of Galen's pronouncements and made the production of the *Fabrica* possible. Vesalius tells us that any such discrepancies in the Galenical anatomy which he had observed, he had noted in the *Institutiones Anatomicae* (1538), with uncertainty and trepidation. The *Tabulae Sex* (1538), great advance in anatomical illustration though they be, show all the characteristics of the old anatomy. "The plates are in fact Galen's" is Singer's judgment,[4] "well and diagrammatically portrayed." However in the second of these plates is a mild criticism of Galen in connection with the origin and distribution of the vena azygos together with some remarks on its relationship to venesection in *dolor lateralis* (pleurisy). This is the theme which is elaborated in the following year, 1539, and forms the content of the present communication to his friend and mentor Nicolaus Florenas.

Since remote antiquity, venesection has occupied a unique and important position in the minds of physicians as the sheet anchor of therapeutics. In the sixteenth century the subject had become one of violent and bitter controversy. The humanists in clearing away the rubbish of Arabian compilations and scholastic commentary had exposed how far current practice had deviated from the teachings of Hippocrates and Galen. Armed with the new learning they sought not only to defend the purified classics against the

3. *Epistola Chynae*, p. 196 (for 195), f. BG2r.
4. Charles Singer, *The evolution of anatomy* (New York, 1926), p. 114.

onslaughts of the Arabists, but with subtle dialectic each attempted to uphold the rightness of his textual criticism. Barren and sterile though this controversy may have been, none the less it was to every physician, anxious for the welfare of his patient, a subject of very real importance. Impelled by such motives and employing the familiar tools of a scholastic tradition, Vesalius enters the fray.

Hitherto, every argument rested upon acceptance of the humoral doctrine and every measure directed toward the practice of phlebotomy depended upon the opinion of Galen for its anatomical interpretation. There is however, no part of Galen's anatomy more vulnerable and unsatisfactory than his description of the venous system. Vesalius, while fully accepting the philosophical basis of his heritage, introduces into the debate a new element, the findings of direct observation. These observations are, as he advises us, no isolated discovery, but the outcome of repeated dissections, and they enable him to challenge with growing confidence the infallibility of the Prince of Physicians. The emancipation of Vesalius begins with the venesection letter. The chain has been broken at its weakest link and, what is of the greatest importance, on the eve of preparations which foreshadow the writing of the *Fabrica*, "if," as he says, "the opportunity of bodies offers, and Joannes Stephanus [Van Kalkar], outstanding artist of our age, does not refuse his services . . . . " How significant the subject of blood-letting was in his liberation can still further be judged by the attention devoted to it again and again in both the *Fabrica* and in the second part of the China Root Letter directed against the attacks of his old master, Sylvius.

We know little or nothing of the origins of venesection as a therapeutic procedure. It has been suggested that the practice arose in primitive folk-medicine from conceptions as to the beneficial influences of periodic blood loss in menstruation or to the revulsive effects of accidental haemorrhage.[5] The first textual records of any significance are to be found in the Hippocratic collection in the form of scattered references, sometimes contradictory, which give the impression that the procedure had long since passed into standard practice. There is no work, however, either in the so-called authentic books or in the rest of the collection, devoted in whole or in major part to the subject.

Hippocrates recommends venesection as both a therapeutic and

5. F. H. Garrison, *An introduction to the history of medicine* (Philadelphia, 1929), p. 29.

prophylactic measure. Although employed in the treatment of a large variety of maladies, the primary indication appears to have been the acute diseases. We are told to "Bleed in the acute infections"[6] and that in "Hypochondria . . . strong pains of the liver, heaviness of the spleen, and other phlegmasiae and intense pain above the diaphragm, diseases connected with collections of humours, . . . venesection holds the first place in conducting the treatment."[7]

As Vesalius concerns himself with venesection in pleurisy, it is of particular importance to examine the opinion of Hippocrates in this respect. Pleurisy is an epidemic disease[8] and one of the "acute affections," but venesection is to be employed only when the pain is above the diaphragm.[9] An admonition of such importance that it is repeated a little later in the same work.[10] This restriction in the use of venesection is somewhat puzzling. It would seem to revolve around the question of the exact meaning of the term employed by Hippocrates which has been rendered by the classical Latin authors as *dolor lateralis*. It has been assumed by both sixteenth-century and modern writers that the disease so described is pleurisy or some allied pulmonary disease. There can be little doubt that pleurisy is, even in classical times, usually implied by this phrase. Vesalius,[11] however, interprets the expression, and we believe correctly, as a general one to be taken literally as "pain in the side," in which case pleurisy is but one of several diseases covered by the term, and the restriction is logical in light of theoretical considerations of the humoral pathology. In this view, Hippocrates' teaching was that one should let blood in pleurisy but not in other forms of *dolor lateralis* occurring below the diaphragm. The interpretation of *dolor lateralis* as pleurisy alone consequently gave rise in later times to great confusion and dispute as to the rationale of its treatment.

In the employment of venesection as a prophylactic measure, Hippocrates mentions astronomy and meteorology as a source of prognostication,[12] based on the recognition that certain diseases are more apt to occur and to be exacerbated at certain seasons of

6. *Regimen in acute diseases*, "appendix," sect. 2.
7. *Ibidem*, "appendix," sect. 3.
8. *Airs, waters*, etc., sect. 3.
9. *Reg. acute dis.*, "appendix," sect. 7.
10. *Ibidem*, "appendix," sect. 11.
11. Text, pp. 54 ff.
12. *Airs, waters*, etc., sect. 2.

the year.[13] The two solstices, especially the autumnal, are particularly dangerous.[14] One may expect the acute diseases in a summer of drought and a summer preceded by a dry cold winter, and a rainy spring will bring the acute fevers, ophthalmia and dysenteries.[15] The winter is the time of pleurisy and pneumonia.[16] Such views on meteorological medicine gave the authority of the "Father of Medicine" to the extraordinary astrological beliefs of later times. Elaborated by Galen in his work on the critical days, *De diebus decretoriis*, embroidered by the Arabs, these beliefs particularly affected the practice of phlebotomy and engendered the familiar calendars of blood-letting.

Hippocrates recognised that certain diseases were most prevalent according to age; the young to haemoptysis, phthisis, acute fevers and epilepsy[17]; those of mature age to asthma, pleurisy, pneumonia, haemorrhoids, etc.[18]; and those of advanced age to a multitude of complaints.[19] Moreover, apart from seasons, certain conditions of locality are conducive to, and certain types of men are subject to pleurisy.[20]

In respect to the general procedure of venesection, it must be noted that the season of the year had to be taken into account, the spring being most advantageous.[21] One should ascertain that the patient "is in the prime of life" [22] although precisely what were the age limits is not clear. As we shall see from Galen, venesection was proscribed for children. Furthermore, "venesection is to be practised when the person has dined more or less freely and drunk, and when somewhat heated, and rather in hot weather than in cold";[23] but after venesection a certain amount of restriction in fluids and diet was enjoined.[24] It is most important not to perform venesection in a patient lacking strength. "Bleed ... if they have strength"[25] and again, "if he ... is strong." [26]

13. *Aphorisms*, III, 19.
14. *Airs, waters*, etc., sect. 11.
15. *Aphorisms*, III, 7, 11.
16. *Ibidem*, III, 20-22.
17. *Ibidem*, III, 27, 29.
18. *Ibidem*, III, 30.
19. *Ibidem*, III, 26, 27, 31.
20. *Airs, waters*, etc., sect. 4.
21. *Aphorisms*, IV, 47, 53.
22. *Reg. acute dis.*, "appendix," sect. 20.
23. *Ulcers*, sect. 16.
24. *Reg. acute dis.*, "appendix," sect. 24; *Ulcers*, sect. 14.
25. *Reg. acute dis.*, "appendix," sect. 2.
26. *Ibidem*, "appendix," sect. 20.

Hippocrates gives almost no instructions on the technique of venesection. He warns that in bleeding by scarification, pressure must be avoided lest contusion be produced. The incisions are then washed with vinegar and no clot allowed to remain between the lips of the wounds as inflammation may ensue. Finally the wound is dressed with wool previously soaked in wine and oil. If after cupping the blood continues to flow, the instrument must be re-applied before the wound heals.

The Hippocratic tradition of therapeutic bleeding was carried on by Diocles of Carystos[27] and his pupil Praxagoras of Cos to influence the great Alexandrian anatomist Herophilus. Herophilus employed venesection especially when he desired to stop a haemorrhage[28] and modified the Hippocratic view with regard to the treatment of pleurisy in that he established a general rule never to bleed after the fifth day of the disease.[29] In his therapy he favoured the more drastic measures and his meddlesome tendencies led to an excess of venesection. On the other hand Erasistratus, his contemporary, followed the views of his teacher Chrysippus, the exponent of the rival school of Cnidus, who rejected phlebotomy doubtless because like the Pythagoreans, he placed the seat of the soul in the blood. "Chrysippus the Cnidian," says Galen, "considered phlebotomy ought to be removed altogether from our means of cure."[30] In its place he substituted a regimen of strict dietary control. Caelius Aurelianus tells us that Erasistratus did, however, practice venesection to a limited extent but that his disciples completely discarded the procedure.[31] Such divergences of opinion began the long, acrimonious and futile controversies of Roman times; Erasistratean methods extending through Asclepiades of Prusa to the more temperate therapy of Celsus and the Herophileans to the drastic pharmacy of Galen. It remained for later writers, notably Galen and Antyllus, to enlarge and comment upon venesection. Antyllus's writings are known only through such parts as survived in the pages of the encyclopaedists whereas acceptance of Galen as the exponent and commentator upon the "Father of Medicine," apart from his philosophical system, assured his dominating position. Generally speaking we may say that Galen explains the therapeutic indications of venesection and Antyllus, the operative procedures.

27. Galen, *De ven. sect. adv. Erasis.* 5.
28. Cael. Aurelianus, *Acut.*, II, 13.
29. *Idem, Acut.*, II, 21.
30. *De curandi per ven. sect.*, 2.
31. Cael. Aurelianus, *Acut.*, II, 13.

According to Galen, the diathesis which had most need of venesection was plethora or plentitude, the quantitative ascendency of the humours in their original or normal proportions. Elaborating on Hippocratic conceptions currently in dispute, he exhorts his readers to recognise the reality of two kinds of plethora; that affecting the strength and that related to the content of the vessels.[32] The first of these occurs when the quantity of the humours is great enough to overwhelm the strength, either because of their superabundance alone, or because of persisting "weakness of strength." This syndrome is indicated by a feeling of heaviness and difficulty in movement. The second variety occurs when the humours by their increase distend the vessels or merely surpass the measure of the normal quantity and give rise to a feeling of tension, soreness or pain. As either type may exist in health or in disease and may be either local or general, we are provided with the necessary justification for the use of both prophylactic and therapeutic venesection as well as its local and general application.[33] The terms plethora (πληθώρα) and plenitude (πλῆθος) are usually synonymous and without distinction.[34] Galen defines plenitude as "the superabundance of humours in the entire body of the animal" but on occasions reserves the term, plethora, exclusively for that kind of plenitude affecting the capacity of the vessels.[35]

There is however another kind of humoral redundancy, known as cacochymia, in which there is either the quantitative ascendency of a single humour and proportional imbalance or the humour is qualitatively altered .... "When all the humours have augmented in the same proportion, this state is called plenitude or plethora; but when the body is filled with yellow or black bile, phlegm or serous liquid, such a diathesis is not called plethora but cacochymia."[36]

The theory of plethora is a fundamental point in the system of Galen. He devoted a special treatise, *De plenitudine*, to the subject and returned to the topic again and again, in his extensive works. It constitutes the basis of the whole rationale of venesection on which Vesalius's argument rests. Likewise the distinction between a superabundance in equal proportion of all the humours and the quantitative or qualitative ascendency of a single humour

32. *De plenitudine*, 2.
33. *De plenitudine, passim.*
34. *Methodus medendi*, XIII, 6.
35. *De plenitudine*, 6; *Adversus Julianum*, 7.
36. *Meth. med.*, XIII, 6.

should be noted, especially since, with the revival of Greek medicine in the sixteenth century, it was regarded as of supreme moment.

The plethoric state, Galen contends, requires evacuation to rid the body of excess humours for the excess may settle in some or other part of the body, causing inflammation, and there undergo corruption. But it is not always necessary to draw blood, as purgatives, baths, frictions, sweating, and even walks, suffice for evacuation. There are precise indications, relating to the state of health or sickness, which determine the method to be employed. One must take into account the quantity and quality of the plenitude, the age, strength, and natural complexion of the patient as well as the season, locality and the constitution of the air. There are, in addition, special circumstances which decide whether or not one can draw as much blood as the sickness in itself allows.[37]

Galen's main rule, governing the use of or abstention from venesection, would seem to be so-called "integrity of strength."[38] There are three kinds of strength dependent upon the three primary faculties, animal, vital and natural, and therefore psychic strength which resides in the nervous system and rules the acts submitted to the will, vital strength derived from the heart and vessels, which controls the movement of the blood, and natural strength which has its point of departure in the liver and governs nutrition. "When the strength is intact, and there are signs of plethora, and in addition, when an inflammation exists of whatever cause, and it is a question, above all, of plethora in regard to content, then one must bleed without making any other distinction, that is without regard to the locality, the season and other circumstances . . . ."[39] Galen's sole exception to this rule is age; childhood and old age, but especially childhood, are a contra-indication in regard to venesection.[40]

The evacuation of the redundant humours may be carried out in two ways, known as revulsion and derivation. These methods, according to Galen, were invented by Hippocrates,[41] but they are referred to very obscurely in his writings. For the modern reader, the precise meaning and significance of these terms, and particularly of the theory underlying the rationale of their employment in

37. *De curandi per ven. sect., passim.*
38. *De curandi per ven. sect., passim.*
39. *De curandi per ven. sect.*, 20.
40. *Ibidem*, 9.
41. *Meth. med.*, v, 3; *Ad Glauconem*, II, 4.

therapy, is difficult to follow. Further elaborations, and especially of those engaged with Vesalius in the venesection controversy, make the subject so confused as to be at times almost unintelligible; a confusion often compounded by many recent writers in the history of medicine who have been guilty in their studies of even reversing the meaning of these terms.

The idea apparently underlying the origin of these methods, arose from the conception that an inflammatory lesion is due to the local collection of humours which have escaped from the blood stream or congest the regional vascular bed. Once these humours have collected at a local site they may undergo corruption leading to the formation of pus or other fluid, or in abortive lesions they may disperse and be evacuated through normal channels resulting in what we now call resolution. Galen tells us that Hippocrates was in the habit of using the word derivation with reference to a humour which while proceeding to its normal site of evacuation, is turned aside to the site of some neighboring affection.[42] It is emphasized that the path of the humour is not completely deviated from its proper direction so as to course towards a diametrically opposed region. Nowhere does Galen give a definition of revulsion but he explains its nature by example. "If," he says, "in the case of the existence of one of these evacuations [i.e. by stool or urine] we cause vomiting, Hippocrates calls that revulsion, just as we act revulsively on vomiting by irritation in the region of the uterus, the bladder or the ham."[43] By this was meant that the direction of flow of a humour could be reversed and the humour thus induced to proceed in a directly opposite direction toward an irritative focus whence it could be evacuated. Therefore, according to the ancients and to Galen in particular, the fundamental difference between revulsion and derivation is that the first diverts the humours from the affected parts and induces them to proceed to the healthy, while derivation draws these same humours from the healthy towards the affected parts.

Besides these differences between revulsion and derivation, they are distinguished, when used as therapeutic procedures, by the time of their application. In the early stages of a disease, while the humours are still rising strongly or in "flux," one should perform revulsion and thus by reversing the humoral flow, prevent their local accumulation. Consequently, revulsion is used as a prophy-

42. *Comm. in Lib. VI Epid.*, sects, 11, 7.
43. *Comm. in Lib. VI Epid.*, sects, 11, 7.

lactic measure. On the other hand, once the humours have ceased to flow and are fixed at the local site of the disease, then it is better to derivate, but, Galen adds, if it is not possible to evacuate at the site of the disease itself, as for example in an internal lesion, then derivation is to be carried out from the parts which are nearest to the affection. These principles are employed not only in venesection but in all forms of evacuation therapy as in the use of emetics, purgatives, cupping glasses, scarification, friction, etc.[44]

As applied to venesection there are four routes over which revulsion operates and the flux may be turned; (1) from below upwards or from above downwards,[45] the type most frequently employed; (2) from front to back or back to front,[46] used chiefly for affections of the head; (3) from within outwards or from without inwards; and (4) from right to left or from left to right.[47]

Galen, interpreting Hippocrates, insists that revulsion must be performed κατ' ἴξιν;[48] an expression which was later to prove very troublesome to the sixteenth-century controversialists. The word ἴξις (the Ionic form of ἶξις) is derived from the verb ἱκνέομαι "I come" and the expression therefore is literally "according to the arrival" and by transference "in a straight line," by which was meant in the line of the natural direction of the vessels on which the current of the blood depends. Galen often interprets κατ' ἴξιν by κατ' εὐθύ, or κατ' ευθυωρίαν,[49] expressions employed by Hippocrates only in connection with the reduction of fractures where they refer to the restoration of alignment. As the left and right halves of the body each has its distinct vessels, κατ' ἴξιν means that revulsion must be performed on the same side of the body as the affection and it is therefore clear that revulsion κατ' ἴξιν is not applicable for venesection in which it is hoped to revulse from right to left or from left to right. This idea apparently arose from an observation of Hippocrates in the *Prorrhetics*, that if in a patient with an enlarged spleen, nose bleeding occurred from the nostril of the opposite side, the omen portended death.[50] The question of whether one should bleed from the same or the opposite side of the affection became one of the points most acrimoniously argued in later times.

44. *Meth. med.*, IV, 6, XIII, 11; *Sanguinis missio*, 19; *Ad Glauc.* II, 4.
45. *Meth. med.*, IV, 6; *Comm. in Hum.*
46. *Meth. med.*, XIII, 11; *Comm. in Hum.*; *Sanguinis missio*, 19.
47. *Comm. in Hum.*; *Meth. med.*, V, 3.
48. *Ad Glauc.* II, 4; *Comm. in Hum.*
49. *Comm. in Hum.*; *Comm. III in Prorrh.*; *Meth. med.* V.
50. *Prorrhetics*, I.

Closely connected with the expression κατ' ἴξιν is the counsel to perform revulsion and derivation along common vessels.[51] If this advice did not apply equally to both revulsion and derivation, one would be tempted to regard it as identical with that of κατ' ἴξιν. However Galen seems to consider here more especially the specific vessels, and he indicates that there must be a direct vascular communication between the affected organ and the site of application of the derivative or revulsive agent. A striking example of the application of this precept is seen in the revulsive treatment of menorrhagia, so often recommended by Galen, in which cupping glasses are applied to the breast; a procedure based on the knowledge of the anastomosis between the internal mammary and inferior epigastric vessels and the belief that the latter were connected with the uterus.[52]

In the post-Galenical period, the venesection argument waxed and waned between derivation and revulsion, between right side and left, between the conservatism of the Erasistrateans and the excesses of the Herophileans, until we meet with the Arab practice in which bleeding was generally, if not exclusively, revulsive at a site chosen as remote as possible from the seat of the affection. The Arab practice was the standard from the mediaeval period until the sixteenth century when it was first definitely opposed as a result of the development of Greek studies and the new and accurate translation of Hippocrates and Galen. It was, however, difficult for innovators to cast aside all tradition, and we find Symphorien Champier, pioneer though he was in the comparison of Greek and Arab medicine and despite several works on the subject, failing to note any discrepancy with the ancient teachings.[53]

It remained for Pierre Brissot, a physician of Paris, to enunciate and support the Hippocratic and Galenical procedure by actual practice, an epidemic of "pleurisy" in 1514 providing the opportunity. The results were, in his opinion, so brilliant that in the following year he felt called upon to make a public pronouncement, and thus began one of the most violent, acrimonious and extensive medical controversies whose repercussions extended into the seventeenth century. He condemned as Arab nonsense, the prevailing practice of slowly bleeding drop by drop from the region most

51. *Ad Glauc.* II, 4; *Comm. in Hum.*
52. *Meth. med.*, V, 3; *Ad Glauc.*, II, 4; *Comm. in Hum.*; *De usu part.*, XIV, 8; *Comm. in Aphor.* V.
53. *De morborum generibus* (Basiliae, 1547), III, 6.

distant from the site of the affection; a practice which had reached such heights of absurdity that it was thought sufficient to express a drop or two of blood from the big toe of the opposite side. He maintained that for bleeding to be effective, a sensible quantity of blood must be removed and since pleurisy existed in a region drained by the vena cava, it made no difference whether the right or left side was selected. Furthermore he believed that by opening a vein of the arm on the affected side, sufficient remoteness existed in the Hippocratic sense for revulsive bleeding, and it was therefore an error to choose, as was customary, the saphenous vein of the leg.[54]

Although Brissot obtained a few influential supporters from among his teachers at Paris, his views were received with general antagonism, but the controversy remained meanwhile a purely local affair. The explosion began some years later in Portugal whither Brissot had migrated. An epidemic of "pleurisy" at Evora in 1518 once again presented him with the opportunity of applying his principles and with such success as to invite the jealousy of the royal physician, Denis, who attacked the new-fangled method in a bitter polemic. Owing to his premature death, Brissot's reply was not issued until 1525 but with its posthumous publication, the medical world promptly split into the two major factions to which Vesalius constantly refers.[55]

The opposition party based their theories on opinions long held. These opinions although coloured by Arab sources, initially derived from the attempts of the encyclopaedists, such as Oribasius, to conciliate the methods of the Hippocratic-Herophilean-Galenical school with those of Chrysippus and Erasistratus.[56] Therefore they were little influenced by the new and accurate translations of Hippocrates and Galen, and paradoxically many of the foremost humanists adhered to this party, usually called the Arabist, but perhaps better referred to as the traditionalist.

The traditionalists claimed that at the onset of a malady little harmful matter had as yet accumulated at the site of the affection and that in revulsive bleeding a vein must be selected at the maximum distance from the disease and therefore on the opposite side of the body. Immediate bleeding anywhere near the region of the disease would, they argued, only increase the flow of the noxious

54. Brissot, *Disceptatio apologetica*, ed. Moreau (Parisiis, 1622), pp. 1-84.
55. Cf. note 103.
56. *Oeuvres d'Oribase*, ed. Daremberg, Lib. VII, capp. 5-6.

humours to the site of the disease and thereby increase the complication. Revulsion, therefore, is to be performed first, and derivation should not be undertaken for at least a week. Such in general is the view expressed by the earliest literate opponents of Brissot such as Andreas Thurinus,[57] Louis Panizza,[58] Caesar Optatus[59] and Benedict Victorius[60] and which such advocates of the revived Hippocratic and Galenical medicine as Jean Argentier,[61] Guinter of Andernach[62] and Conrad Gesner[63] supported.

The earliest proponents of Brissot were Manardus[64] and Curtius.[65] Manardus agreed with Brissot that in pleurisy the arm of the affected side was sufficiently distant for revulsive bleeding. Curtius's defense rested upon an attempt to clear away contradictions in the writings of the ancients. An important view which characterised many of this sect was the apparently paradoxical idea that revulsion and derivation could be performed simultaneously at the same venesection. This was possible, they contended, as the opening of the vein diverted the humours still in a state of flux to the site of the venesection. Therefore the humours are caused to by-pass the seat of the disease, and this is revulsion. At the same time the humours which have accumulated and are causing the disease must flow back along regional vessels into the main channels to replace the blood removed and are in turn drained off, which is derivation. As the first blood removed is revulsive and that which follows, derivative, the closest attention must be paid to its colour during venesection which satisfied the Hippocratic maxim that in pleurisy one should not fear to draw blood until it becomes more red or livid in colour. Leonard Fuchs, an adherent of the Brissot party, tells us for example that there are, therefore, four ways of letting blood; (1) revulsion, which draws back the blood about to press upon and slip into some part of the body "and which therefore should be used to guard against a future disease"; (2) derivation, which removes the blood "from the suffering into a neighboring part" and which is to be used once the humour has es-

57. K. Sprengel, *Hist. de la médecine, trad. de l'allemand*, III (Paris, 1815), pp. 40-41.
58. *Ibidem*, p. 41.
59. *De hectica febre* (Basiliae, 1536), p. 170.
60. Sprengel, III, p. 42.
61. *Opera* (*Hanoviae*, 1610), "In Galeni art. med.," III, col. 731-750.
62. Cf. note 93.
63. *Epistolae medicinalium* (Tiguri, 1577), I, f. 19vf; f.21r.
64. Cf. note 100.
65. Cf. note 102.

tablished itself at the local site; (3) simultaneous revulsion and derivation to be used when the disease is as yet in generation; and (4) a simple evacuation (often called a variety of derivation), carried out by cupping glasses and which neither revulses nor derivates and is to be used on the site of the disease itself.[66]

In order to supply a rational explanation of the mechanism of the two procedures, Fuchs applied concepts derived from Galen's *Natural Faculties*. Here Galen, in discussing the function of the various organs, tells us that they are made up of three kinds of fibers. Longitudinal, oblique and transverse. The longitudinal supposedly possess the power of attracting nutritive material, the oblique of retaining it and the transverse of expelling the excess. Fuchs believed the veins were similarly constructed of such fibers and interpreted the expression κατ' ἴξιν, so often used in the works of Hippocrates and Galen, to refer to their arrangement.[67] Vesalius subscribes to this view on which he elaborates, and it was not until after Gabriel Fallopius refuted the opinion on anatomical grounds that he abandoned it.[68]

René Moreau who re-edited Brissot's treatise in 1630, tells us its original appearance in 1525 led to a storm of contention. So violent was the dispute that in Spain a public edict was issued forbidding the new method. The University of Salamanca, appealed to for an opinion, supported the new method, whereupon the enraged opponents took their case to the court. The emperor, recalling the recent death from venesection in the traditional manner, of a prince of Piedmont, one of his relatives, refused to support the traditionalists. The same story is told by Vesalius, although he places its occurrence later than does Moreau whose chronology is notably untrustworthy. While there is no doubt that Brissot's account aroused much opposition, yet the aforementioned incident in Spain seems most likely to have occurred in 1537/1538.

The approach of Vesalius to the controversy is unique. In general terms an adherent of the Brissot party, he stands with the champions of the purified classics but his position inflexibly rests on the secure ground of factual observation. Confident in his knowledge of the true arrangement of the azygos system, upon which the whole rationale of the place of venesection in the treatment of pleurisy rests, he is willing to go further and to promul-

66. *Instit. med.*, Lib. II, sect. 5, capp. 5.
67. *Ibidem.*
68. Cf. note 143.

gate on anatomical grounds his own aphorism. For the first time, the infallibility of Galen in anatomical matters is challenged.

It is unnecessary to trace any further the tortuous windings of the venesection controversy to the extravagant excesses of bloodletting which climaxed its decay as a therapeutic method in the eighteenth century. It should be observed, however, that it was Vesalius's insistence on the significance of the azygos vein in phlebotomy which led to the discovery of the venous valves.

Despite much discussion, the entire question relating to this epochal discovery has become somewhat beclouded and confused. Yet the story is clear enough if we keep in mind the circumstances surrounding the statements of the various writers of the time and their relationship to the burning problem of phlebotomy.

The Galenical physiology and the notions based upon it naturally engendered an abnormal preoccupation with the venous system, and with the publication of the *Venesection Letter* and further Vesalian studies this preoccupation had become greatly intensified. One need only examine an anatomical work appearing after the middle of the sixteenth century to observe the disproportionate treatment given to the venous over the arterial system—a complete reversal from what obtains in the modern textbook—to appreciate how deeply concerned the physician was with its every detail.

The issuance of the present work had now entirely changed the complexion of the controversy. Up to the year 1539 every participant had marshalled his arguments from the pronouncements of authorities or from empirical observations on the outcome of illness, but thereafter, if he was to attack the Vesalian thesis effectively, he must adopt the new objective method of dissection. At our distance we are apt to forget that venesection was the major practical therapeutic measure evolved from the universally held humoural doctrine. Its effective exploitation depended upon knowledge of the venous system, presumed to be correct; hence the great cogency of the Vesalian argument. From his repeated references to this earlier work in his later writings, Vesalius, no less than his contemporaries, was fully cognisant of the strength of his position. The physician, therefore, if he was to remain in the mainstream of what was to him logical and rational medicine, perforce was left by the new doctrine no option but the standard, and now ineffectual, use of polemical abuse, or he must take up the scalpel and stain his hands in the cadaver. Thus out of the venesection controversy

came as a purely incidental finding the discovery of the venous valves. Their real significance could not, of course, be appreciated, because the focus of attention was on the arrangement of the veins and not on such apparently trivial details. But the question of their existence determined a Paduan tradition and so left a minor puzzle which in the consciousness of Harvey was to provide the key unlocking the door to the circulation.

The first mention of the presence of venous valves can be ascribed without question to Charles Estienne (Stephanus), 1503?-1564. His discovery was of little significance for he had reference to the relatively insignificant ostial valves of the hepatic veins found at the mouths of tributary branches and not to the more striking and more evident parietal formations occupying the lumen of venous channels. Furthermore his discovery bore no immediate relationship to the venesection controversy and therefore gained no contemporary recognition or influence and thus remained a curiosity of observation to which attention has been drawn in comparatively recent times.

The anatomical work, *De dissectione partium corporis humani*, in which Estienne's observations were recorded, was almost complete and the greater part in print by 1539, when owing to a dispute and subsequent prolonged litigation it was held up and the publication delayed until 1545. The Latin edition was immediately followed by a French translation with emendations which was issued in 1546. Since the section dealing with the venous valves was, according to the preface, part of the work completed before suppression, we may assume that his discovery occurred prior to 1539.

Under the terms *apophyses membranarum*, *epiphyses* or *tayettes*, Estienne apparently has reference to the sickle-like folds or ostial valves to be found at the orifices of the hepatic veins. He believed that these structures prevented undue engorgement of the liver with blood, and he compared their function to that of the valves of the heart. At the end of his volume, and therefore probably an addition of later date, he again mentions these processes but has changed his mind as to their function, for he now thinks that they hold back the blood formed in the liver for its more perfect elaboration.

Many writers in the history of medicine will not grant any merit to Estienne's claim on the grounds that there are no valves in the hepatic veins of man and many other common forms. No doubt such authors, as suggested above, are thinking of the more typical

parietal valves, absent in this vessel, rather than those at the openings of tributaries which are not uncommon. On the other hand, we find writers, such as Streeter,[69] who criticise Estienne by stating that he had described valves in the portal vein, which are found only in lower animals but not in man, but these writers have obviously misread the passage. We therefore give Estienne's statements in full as taken from the French edition of 1546 where he has expressed himself with somewhat greater clarity. The reader may then judge for himself of Estienne's claim to recognition. *La grand vene* mentioned is, of course, the hepatic vein.

Membranes au foye. Epiphyses. Le mesme qu'avons dit de la vene porte a la partie cave du foye: est semblablement faict a la partie gibbeuse ou estlevée d'iceluy par la grand vene. Au reste, de peur que le sang qui se fait & laboure audict foye, par quelque inconvenient ne regorge quelquesfoys & engendre douleur ou deffault audict foye: ont esté faictes en iceluy certaines petites membranes deliées, que lon appelle Epiphyses: pour engarder & obsister que tel peril ne puisse advenir: & servant lesdictes epiphyses de ce que voyons servir les valvules au cueur.[70]

Tayettes au foye. Ceste substance [du foie] pourras evidemment appercevoir en menant deux ou trois trenches droictes du bout du rasoer sur le dehors dudict foye. Et par ce moyen verras sortir le sang de plusieurs petispertuys fort menuz. Et oultre apperceuras plusieurs petites tayettes, a lendroict desquelles j'estime que se face le labeur du sang le plus pur qui soit audict foye. Car cesdictes membranes empeschent que la matiere du sang ne regorge si tost au dehors: ains soit plus longuement retenue & arrestée en ce lieu pour plus parfaicte elaboration.[71]

It is on the authority of Vesalius himself that the discovery of multiple valves in the veins of man is attributed to the genial and generous anatomist of Ferrara, Giambattista Canano, 1515-1578. The disclosure was made to Vesalius in connection with a consultation, attended by both physicians, held at Ratisbon in 1546 over the illness of Francesco d'Este. On this occasion Canano is reputed to have asserted that valves which would effectively oppose the reflux of blood existed in the azygos, as well as other veins. Un-

69. Edward Streeter, "introduction," p. 44, in *Joannes Baptista Canano, Musculorum humani corporis picturata dissectio . . . facsimile edition annotated by Harvey Cushing & Edward C. Streeter* (Florence, 1925).

70. Charles Estienne, *La dissection des parties du corps humain* (Paris, 1546), Lib. II, cap. ix, p. 194; Latin ed., 1545, p. 182.

71. *Ibidem*, Lib. III, p. 384; Latin ed., p. 357.

fortunately the tenor of this important conversation was not recorded until 1564 when Vesalius was writing his reply to the *Anatomical Observations* of Falloppius. It is perhaps still more unfortunate that Vesalius, on his way to the Imperial Diet at Ratisbon, was delayed at Nimwegen by the illness of the Venetian ambassador, Bernardino Navagerio; otherwise we might have had an extended account of this puzzling subject in his *China Root Letter*, composed during the period of enforced idleness necessitated by having to remain with such a distinguished charge, and completed at Ratisbon immediately prior to this conversation.

It would not, however, be too hazardous to suggest that the matter of the venous valves and their influence on the reflux of the blood was brought up at the consultation on Francesco d'Este over the correct procedure for venesection in this noble patient. In the *Venesection Letter* Vesalius had established a new and anatomical basis for the employment of phlebotomy which would have much appeal for the young Canano, himself a kindred spirit and investigator of the anatomy of the body at first hand. Such an opinion receives corroboration from the first published account of these structures given by Amatus Lusitanus, 1511-1568, for the subject is introduced by him specifically in connection with the venesection controversy and his criticism of the Vesalius thesis. Failure to appreciate the context of the argument has been responsible in recent times for much confusion concerning the precise rôles of the various participants in the discovery.

The account of Amatus Lusitanus first appeared in his *Centuria I*, issued in 1551 at Florence, but, as stated by Friedenwald in his excellent study of the Portuguese physician, the writing of the work was finished in 1549.[72] Because of its importance as the first published statement on the presence of parietal valves and its relationship to the *Venesection Letter* of Vesalius, his account is here given in full.

Vesalius of Brussels, the distinguished anatomist and physician to the Emperor Charles V, published some years ago a discussion on this subject in which he argued that in pleurisy, whether the inflammation be on the right or left side, the internal vein of the right side must always be opened whether the said vessel be the basilic, the iecoraria or the axillary. The reason given by him is as follows: Since the vein

72. Harry Friedenwald, "Amatus Lusitanus," *Bulletin of the history of medicine*, v (1937), p. 609.

called the azygos, that is "without a fellow," arises near the heart from the right side of the vena cava and in its passage downward along the spine, nourishes the eight lower ribs of either side and is distributed to the diaphragm and separating membrane [mediastinum], hence (so he said) the matter causing the pleurisy would be eradicated and evacuated far better if the blood is withdrawn by venesection from the right arm rather than the left, because the basilic vein of the right arm is furthermore more directly in accord with the azygos than the basilic of the left. This then is the argument by which, as I have said, Andreas Vesalius supports the contention that in pleurisy one should always section the axillary vein of the right arm whether the pleurisy occupies the right side or the left.

Forsooth, this teaching should be exploded as an error and eliminated from practical procedure as a menacing danger. In this connection it is easy to see that the argument of Vesalius is utterly erroneous because the azygos vein does not once again return the blood which it receives from the vena cava. On the contrary, it is so constructed at its orifice where it is joined to the vena cava as to possess certain ostiola which are opened to permit the imbibition of blood and which are later so closed that they no longer allow the blood which has been received, to return. Thus the azygos vein operates in this regard like the orifices of the urinary bladder or of the vessels of the heart. That this is a characteristic feature of the azygos, that is to say, that it no longer returns along the same channel the blood which it has received, we have determined from the dissection of bodies.

If you sever the upper portion of the vena cava and after inserting a tube into it, blow downwards, the whole of the lower part of the vena cava together with the azygos will be inflated and become turgid; but if you divide the azygos vein in its lower part, and having inserted a tube or reed into its mouth, force air upwards, unquestionably the vena cava will not be inflated nor become turgid, because the air contained in the azygos is unable to escape on account of the aforementioned ostiola or opercula which it possesses at its junction to the vena cava. Hence it is certain that if air cannot be derivated from the vena azygos to the cava, *a fortiori* neither can there be a reflux of the blood which is thicker than air. What we have said concerning the azygos is established, nor should the matter be in any doubt since we have tried it a thousand times. For in the year 1547 we made dissections of twelve human cadavers and of animals, and in the presence of a large assembly of learned men we observed this to happen in all cases; just as Joannes Baptista Canano, the admirable anatomist, was accustomed to observe the same. Since these arguments [of Vesalius] are invalidated, it therefore remains for us to put forward the true reasons why, especially in

pleurisy, the withdrawal of blood should be made in particular from the same side as that attacked by the pain.[73]

From many sources it is possible to prove beyond the shadow of a doubt that the meeting between Vesalius and Canano at Ratisbon occurred in the year 1546, and, in fact, to establish with some accuracy that the two foregathered at the bedside of Francesco D'Este in the month of July of that year. Thus, if we accept at face value the statement of Amatus that his experiments were carried out in 1547, even assuming that the demonstrations were conducted throughout the winter of 1546/47, as the most favourable time of the year for the dissector of unembalmed material, we are forced to conclude that Canano had prior knowledge of the venous valves. From the evidence we therefore find ourselves in complete agreement with conclusions of Friedenwald that the credit of the discovery should be shared by both Canano and Amatus Lusitanus. Furthermore, it is known that the relations between the two physicians had long been very intimate and that it was customary for Canano to perform the dissections while Amatus read the appropriate passage from Galen or prepared a *resumé* of Canano's remarks, perhaps in connection with the projected publication of a continuation of that anatomical work of which only the first fasciculus was ever issued. Their relationship would seem to be with more justice that of collaborators, and the "we" of the passage quoted from Amatus is perhaps more than editorial and should be taken literally; especially as both agree in the erroneous opinion that these valves would interfere with the reflux of blood into the vena cava. Streeter, in his excellent study on Canano, implies that Amatus deliberately falsified his findings in placing the valve upside down and involved Canano in his own egregious blunder. Such an implication is scarcely justifiable, not only in fact, but, as well, the true significance of the valves could not be appreciated in terms of the Galenical physiology and had to await the discovery of the circulation. Indeed, in view of the crudity of the experiments, the frequency with which the valves of the azygos vein are incompetent, and the very great practical possibility that the vessel may be obstructed by blood-clot, the error is more likely to have been one of observation influenced by the weight of tradition.

73. Amatus Lusitanus, *Curationum medicinalium centuriae* VII (Burdigalae, 1620), Centuria I, curatio LII [for LI], scholia, p. 81-82.

The opinion first voiced by Canano and now openly published by Amatus, by striking with objective evidence at the very foundations of Vesalian doctrine, merited at least some sort of reply. This Vesalius deigned to give as a sort of after thought appended to the end of the chapter taking up general considerations of the glands and structure of the veins in the second and revised edition of the *Fabrica* issued in 1555. Characteristically, without mention of any names, his reply is very obviously directed at the account published by Amatus, and possibly the "certain individuals" includes Canano. Here then is what he has to say.

As we shall treat of the shape and substance, the special and separate uses of each gland in its proper place, nothing further should be said about them here. Our discussion must now be turned to the arrangement of the veins as soon as I have added to what has already been mentioned in connection with the glands. Not only is provision made for strength in their distribution but the walls of the veins are also seen to be thicker and more compact, as for example wherever a branch is distributed from a stem vessel or where a trunk is divided into branches. Thus a projection occurs in the orifices of the branches themselves, not unlike the thicker substance of the stomach which, you will hear, is made with no little industry like a ring in both of its orifices for the sake of strength. In fact, when the veins are emptied of blood and divided lengthwise while flaccid, this thicker substance is seen hanging down within the vessel and thus closes the lumen. Consequently some of the bystanders at dissection have at times claimed that this substance is fashioned like the membranous body which prevents the urine from flowing back or returning into the passage which carries it from the kidneys into the bladder. Likewise they sometimes attempt to compare this projecting substance of the venous wall to the membranes which are seen at the orifices of the great artery [aorta] and arterial vein [pulmonary artery] where they emerge from the heart. Forsooth, just as if, in bloodletting, in the various motions of the spirit and on occasions of this sort, it were impossible for the blood to return into the trunk of the cava from the azygos and the veins entering the arms, head, kidneys and legs, and from many similar veins, which is far otherwise than I myself believe. I am accustomed to contend in the schools that this thicker substance of the venous wall met with on dissection of its branches, is created by Nature for the sake of strength. I am of course not unaware of the faulty judgment of certain individuals who shamefully declare that not even air can pass from the azygos vein into the stem of the cava.[74]

74. Andreas Vesalius, *De humani corporis fabrica* (Basel, 1555), Lib. III, cap. iv, p. 442-443.

Every writer on the subject has stated that Vesalius failed to find the venous valves and denied their existence. Yet, as is apparent from the above passage and from his statement to Falloppius, which will be given later, he found something in the lumen of the vessel which he variously calls *protuberans*, *substantia eminens* or *extuberatio*, and which he thinks may close the collapsed vein. Very obviously he is referring to something projecting from the venous wall and if, for example, we take the contemporary use of the word *extuberatio* in anatomical context, often but incorrectly translated from classical usage as a swelling, we find from the lexicon of Blancardus, as well as from other sources, that its synonyms are *apophysis*, *probole*, *echysis*, *processus*, *productio*, *projectura* and *protuberantia*, and it is defined as something "projecting beyond the plane of the surface." As to what Vesalius means exactly, is further clarified in his later account when he compares these projections to the valve-like structure overlying the opening of the ductus arteriosus of the foetus, and which even modern authors have, according to Barclay, Franklin and Pritchard,[75] erroneously regarded as a valve.

There can be no doubt whatsoever that Vesalius saw the venous valves but not as valves in the functional sense. He appreciated the relationships which they bear to tributary vessels. Therefore he apparently thought of them as being produced by a sort of partial intussusception of these tributary vessels into the parent stem. Thus he concluded that they contributed in some way or other to the strength of the venous wall. Vesalius' error was like that of Canano and Amatus, one of interpretation, and if he largely confined his investigations to the azygos vein, in such few opportunities available to one who was now a busy court physician, then, in view of the frequency with which the valves of this vessel are rudimentary, incomplete and incompetent, his error of interpretation is quite understandable. It is regrettable that one who so fully understood the power of the illustration should have failed us in this regard. Had he but supplied an inset drawing, how greatly would he have clarified his meaning. Perhaps this failure is to some degree a measure of the insignificance in which he held the subject.

Almost simultaneously with the publication of the revised edition of the *Fabrica* containing Vesalius' estimate of the opinions of Canano and Amatus, there appeared the last and posthumous work of Jacobus Sylvius, 1478-1555. Once the teacher, but now the

75. Barclay, Franklin, Pritchard, *The foetal circulation* (Oxford, 1944), p. 100.

deadly enemy of Vesalius, he was able to report, no doubt with great satisfaction, that "membranous epiphyses are also to be found in the mouth of the vena azygos and frequently in other large veins, such as the jugular, the brachial, the crural, and the trunk of the cava as it emerges from the liver." And so Sylvius in confirming, not the presence of the valves, but the interpretation placed upon them by Amatus, thought to destroy the opinion of his enemy on venesection and literally with his last breath, sought to lodge his last dart in the side of one whom he had savagely called, this purveyor of filth and sewage, this cloven-footed ass, this Aesopic crow, this pimp, this liar; a richness of obscenity which, as has been said, is lacking to the language of decency.

Knowledge on the subject of the venous valves was extended by Realdus Colombus, 1516?-1559, pupil and successor to Vesalius in the chair of anatomy at Padua, who describes the presence of "membranes" in the smaller radicles of the mesenteric veins. We shall let Colombus tell us in his own words the nature of his original discovery and his opinion on their function, staying but to remind the reader that the idea that chyle passed into these vessels whence it was carried to the liver for elaboration into blood, was a standard notion derived from Galen. Colombus says:

> Of these, the three branches [to the colon, small intestine and rectum] which, we said, are carried to the intestines, when they reach the mesentery, are divided into an innumerable and almost infinite number of the mesenteric veins previously mentioned. The latter not only encircle the intestines but also perforate down to their internal cavity. Sagacious nature has placed here in each of these veins a membrane of the type which she has provided in the bladder cavity at the terminations of the ureters giving entrance to the urine descending to the bladder and which prevent the urine from again returning upwards. Nature does the same at the extremities of these mesenteric veins which we said are innumerable. This is a feature which, as far as I know, has not been noticed hitherto by anyone. All are unanimous in saying that the mesenteric veins have been made in order to suck the chyle out of the intestine. They have however been very careless in this connection because they have neglected to follow these veins to their end where they might easily have observed the great industry of nature, that is to say, with what great art she contrived matters so that these veins could easily receive the chyle but so that these little membranes would prevent its escape.[76]

76. Realdus Colombus, *De re anatomica* (Venetiis, 1559), Lib. IV, p. 165.

Nowhere does Colombus mention the existence of venous valves in the azygos or other veins. Yet it is obvious from the tell-tale remark comparing them to the valve at the lower end of the ureter, that he had read, or knew by hearsay, the opinions of Canano and Amatus. Furthermore, we know from internal evidence that he had read the second and revised edition of the *Fabrica*. In addition, the passage which immediately precedes that quoted by Colombus is almost identical with, and almost certainly derived from, the passage in Estienne which also is strangely followed by the latter's discussion of valves in the hepatic veins. Consequently it is perhaps not unlikely that Colombus was inspired to search for similar structures in the mesenteric vessels through the influence of Estienne. As is well known, valves are not found in the trunk of the portal or splenic veins of man but only in some of the smaller tributary branches, and especially in the smaller radicles of the intestine and colon. In view of the plain statement of Colombus that these structures have been overlooked, owing to the failure of anatomists to follow the vessels to their extremities, it is surprising to find K. J. Franklin in his thorough and extensive survey on the history of valves in veins,[77] observing that we cannot be certain that Colombus' findings refer to the smaller veins of the portal system, and Streeter dismissing Colombus with the remark that "Realdo Colombo in 1559 reported valves in the mesenteric veins, —an error of observation."[78]

The unfortunate Amatus was a Jew. His parents were so-called Marranos who had been compelled to accept the Christian faith by forced baptism under the persecution of the Spanish Inquisition. The young physician soon after graduation had, like his parents before him, to flee his native Portugal in order to escape the same malignant influence and thus began a peripatetic career. He was apparently never popular among his colleagues, no doubt because of his origins, and he was later, 1558, viciously and unjustly attacked by the botanist Matthiolus who virtually accused him of apostasy. There were many who put little faith in his observations. Franciscus Valesius, Bartholomaeus Eustachius and Gabriel Falloppius, all scouted the idea that valves could exist in the origin of the azygos vein, which would prevent the reflux of blood into the cava. From the tenor of their remarks one wonders how much they

77. K. J. Franklin, "Valves in the veins: An historical survey," *Proceedings of the Royal Society of Medicine*, Vol. 21:1 (1927-1928), p. 12.
78. Streeter, *Op. cit.*, p. 45.

were influenced by personal animosity and the knowledge that Amatus had now openly returned to the faith of his fathers. Thus Falloppius writing in his *Observationes anatomicae*, 1561, suggests that Canano had played some practical joke on Amatus or that the latter had falsely attributed these findings to the anatomist of Ferrara.

I have noted many things on the vena azygos which (so it seems to me) were either added by others incorrectly or were omitted through gross carelessness. The following has been put forward. Amatus the Portuguese physician (to begin with him), in the fifty-first *scholia curationis* of his *Prima curationum medic. centuria*, wishing to establish that the vein of the elbow on the affected side should be opened in pleurisy, asserts that small membranes, *ostiola* or so-called *opercula* such as are found in the orifices of the cardiac vessels, are present in the origins of the azygos vein, which permit the entrance of blood from, but not its exit into, the vena cava. Hence it follows, he says, that although the vein divided at the elbow evacuates the cava, no blood is however drawn out of the azygos because these *ostiola* prevent the regurgitating blood from entering the cava. His evidence is based partly on the living and partly on the dead, for he testifies that this had been demonstrated to him by Joannes Baptista Canano, the noble anatomist, and had been fully established in the dissection of twelve human and a like number of other animal cadavers.

I wish, my dear Petrus [Petrus Manna, a physician of Cremona], that you were acquainted as well as I am, with the irreproachable character and flawless teaching of Joannes Baptista Canano, since then you would judge the man capable of any other purpose except the forging of lies, and you would not believe that this dogma had ever been propounded by him (unless, perhaps, for the sake of a laugh he was jesting with some of those present with Amatus). As a matter of fact, these *opercula* are not found in man nor in the animals which I have dissected. Neither is Canano so inept that he could not on dissection see perfectly the patent and wide opening of the azygos at its origin. Therefore I rather hold against Amatus, in other respects a learned man, the blame for this error, since he did not correctly see or understand all those features pertaining to anatomy which were correctly explained by Canano.[79]

Falloppius then continues with a discussion of Amatus' contention that extensive and direct communications exist between the thoraco-epigastric branch of the axillary vein and the azygos system, which, owing to the action of azygos valves in preventing

79. Gabriel Falloppius, *Observationes anatomicae*, in Andreas Vesalius, *Opera omnia*, ed. Boerhaave & Albinus (Leyden, 1725), II, p. 726.

blood from returning to the vena cava, is the route whereby noxious material is extracted by venesection in pleurisy and thus is the rational basis for the procedure which Amatus now propounds. In the opinion of Falloppius such a thesis is only in part true as any anastomosis between these vessels is limited to but a few intercostal spaces and therefore inadequate for the drainage of humours from the chest by venesection.

The criticism directed at Amatus by Falloppius is essentially concerned with venesection, and his failure to find valves similar to the cardiac valves, in the orifices of the vena azygos, induces him to believe that perhaps Canano had foisted a practical joke on Amatus. It is interesting to note that Falloppius, as almost every other contemporary author, reads Amatus as saying that the valves had been demonstrated to him by Canano. In doing so he is accused by some modern writers of being guilty of a serious misstatement. "It has," says Friedenwald, "no foundation whatever. This error has been so constantly repeated that it has come to be an accepted fact." Following Salomon, he quotes the statement of Amatus, *ut ibidem quoque adnotabat Joannes Baptista Cananus, admirandus anatomicus*, which he renders, it would seem to us in violation of syntax, "And at the same occasion Canano, the admirable anatomist, likewise observed this," and thus concludes, incorrectly, as we believe, that Canano was the one to whom the matter was shown.[80]

It was in reply to Falloppius that the famous remarks of Vesalius attributing the discovery of the valves to Canano were made. Consequently, in rendering the passage it is of importance to keep the context of the argument in mind; otherwise, the precise meaning of the passage is altered, as in the translation of Withington[81] on whom so many have relied. It will be seen that Vesalius is unwilling to accept the suggestion that Canano was joking and reiterates the opinion previously published. He now employs the word *extuberantia* which, for reasons previously mentioned, has been translated as projections, although one could just as well use the term apophyses, and clarifies his meaning in his discussion of the ductus arteriosus. Vesalius writes:

80. Friedenwald, *Op. cit.*, p. 643.
81. Edward T. Withington, *Medical history from the earliest times* (London, 1894), p. 277.

I am not so sure Canano spoke to me in jest, although you are convinced that, not content with me, he was amusing himself at the expense of Amatus and several others. For when I visited the sick Lord Francesco d'Este with him at Ratisbon, he told me that he had observed membranes similar to those occuring at the origins of the arterial vein [pulmonary artery] and great artery [aorta], at the commencement of the azygos vein as well as in the orifices of the veins entering the kidneys and of the divisions of the vein found near the upper aspect of the sacrum. He asserted that these structures prevented the reflux of the blood. Hence, when I was offered the opportunity of investigating by early dissection whether the matter was so, and when I learned furthermore, that Amatus was of Canano's opinion, and read that he supported the latter's judgment, I added plainly enough at the end of the chapter in which I described how Nature provides for the strength of veins in their distribution, what conclusion I had reached on membranes of this sort. I did not find these membranes [valves], but I observed in the veins a noteworthy thickness of the orifice of the venous wall for purposes of strength (such as we see in the orifices of the stomach), making a projection (*extuberatio*) which, I wrote, investigators had mistaken for membranes. However, when in the schools you come to discuss this projection (*extuberatio*) of the substance of the wall of the vein hanging down, as it were loosely, when the blood flows, you ought not to overlook the membranous body which lies behind the orifice [foramen ovale] where the artery we call venous [left atrium] leads into the cava [right atrium], and which I shall not neglect in its place. This membrane is attached to the region and hangs down into the cavity of the arterial vein [left atrium]. I have already investigated this structure by dissection in a fairly large foetus, and it is the material which closes the foramen accurately when the foetus is brought to light rather than preventing the reflux of blood into the vena cava [right atrium].

Furthermore, it also happens here that the membrane which hangs circumferentially and is conspicuous in that foetal orifice [of the ductus arteriosus], which we have found to be common to the vein we call arterial [pulmonary artery] and the great artery [aortal], does not obstruct the reflux of blood at all or, in the foetus close to term, is not even clearly discernible. In addition, as I have carefully examined the nature of the orifice of the azygos vein, I also felt compelled, because of Amatus, to search for some connection or union between the veins running along the ribs and the vein [thoraco-epigastric] derived from the axillary as it is about to slip out of the axilla, and which is distributed to the external aspect of the thorax and especially to the skin and external surface of the muscles found in this region. This vein,

together with its associates, is explained in detail in my writings. For Amatus proposed a union of the internal veins with the external, which I have never seen on dissection, and he asserted that the connection is made obvious in dissections by the inflation of the veins with tubes, and that it was established by nature for the treatment of *morbus lateralis* [pleurisy]. I had it later on the authority of my brother of sacred memory (so he personally informed me) that truth was violated and distorted, and that the veins passing out of the thoracic cavity through the rib intervals, to be distributed to the muscles which everywhere cover the thorax, were falsely held to be branches of this vein. We know that the branches of the vein which arises around the axilla do not enter the deeper or more profound regions of the body. Therefore, as I know that the whole account of this matter is in my books, and because I consider his theory of anastomosis ought to be scoffed at rather than considered otherwise, I did not mention it.[82]

In reading the above passage from Vesalius, it should be borne in mind that the heart was considered as consisting of two chambers only. The left atrium was thought of as the common stem of the venal artery or, as we would now call it, pulmonary vein, whereas the right atrium was regarded as a portion of the caval trunk, leading by means of the right atrio-ventricular orifice into the corresponding ventricle.

The grouping of what he calls "projections" in the veins with the valve of the foramen ovale and the pseudo-valve of the ductus arteriosus, leaves little doubt that he saw the valves described by Amatus but that he did not consider that they were of sufficient moment to interfere with the ebb and flow movement of the blood.

It is evident enough that a considerable tradition on the existence of the venous valves must have existed at Padua and notably in Canano's old school at Ferrara. Any dispute which had arisen was not so much over the presence or absence of these structures, but whether they were of sufficient moment to obstruct the ebb and flow movements of the blood and thus disturb existing notions on the rationale of phlebotomy. Even in the case of Falloppius the real concern, if the passage is read in context, is centered over the relationship of the veins to the evacuation of noxious material in cases of *dolor lateralis*. His severest criticism is directed at the statement of Amatus that direct connections exist between the thoraco-epigastric veins on the surface of the thorax and the deeper lying azygos system which Amatus sets up as the fundamental an-

82. Andreas Vesalius, *Examen*, in the *Opera omnia*, II, p. 794-795.

atomical basis for the theory of venesection to which he subscribed. Falloppius's denial of the existence of valves is the outcome of his failure to find structures similar to the pulmonary and aortic valves, as described by Amatus, specifically at the mouth of the azygos vein, the presence of which would vitiate all current conceptions on venesection. Consequently, it is not surprising that he thought Canano may have attempted some practical joke on the Jewish physician.

Every physician of the times must have been fully acquainted with the pros and cons of the venesection controversy, especially as the procedure occupied the pivotal position in all therapy. It is therefore astonishing to find Hieronymus Fabricius of Aquapendente, 1533?-1619, now occupying the famous chair of anatomy at Padua, stating in his classic monograph, *De venarum ostiolis*, 1603, that he had discovered the venous valves as early as 1574, as though it were an entirely new discovery. Fabricius' claim of originality may have been no more than rhetorical vainglory or may be excused by his old age and illness, for his pupil Salomon Alberti, at the instigation of his master whom he acknowledges, had written on the subject and published the first illustration of the venous valves in 1585 and had recognised the contributions of Canano and Amatus. That the tradition was very much alive is indicated by the fairly full account issued in 1586 by Archangelo Piccolhomini who now occupied the chair of his former master Canano at nearby Ferrara. Nonetheless, the clear and detailed monograph of Fabricius with its fine illustrations is deservedly the most important of all the early contributions. With it the subject was elevated from the realm of dispute, and no longer could there be any doubt as to the presence of valves in the veins, even though Fabricius, conditioned by the physiology of his era, still clung to an interpretation of their function not very dissimilar to that first propounded.

The venesection controversy was not therefore entirely fruitless, no matter how absurd it may appear from modern perspective. From it emerged in the *Venesection Letter* of Vesalius, not only an attempt to re-examine objectively the content of traditional anatomical knowledge, which was to herald a still greater achievement in the *Fabrica*, but to apply the findings so obtained in a basic science to the establishment of a rational method of therapy. There is perhaps in the whole history of medicine no simpler example of the bizarre results which may arise when a truth is applied to the

weight of traditional conceptions and therefore of the necessity of an even development in science and for the treatment of biological phenomena in unity, even for the solution of the practical problems of medicine.

Out of the controversy was also to come the incidental discovery of the venous valves which was to lead William Harvey to the discovery of the circulation, so that Robert Boyle could report that ". . . when I asked our famous *Harvey*, in the only Discourse I had with him, (which was but a while before he dyed) What were the things that induc'd him to think of a *Circulation of the Blood?* He answer'd me, that when he took notice that the Valves in the Veins of so many Parts of the Body, were so Plac'd that they gave free passage to the Blood Towards the Heart, but oppos'd the passage of the Venal Blood the Contrary way: he was invited to imagine, that so Provident a Cause as Nature had not so Plac'd so many Valves without Design: and no Design seem'd more probable, than That, since the Blood could not well, because of the interposing Valves, be sent by the Veins to the Limbs; it should be Sent through the Arteries, and Return through the Veins, whose Valves did not oppose its course that way."[83]

Giambattista Canano is reputed to have first made known the existence of the venous valves but failed to record his discovery. Amatus Lusitanus[84] corroborated, in a letter to Vesalius anent the venesection controversy, their presence in the azygos vein. He believed that they effectively opposed the flow of blood from this system into the vena cava which if true, destroyed the Vesalian argument. Streeter in his masterful study[85] implies that Amatus deliberately falsified his findings, in placing the valve upside down, an implication scarcely justifiable, for the significance of such valves could have little meaning in the Galenical physiology and is more consonant with error of observation influenced by the weight of tradition. Amatus's claims brought a storm of protest from the leading anatomists, Vesalius,[86] Fallopius,[87] and Valesius,[88] and the

83. Robert Boyle, *A disquisition about final causes of natural things*, in the *Works*. v (London, 1772), p. 427.
84. *Curationium medicinalium centuriae* (Basiliae, 1556), I, cur. 51, p. 84.
85. H. Cushing, E. C. Streeter, *Monumenta medica* IV [Canano] (Florence, 1925), p. 34.
86. *Fabrica* (1555), Lib. III, cap. 4.
87. *Observat. anat.* (Parisiis, 1562), p. 74.
88. *Controversarium medici et philos.* (Compluti, 1556).

subject had to await the rediscovery by Fabricius to direct Harvey to a knowledge of the circulation.

The first edition of the venesection letter was published by Robert Winter at Basel in 1539. The title runs: Andreae/VVesalii Bruxellensis,/ Scholae Medicorum Patavinae/ professoris publici, Epistola, docens venam/axillarem dextri cubiti in dolore laterali secan-/dam: & melancholium succum pertinen-/tibus, purgari./ Basileae.// [*Colophon*: Basileae,/in Officina Roberti/VVinter, Mense/ Aprili. Anno/ M.D.XXXIX.]

The only other edition to appear in the sixteenth century was that by Cominus de Tridino Montisferrati, possibly at Venice, in 1544. The Latin text together with a Dutch translation by Dr. M. A. Van Andel was published in the eighth volume of the series, *Opuscula Selecta Neerlandicorum De Arte Medica*, Amsterdam, 1930. For convenience we have employed the Latin text of this Dutch edition, unfortunately containing many typographical errors, and checked it with the first edition of 1539, made available to us through the courtesy of the Army Medical Library, Washington, D. C. The pagination and signatures of the 1539 edition are inserted in the text.

In regard to the translation of the venesection letter, it must first be noted that Vesalius's Latin is a far cry from the facile and flexible instrument of such humanists as Erasmus or even of many of his fellow-physicians, such as Servetus. Clauses are linked together in a seemingly never-ending succession, although this fault is exhibited in its greatest degree in the *Fabrica* and *Epistola Chynae*, so that at times it requires considerable concentration on the part of the reader to observe any coherence of thought and, even his contemporary, Fabricius, comments upon this difficulty. While non-classical forms are everywhere apparent in his style, the chief difficulty in translation has been that of precisely rendering into English, the Vesalian technical nomenclature. This difficulty was still further increased by the fact that Vesalius himself apparently was sometimes at a loss for terms to express his ideas and, in addition, on occasion uses without distinction, notably in reference to the veins, the older Latin forms coined by the translators of the Arabs and the newer ones coming into use in his own day. In order to avoid the false connotation which modern terms necessarily give to sixteenth-century writings we have sought the appropriate word or expression from contemporary English works. Compari-

son of the Latin with the English edition of Paré is invaluable in this respect. We have felt the prime requisite to be an exact and faithful translation, and no attempt has been made to give it elegance aside from the necessary rearrangement required for a language lacking in inflexions. If it is Vesalius and not the translators speaking in English, the task will have been suitably accomplished. It is an astonishing fact that after the passage of four hundred years this is the first time a complete work of Vesalius has appeared in the English language.

[A1 (r) t.-p.(r) p. 1] A letter of ANDREAS VESALIUS OF BRUSSELS, public professor of the medical school of Padua, demonstrating that in *dolor lateralis*[89] the axillary [basilic] vein[90] of the right elbow must be cut: and that the melancholic juice is purged from the branches of the portal vein extending to the fundament.[91]

At Basel.//

[A1 (v) t.-p.(v) p.2] *Epistle to the candid reader*

Reader

Health unto suffering man, I have here re-discovered,
Turning it back when 'twas stolen away and in flight.
Frightened at first by the tempest of jealousy violent,
What is there not that its spitefulness does not oppose?
Broken the barriers lie and in spite of the master,
Envy dethroned now, all read as the presses unfold.
Thou, Philomenus accept here the fruits of my labour;
Cheerfully take thou my offerings and these do defend.
Swelling and strong in their vigour, despise not their growth;
From slender beginnings and strivings arise a new day.//

[A2 (r) p.3] ANDREAS VESALIUS OF BRUSSELS sends greetings to that most accomplished and illustrious man, Nicolaus Florenas,[92] highly skilled physician and especially so for attending his lord, the invincible

EMPEROR CHARLES.[93]

89. In the sixteenth century *dolor lateralis* was usually rendered as "pleurisy" and believed to be due to the accumulation of humours beneath the pleura or in the intercostal muscles, cf. Philip Barrough, *The method of physick* (London, 1624), Lib. II, chap. viii, hereafter cited as Barrough; Leonard Fuchs, *In-*

stitutionum medicinae (Basileae, 1605), Lib. III, sect. i, cap. xviii, hereafter cited as Fuchs, *Inst. med.* Later the disease was divided into the *vera* and into the *spuria* when it involved the parietes, cf. S. Blancardus, *Lexicon medicum* (Lugduni Batavorum, 1717), pp. 514ff., hereafter cited as Blancardus, *Lex. med.* However, Vesalius considers, following exact humanistic interpretation, that pleurisy is only a special case of *dolor lateralis* which he believes the ancients used as a general term. He discusses the matter fully on page 70, where we appreciate that the question surrounds the translation of the Greek πλευραί as "ribs" or the "side." He therefore uses the term as "pain in the side" and hence we have preserved the Latin form as a technical expression.

90. In Vesalius's time the axillary vein was thought of as the modern subclavian, axillary and basilic veins in continuity. He here, of course, means basilic vein. It was not until later that Vesalius recognized the brachial veins, which he refers to as the *vena profunda axillaris*, and which led to his accusation that Galen saw and described the superficial veins of the arm only. Galen, *De administrandis sectionibus*, Lib. III. Unless otherwise specified all references to Galen will be to the *Omnia opera quotquot . . . in latinam conversa . . .* (Basileae [Froben], 1542), 8 vols. Vesalius, *Epistola rationem modumque propinandi radicis Chynae decocti . . . pertractens . . .* (Basileae, 1546), p. 75, hereafter cited as *Epistola Chynae; idem, De humani corporis fabrica libri septem* (Basileae, 1543), Lib. III, cap. viii, p. 282, hereafter cited as *Fabrica* (1543). In the *Tabulae anatomicae* (Venetiis, 1538), II, he illustrates for the most part the traditional arrangement. According to Hyrtl, *Das Arabische und Hebräische in der Anatomie* (Wien, 1879), p. 64, hereafter cited as Hyrtl, *Anatomie*, for axillary vein the Greeks employed the periphrastic phrase ἡ διὰ τῆς μασχάλης φερομενη φλεψ which was rendered al-ibtī by the Arabs. This in turn became in the hands of the translators; *ascellaris*, then *assellata* and finally *axilla*. The term, basilic vein, is seldom used by Vesalius. Despite its similarity to the Greek, Blancardus's derivation, *a βασιλευώ rego, Lex. med.*, p. 93, is incorrect and has nothing to do with kings and ruling. Hyrtl, *Anatomie*, p. 75, ascribed the origin of the word, basilic, to Avicenna's translator, Gerard of Cremona—a distortion of the arabic al-bāsilīk.

91. The expression here employed is *ad sedem*, literally "to the seat." The term *sedes* is used by Vesalius in various ways and it is clear from his several works and those of his contemporaries that in the present context the term is anatomically rather vague and does not quite correspond to "seat" meaning "the buttocks or posterior" in the modern sense, but rather indefinitely to the "anal region" and therefore here rendered "fundament" in its contemporary English sense.

For a very graphic illustration of the use of the term in this way cf. the initial letter and marginalia of the *Fabrica*, 1543, Lib. II, cap. li, p. 228. At the same time the word in conjunction with the melancholic juice, the site of excretion of which was well known to those versed in the humoral theory, possesses a functional connotation. Compare the numerous uses of "seat" by transference. We have elsewhere rendered the term "region" or "site." Cf. Fuchs, *Inst. med.*, Lib. I, sect. iiii, cap. iv, p. 126; Galen, *De usu partium*, Lib. v; *Commentarium in librum VI epidemiarum*, sect. ii, cap. vii.

92. Apart from the unsupported statement of M. Roth, *Andreas Vesalius Bruxellensis* (Berlin, 1892), p. 64, hereafter cited as Roth, that Nicolaus Florenas was a compatriot of Vesalius, the only definite information we possess is that from Vesalius himself, who dedicated his first published work, *Paraphrasis in nonum librum Rhazae . . . ad Regem Almansorem . . .* (Lovanii, 1537), hereafter cited as *Paraphrasis*, to Florenas. From this we learn that Florenas di-

YOUR recent letter, Patron of my early studies, greatly encourages me in two respects, for you intimate that the plates published by me for the use of students were especially approved by his Imperial Majesty[94] and by other very eminent men. You then state that it

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rected his early medical studies, for which Vesalius voices his appreciation. The tone of this dedication is such as to indicate that Vesalius is not here addressing Florenas in the exaggerated flattery so common to this period but looks upon him, if not as his "parent," certainly as his mentor. The venesection letter tells us that Florenas was one of the physicians of the Emperor Charles V, that he was archiater of Spain and that he was in attendance on the emperor at the peace negotiations in Liguria, cf. note 176. The absence of Florenas's name from the *Fabrica* (1543), may indicate that he had died prior to its appearance or that, as in the case of Curtius, cf. note 102, an animosity may have arisen.

93. Charles V, Holy Roman Emperor (1519-1556), was forty years old at this time. Vesalius would no doubt have an *entrée* to the imperial court through Nicolaus Florenas, but more especially through his father, the court apothecary, who had already presented his son's *Tabulae anatomicae* to the emperor, cf. note 94. From 1544 until the abdication of Charles in 1556, Vesalius was one of the imperial physicians, year by year assuming greater direction over the care of the emperor's health.

94. Of these *Tabulae anatomicae* only two complete copies are known today, the Stirling-Maxwell, reproduced in an edition of thirty copies (1874), and the Venice, reproduced in 1920. The *Tabulae* depict in succession: the liver as the source of the blood, and the generative organs; the venous system; the arterial system; the skeleton viewed anteriorly; laterally; and posteriorly. Although a great improvement over the fugitive sheets then current, they show a decided Galenical influence, as for example the five-lobed liver. In the dedication to Narcissus Parthenopeus, Vesalius gives some information on their origin. While at Padua ". . . considering the treatment of inflammation . . . and the opinion of Hippocrates and Galen on revulsion and derivation, I delineated the veins on a chart . . . to demonstrate what Hippocrates understood by κατ' ἴξιν . . . The delineation . . . pleased the professors . . . and all the students so much that they earnestly sought from me a description of the arteries and also of the nerves . . . I knew delineations of this sort would not be a little useful for those who might attend my dissection . . . Since several have attempted in vain to imitate these things, I have committed the matter to the press, and . . . I have added others in which Johann Stephan [Van Kalkar] . . . has depicted . . . my σκελετον in three positions." The *Tabulae* were published at Venice in 1538, and Andreas Vesalius, the father, presented them to the emperor, according to Roth, p. 60, sometime around the truce of Nice in the same year. Theodor Zwinger, *Theatrum vitae humanae* (Basileae, 1571), p. 3255, wrote: "Andreas, apothecary to the Emperor Charles V, and father of Andreas Vesalius of Brussels, most illustrious physician, who opened an approach to the court for his son by displaying the anatomical plates to the emperor." Cf. *Fabrica* (1543), f.*4r. That Charles V was pleased with the *Tabulae* would be due to the favourable opinion of his court physicians such as Florenas and to the flattery inserted in the dedication, but Vesalius's eventual court position was no doubt assured later with the publication of his major work, the *Fabrica* (1543), dedicated to the emperor directly. In issuing these *Tabulae* Vesalius had already begun to run counter to the opinion of his master, Jacobus Sylvius (1478-1555), who held such efforts up to scorn.

would please you greatly if I were to attempt to explain at length the lines on venesection in *dolor lateralis*, written in the margin of [the plate on] the vena cava,[95] and those at the end of the margin [of the plate] on the portal vein, treating of purgation of melancholic juice through the haemorrhoidal veins.[96]

As, in your judgment, these ideas are insufficiently considered by the majority, you recommend that the subject is worthy of explanation by a more extensive discourse supported by adequate evidence so that they may be made available for reading by the studious. Indeed, to the best of my knowledge, I know of nothing in the course of my life that has given me more pleasure than that you desire this from me and that by it I should be in your greater favour. For I must confess that it is to you [A2 (v) p.4] above all that I owe whatever erudition or suggestion of attainments that I possess. Moreover, such is the magnitude of your kindness to me, that if anyone observing the mutual understanding between us should wish to examine our relationship more closely, he might believe that my surname, at any time erased with difficulty, is gone from your daily journal, and he might regard you as my parent rather than as my friend.

On the other hand, I am tortured by this particular burden which you have imposed upon me and to which I feel completely unequal. Even if I am able to accomplish this task by native ability, I prefer, since times are such, and what ever the subject may be, to maintain silence rather than to expose myself publicly (which is today the common practice) to the attacks of others by new and heterodox opinions. As you well know, even the most erudite dispute fiercely among themselves, with unbridled enthusiasm and by contentious subtlety in open and wordy contradictions, on the place of venesection in *dolor lateralis*; and to such an extent that few physicians of any reputation are to be found who have not undertaken to publish some example of their cleverness in this affair, thereby engendering among their opponents the most atrocious charges and envious attack. So, meanwhile, I ignore those petti-

95. The marginal note (Tabula II, "B") reads: "We see that this vein without a mate [azygos vein], which is said to nourish the lower eight ribs, never originates below the right auricle of the heart but, as in dogs and apes, a little above the auricle. Wherefore, when *dolor lateralis* verges toward the lower regions, more of venesection than of purgation will have to be employed, and I believe, because of the opinion of Hippocrates, that Galen spoke obscurely of this vein in the second book *De victus ratione in morbis acutis*."

96. The marginal note which is found on Tabula I, "P," is given in almost identical words on page 84 of the text, which see.

foggers who, rejecting all that is new, since they are at once eager to defend an obvious heresy, [A3(r) p.5] incite with the greatest injury and contumely against those who are of the opinion that the vein should be opened in line with the affected side.[97]

I am sure that you have not yet forgotten what I wrote some time ago of the physicians of Louvain.[98] Among them there was one,[99] in his own opinion very learned and extraordinarily self-satisfied, for what accomplishments I do not know, who, in a very crowded assembly of the most erudite men was not ashamed to call Manardus,[100] Fuchs,[101] Curtius[102] and Brissot[103] the Lutherans of

97. The expression *e directo* has been uniformly rendered "in line with." The term is the Latin form of κατ' ἴξιν, and refers to the natural direction of the vessels. For a fuller discussion cf. introduction and Fuchs, *Instit. med.*, Lib. II, sect. v, cap. v, p. 387.

98. Vesalius is referring to his dedicatory letter to the *Institutionum anatomicarum secundum Galeni sententiam ad candidatos medicinae libri quatuor* (Venetiis, 1538), written by Johann Guinter and now emendated by Vesalius. In this work, hereafter cited as Vesalius, *Instit. anat.*, he is discussing the poverty of anatomical instruction.

99. This appears, although without certainty, to have been Brachelius (Jeremias Drivere). Cf. note 109.

100. Joannes Manardus (July 24, 1462–March 8, 1536) of Ferrara, was a student of Battisto Guarino; his studies included Arabic, philosophy and medicine. He taught at Ferrara, 1482-1495, whence he went to Mirandola as physician and tutor to Gianfrancesco Pico whom he helped to edit his uncle's *Adversus astrologos* (Bononiae, 1495). After seven years he left Mirandola, but nothing is known of him until 1509 when he was again teaching at Ferrara. Around 1513 he was invited to Hungary as physician to King Ladislas. He remained until 1518-1519, when he returned as professor of medicine to Ferrara for the rest of his life. His chief work was *Epistolae medicinales* (Ferrariae, 1521) and successively enlarged editions. In the same volume were printed some notes on Mesue, amplified in the edition of 1534. Manardus also published a translation of Galen's *Ars medicinalis* (Romae, 1535) with enlargements (Basileae 1536). The *Epistolae* were written between 1500-1536 and show a certain boldness and independence of thought in opposition to the traditional medical thought of the day, notably in their censure of the Arabists. Two of the letters deal with venesection: *Ioannis Manardi . . . epistolarum medicinalium libri XX . . .* (Venetiis, 1542), Lib. XII, epist. v, pp. 249-255, "Ad Iacobum pharusium Regiensem medicum, de venae sectione in pleuritide, & spodio"; Lib. XIV, epist. I, pp. 278-284, "Manard. Andreae Turino. Defenditur opinio de sectione venae lateris patientis." Cf. *Opus epistolarum Des. Erasmi Roterodami denuo recognitum et auctum per P. S. Allen . . .* VI (Oxonii, 1926), pp. 123-124, for further bibliographical and biographical references. This work hereafter cited as Allen, *Erasmi epistolae.*

101. Leonard Fuchs, the well-known adversary of Arab medicine, was born January 1501 in Wemding, Bavaria, and died 10 May 1566. As a supporter of Greek medicine he translated Hippocratic and Galenical treatises into Latin and wrote many controversial works. Although at a later period Vesalius may have had personal relations with Fuchs, cf. Roth, pp. 217-218, at this time he would have known him only through his writings. Those works, aside from his

translations from Greek, which Fuchs had published by 1538, and with which Vesalius was undoubtedly familiar were: *Errata recentiorum medicorum LX numero* (Haganoae, 1530); *Paradoxorum medicinae libri tres* (Basileae, 1535); *Apologia contra Hieremiam Thriverium Brachelium* (Haganoae, 1534), and (Basileae, 1538) with some additions; *Compendiaria ac succincta admodum in medendi artem* (Haganoae, 1531); *Universae medicinae compendium* (Basileae, 1537). All these works contain something on the venesection controversy and especially the *Apologia* against Thriverius to which Vesalius refers indirectly in the venesection letter. For a complete bibliography of the writings of Fuchs see Eberhard Stübler, *Leonhart Fuchs. Münchener Beiträge zur Geschichte und Literatur der Naturwissenschaften und Medizin.* Heft 13/14 (München, 1928), hereafter cited as Stübler, *Fuchs.*

102. Curtius (Matteo Corti, 1475-1542) was born in Pavia, where he held a teaching position from 1497-1515. At that time he transferred to Pisa, and in 1524 to Padua. He also resided for some time in Bologna and Florence. At one period he was physician to Pope Clement VII and later to Cosimo de' Medici. He died in Pisa while holding the chair of medicine. Among his other works he wrote *De venae sectione cum in aliis affectibus tum vel maxime in pleuritide* (Ludguni, 1532; 1538. Venetiis, 1534; 1539. Bononiae, 1539). Cf. August Hirsch, *Biographisches Lexicon der hervorragenden Ärzte aller Zeiten und Völker*, II (Berlin, 1930), p. 117, hereafter cited as Hirsch; Bayle, *Biographie médicale*, I (Paris, 1840), pp. 264-265, hereafter cited as Bayle.

103. Pierre Brissot was born at Fontenay-le-Comte in 1487. He received the doctor's bonnet at Paris in 1514. His first serious study was of the Arabist doctrine, which, however, he soon abandoned in favour of the Greek, since he came to the conclusion that most Arabic works were but corrupt translations. At this time an epidemic of "pleurisy" raged at Paris. Brissot, convinced in theory of the usefulness of the Greek practice, appointed one of his students to bleed the sick of the faubourgs of Paris free of charge and according to the Hippocratic practice. The attempt was crowned with success, and in the following year Brissot made a public pronouncement maintaining the superiority of this method over that of the Arabs. He had the satisfaction of gaining as adherents two of the oldest and most learned members of the Paris faculty, Villemore and Helin, the latter of whom had lost an only son after he had been bled in the Arab manner. However, due to Brissot's forthright manner and to deep-rooted prejudice, he provoked a still larger number of antagonists. For this reason, and because of his interest in natural history, which he hoped to further, he left France for Portugal. Brissot was at Evora in 1518, at which time an epidemic of "pleurisy" was in progress. His method was again successful and earned for him the enmity of Denis, the royal physician, who published a long polemic against Brissot, who replied in *Liber de incisione venae in pleuritide morbo, sive, apologia qua docetur per quae loca sanguis mitti debeat in viscerum inflammationibus, praesertim in pleuritide* (Parisiis, 1525). This was a posthumous publication, brought out by a friend, Antonius Luceus of Evora. Brissot, according to Moreau, died in 1522. However, some doubt is cast upon this by a letter of John Angelus to Erasmus, Allen, *Erasmi epistolae*, V (1924), pp. 379-380. The publication of Brissot's treatise aroused a storm of contention. Some of this is mentioned by Vesalius in his venesection letter; also cf. note 109 and the introduction. The authority for the life of Brissot is a sketch by R. Moreau, prefixed to his edition of Brissot's *Apologia* (Paris, 1622). This must, however, be used with caution. Accounts based on this source are to be found in Bayle, I, pp. 154-155; *Nouvelle biographie générale;* Kurt Sprengel, *Histoire de la médecine, tr. de l'allemand* (Paris, 1815-1832), III, pp. 37-39. This last work is hereafter cited as Sprengel.

physicians[104] because I, relying on the authority of their public pronouncements, had attacked, perhaps too sharply, his conclusion on venesection. Although they, with the greatest energy and no little personal expense, have restored the ancient Hippocratic rationale of therapy from former ignorance and barbarism, the virtuous fellow believed that they should, as the Lutherans of medicine, be ridiculed with every sort of injustice and on every pretext. Indeed, inflated with self-assured knowledge and with exceptional arrogance, he was accustomed to despise everyone else and to offer I know not what heresies, being incapable of anything else. He used to proclaim unashamedly that he had to employ words from the common dung-heap to suit such barbarians lest we, not yet Candidates, be infected by this sort of pestiferous decay. But whatever he and similar [A3 (v) p.6] crickets might chirp I care not a straw (so long as you encourage me).

On the other hand, I believe that I must carefully weigh the opinions of my teachers, that most distinguished group of the highly learned physicians of Paris,[105] of the spirits of Manardus and Bris-

104. The phrase "Lutherans of physicians" appears to be not original with Vesalius. After the appearance of Brissot's *Apologia* and the death of the "prince of Piedmont," cf. note 178, the opponents of the new method of venesection had recourse to Charles V, to whom they proclaimed that the heresy of Brissot was as dangerous in medicine as that of Luther in theology, cf. *Petri Brissoti ... apologetica disceptatio editio nova Renato Moreau* (Parisiis, 1622), p. 102. However, one must be cautious of Moreau's chronology.

105. Vesalius was in Paris from 1533 to 1536, Roth, p. 64. This is based on Gabriel Cuneus, *Apologiae Francisci Putei pro Galeno in anatome examen* in Vesalius, *Opera omina anatomica et chirurgica cura H. Boerhaave et B. S. Albini* (Leyden, 1725), II, p. 851, hereafter cited as Cuneus, *Apologiae Putei examen,* that Vesalius was a pupil of Sylvius for three years. He definitely left Paris in 1536 in which year the Emperor Charles undertook the third Franco-German war with an advance from Italy to France in the second half of the year 1536. This, as Vesalius writes, was the cause of his departure, cf. *Fabrica* (1543), Lib. I, cap. xxxix, p. 161 and *Praefatio,* f.*3r; *Epistola Chynae,* p. 141. At Paris, Vesalius had as teachers Sylvius, cf. Cuneus, *Apologiae Putei examen,* p. 851; *Paraphrasis,* "dedication"; *Epistola Chynae,* p. 151 and cf. p. 42; Vesalius, *Anatomicarum Gabr. Falloppii observationum examen,* in the *opera omnia* cited above, II, pp. 153f., hereafter cited as *Falloppii examen*; and Johann Guinter of Andernach, cf. note 108, Vesalius, *Inst. anat.,* "dedication" and *Epistola Chynae,* p. 177. With these two teachers Vesalius was on intimate terms, cf. Guinter's remarks on Vesalius in the former's *Institutionum anatomicarum libri* (Basileae, 1536), pp. 32f. Other teachers were Jean Fernel, Jean Vasse of Meaux (1486-1550) dean of the Faculty of Paris in 1532, cf. Crummer and Saunders, "The anatomical compendium of Loys Vasse (1540)," *Annals of Medical History,* 3rd ser., I, p. 353, and a certain Oliverius of whom nothing seems to be known today, cf. *Epistola Chynae,* p. 42. For a summation of this period, cf. Roth, pp. 64-73.

sot, and of Fuchs, Curtius and Hubertus Barlandus,[106] the most celebrated men of our age. They sweated and laboured long and with untiring effort to recover and to recall from the most profound darkness into the light the true opinion of Hippocrates and Galen on venesection. More than the other very experienced men of Europe they are unanimously agreed as to that opinion.

I pondered deeply as to whether I should lay myself open to the accusations of those who I have always considered ought to be venerated as deities and gods. For, if like Icarus with wings feebly attached, and little versed in the practice of the methods and essentials of the art, I were to introduce a new dogma on venesection in *dolor lateralis*, the sycophants would aim their barbs from this side, and from that they would pierce me with the virulent stings of their tongues, animated by no other purpose than their devotion to slander. Obviously, such considerations should be scorned, and they should never turn back a free spirit from a most noble purpose. Yet I know that I would be an embarrassment to those who by their great lucubrations [A4(r) p.7] have yet in hand massive volumes on this matter which (as Flaccus[107] urges) they are holding till the ninth year. Indeed I might set them a new task in confuting me, or if perchance they should agree with my opinion, they would already have wasted both time and effort.

106. Hubertus Barlandus, the dates of whose birth and death are unknown, was the nephew of John of Borsselen and cousin of Adrian Aelius Barlandus, both celebrated in the humanistic circles of the low countries. In 1528 he is found to be leaving France from fear of an outbreak of war and going to Basel to spend some time with Erasmus, Allen, *Erasmi epistolae*, VII (1928), No. 2078. There may have been an earlier acquaintance between them since Vives, the friend of Erasmus, had been his teacher in Louvain. Mention of Barlandus in the Academy of Louvain is to be found in the *Fasti Academici studii generalis Lovaniensis edente Valerio Andrea Desselio* (Lovanii, 1650), p. 397. At about Christmas time Barlandus went to Strasburg, and there in February 1529 he edited the *Medicinales epistolae* of Manardus, cf. note 100. The preface indicates that Erasmus, who had a high regard for these *epistolae*, had recommended the task to Barlandus. The last trace of him is to be found in an autograph letter dated 1 August 1544, and bound into a volume of Chr. Oroscius's *Annotationes* on the translators of Aëtius (Basel, 1540) in the British Museum. On Barlandus cf. Allen, *Erasmi epistolae*, VII (1928), p. 545. While Barlandus wrote a number of books, it seems most likely that Vesalius is mentioning him here as the editor of Manardus.

107. Horace, *Ars Poetica*, lines 386ff.:

> "... si quid tamen olim
> scripseris, in Maeci descendat iudicis auris
> et patris et nostras, nonumque prematur in annum,
> membranis intus positis: delere licebit
> quod non edideris; nescit vox missa reverti."

I recall having read some time ago Barlandus's sound volume directed against the physicians of Louvain and sent by the author to Johann Guinter,[108] a very erudite and learned man. Indeed this work, denied the services of the printers (which Brachelius[109] un-

108. Johann Guinter (Günther, Guintherius, Gonthier, Winter, Winther, 1505-1574) was born at Andernach. Physician, anatomist and humanist, his influence was very great owing to the number and distinction of his pupils. He taught at Paris from 1527 to 1537, where he had as students, Vesalius, Servetus, Rondelet and many others. He spent the years 1537-1544 in Metz and from thence went to Strasburg to teach Greek in the famous school of Jean Sturm, and later, 1549-1558, medicine. Vesalius had been praised by Guinter in his *Institutionum anatomicarum libri quatuor* (Basileae, 1536), and the pupil had returned the compliment by issuing an edition of the work two years later with his own emendations. Guinter was a confirmed Galenist, ignorant of practical anatomy, and it was but natural that the pupil, relying on the factual rather than the philological, should fall out with the master. In the *Fabrica* (1543) there are numerous oblique references to Guinter's anatomical ignorance. Vesalius writes more openly in his *Epistola Chynae*, p. 177, "Johann Guinter, for many reasons, and in my published writings, I count him as a preceptor in medicine, but I would not mind having as many cuts inflicted on me as I have seen him make on one or other brute (except at the banqueting table). I do not believe that Guinter will resent my saying this, since he, along with many others, knows whether he is indebted to me in this branch of our art; that is, if he claims any knowledge of dissection beyond that contained in Galen's well-known books." Naturally the old scholar was irked and censures Vesalius in his *De medicina veteri et nova* (Basileae, 1571), Comm. I, dial. iv, p. 91. While Vesalius may have considered Guinter at this time to be in the right camp in the matter of venesection, yet later in his above-mentioned work, Comm. II, dial. iii, Guinter attempted a reconciliation of ancient and modern views and accused physicians such as Vesalius of ignorance in their teachings.

109. Brachelius was Jeremias Drivere, born 1504 at Brackel. In the manner of the day he latinized his name as Thriverius Brachelius. He studied philosophy at the College du Faucon at Louvain, and appears to have taught philosophy in one of the schools of that city. 3 November 1531, he was received as a member of the faculty of arts of the university. In the following years he pursued the study of medicine which he had begun under his father, a physician, and he assumed the doctor's bonnet 6 May 1537, although he may have taught medicine privately before this. His medical writings, at any rate, ante-date this year. Two of the four public chairs of medicine in Louvain were amalgamated and given to Thriverius, and he continued to hold them with success until his death in December 1554. He was reputed to be a man of great erudition and a capable teacher. According to Hirsch, II, pp. 309-310, his treatise of 1544, *De duobus hodie medicorum sectis ac de diverso ipsorum methodo*, was a capable work written for the introduction of his students. Greater fame as the teacher of Vesalius should have rested upon his shoulders were it not that a feeling of enmity developed between teacher and pupil, possibly as Roth, pp. 75, 96, suggests as a result of a public disputation at Louvain which Vesalius mentions in his venesection letter. Roth writes, p. 96, n. 4, that Vesalius was ridiculing Thriverius's lack of anatomical knowledge when he wrote in his letter, p. 31, "I consider the matter may be of a kind which needs neither lengthy handling nor diversified demonstration, for, unlike the tenets of

justly jokes about in a later *apologia* directed against Fuchs, a man of rare erudition), I am convinced has been concealed until quite recently, especially since I have learned that the Parisian printers have with great diligence and assiduity searched for the autograph copy itself. Next to him stands Curtius, a man of the most penetrating judgment who, as we know, is about to publish a long promised commentary on venesection in internal inflammations. For some months ago, when I had gone to Bologna, partly on his invitation and partly to refresh myself, and had personally foregathered with him at length, he showed me three printed editions of his commentary.[110] Indeed I greatly wonder why the rest have not been forthcoming recently. Believe me, [A4(v) p.8] these things not without reason deter and bar me from what you so strongly urge me to undertake. Yet, lest I may seem any longer to be either altogether unresponsive to such earnest solicitations or to acknowledge too little your kindnesses to me, having now some leisure from public lectures,[111] with all willingness I shall write to

others, it depends mainly upon the very careful inspection of dissections." Despite Thriverius's published editions of Hippocrates and Galen, Roth, p. 75, terms him a "secret Arabist," although no source is given for this remark. However, his controversial writings are sufficient indication. The appearance of Brissot's posthumous *Apologia* published by his friend Antonius Luceus, cf. note 103, led Thriverius to the publication of an answer, also aimed at Leonard Fuchs, cf. note 101, a strong antagonist of Arabist medicine, *De missione sanguinis in pleuritide ac aliis phlegmonis tam externis quam internis omnibus cum Brissoto et Fuchsio disceptatio* (Lovanij, 1532). It is in this work that Thriverius refers by innuendo to the difficulties of Barlandus in obtaining a publisher, *At si noster elenchus magis illorum arguat eruditionem q. errorem, nonne merito illorum literis gratulari magis videbimur, q. honoris merito detrahere? Atque hi tamen excusari forte poterunt*, signature Aiiii (r). This was answered by Fuchs, cf. note 101, in 1534, and in the same year Thriverius published *Integri commentarii de temporibus morborum et opportunitate auxiliorum. Adjectus est elenchus apologiae L. Fuchsii de missione sanguinis in pleuritide.* The subject was still pursued by Thriverius in 1541, *Corollarium super missione sanguinis in pleuritide.* Cf. Hirsch, II, pp. 309-310; Bayle, I, pp. 210-211; Roth; Stübler, *Fuchs.*

110. While Vesalius had gone to Bologna to hold anatomies, *Fabrica* (1543) Lib. II, cap. xxxv, p. 290, cap. xli, p. 303, Lib. v, cap. xix, pp. 547, 553, this trip in 1538 appears primarily to have been in the nature of a vacation. Vesalius had already become interested in venesection in pleurisy, cf. dedication to the *Tabulae anatomicae*, note 94, and he possibly made use of his leisure to talk over the problem with Curtius, who had published a volume on the subject. That Curtius could show him three editions, and since the third edition appears to be that of Lyon, 1538, this would mark the earliest time for the composition of the venesection letter.

111. The practical lectures and demonstrations in anatomy began in January or February in the late sixteenth century, *The embryological treatises of Hieronymus Fabricius of Aquapendente . . . with an introduction, a translation*

you privately and more extensively my opinion on this matter (although cursorily and hurriedly). But I shall wait for some other time before committing myself and my practice to public debate. However, in other respects I consider the matter to be of a kind which needs neither lengthy handling nor diversified demonstration, for, apart from the principles of others, it depends mainly upon the very careful inspection of dissections. Therefore, lest I delay you longer, I know that you are fully aware of the two opinions on venesection in *dolor lateralis*.

The authors of the first assert that the vein on the inner side of the elbow must be opened in line with the affected side whether it is desired to produce either revulsion or derivation.[112] However, they may disagree to some extent among themselves, for some contend that both revulsion and derivation must be performed simultaneously on the same vein, but they would do otherwise if the strength of the patient did not permit two evacuations at the same time. Then to produce revulsion they would divide the vein of the popliteal region [small saphenous[113]] or of the ankle in line with

and a commentary by Howard B. Adelmann (Ithaca, N. Y., 1942), p. 12. If this were a long-standing practice it might account for the leisure since Vesalius's venesection letter is dated January 1.

112. Revulsion and derivation refer to the two methods of bleeding which according to Galen, *Methodus medendi*, Lib. v, cap. iii; *Commentarium I in humoribus*, sect. xiv, were introduced by Hippocrates. At the beginning of a disease, according to the humoral pathology, it was believed that there was a period of time during which the humours were still flowing to the site of the malady and it seemed logical that these, while in a state of "flux," might be drawn off by bleeding at such a distance and position as to reverse their course. This was known as revulsion. On the other hand once the humour had settled in the part, thus producing inflammation or a "phlegmon," then the humour should be drawn off from as near the site of the disease as possible, taking care not to lead the noxious agent *via* the venous system through the more vital parts of the body. This technique was known as derivation. The whole venesection controversy revolves around the precise use of these two methods. For a fuller discussion cf. the Introduction.

113. Vesalius, strongly influenced by the new humanism, as a rule studiously avoids anatomical terms of Arabic origin. At this period he usually follows the classical authors and refers to the saphenous veins as *venae ad malleolos*, adding *interior* or *exterior* as the case may be. The small saphenous is frequently *vena ex poplite*. Hyrtl, *Anatomie*, p. 212, points out that despite the Greek words σαφής and σαφηνής, these adjectives were never used by the ancient writers to describe these veins but were taken over from the *Canon* of Avicenna almost intact from the Arabic, sāfin. The word, curiously the opposite in meaning to the similar sounding Greek adjective, means the concealed or hidden one. Hyrtl believes that the Arabs were unacquainted with the course of the saphenous, knowing it only at the ankle and dorsum of the foot and held it for a branch of the popliteal vein, hence a *res occulta*. Cf. *Fabrica* (1543), Lib. III, cap. x, pp. 291ff.

the affected side. [B1 (r) p.9] On the following day, or at a greater or lesser interval of time, depending upon the strength of the patient, they would carry out derivation by boldly dividing the vein of the elbow in line with the disordered side. Other proponents of this view express the opinion that revulsion, because of constitutional debilitation, merely causes harmful effects. Therefore they will section the vein of the affected side as if for revulsion and then, after an interval of time, will undertake derivation from the same vein. Meanwhile, I wish you to understand that it is the constitutional strength which governs the amount of blood to be withdrawn from the vein.

The leaders of the second group dissent entirely from the above and, in full agreement with the opinion of the Arabs, they, distinguishing the seasons of bodily plethora and of generation of diseases,[114] express what they hold to be the teaching of Hippocrates and Galen. If from specific indications[115] they suspect that there is a plethora, or that blood still flows into the diseased site, they advise the diversion of the blood to the most distant point by means of revulsion, and they cut either the axillary [basilic] vein at the elbow on the side opposite to the malady, or the venule running between the little and the adjacent finger.[116] Among these, however, you will find that the most skilfull first withdraw the blood from the popliteal region [small saphenous vein] or from the inner aspect of the ankle [great saphenous] vein on the affected side. And so having performed revulsion in this manner they hasten, [B1 (v) p.10] often after the elapse of several days, to derivation, by which they contend they will evacuate the blood which has gathered in the affected part, or (as they say) is in a state of "flux," and they divide the cubital vein in line with the affected side. If indeed they

114. The term "plethora" refers usually to an excess of all the humours in equal proportion, which was most likely to occur in the late spring. This state was believed to initiate an infinite variety of diseases. However, the precise use of the term was, at this time, the subject of much contention. Cf. Introduction.

115. For definition and nature of these indications, cf. Galen, *Methodus medendi*, Lib. VII; *Sanguinis missio*, cap. xi. They constituted an elaborate system which relates to season, sex, complexion, state of health, etc. An excellent summary is given in *The workes of that famous chirurgion Ambrose Parey, translated out of Latine and compared with the French by Th. Johnson* (London, 1634), Lib. I, cap. xii, hereafter cited as Paré. Cf. Introduction.

116. This would be considered the equivalent of opening the basilic vein which was regarded as terminating here. The venule between the middle and forefinger was looked upon as the termination of the cephalic vein and was frequently known as the *salvatella* on the right and the *splenetica* on the left. Cf. Paré, Lib. VI, cap. xxii.

conclude that the body is not at all congested with blood at the onset of the illness and that no humour has as yet flowed (which I believe scarcely possible), then also they first incise the inner vein [basilic] of the elbow in line with the affected side. It is granted by the majority of them, a great error, that they may more frequently prescribe the opening of the vein at the hand[117] than that at the elbow. And so by such reasons they support and affirm, each his own dogma, with various and often distorted quotations of authors. Obviously it would be ridiculous to dilate upon this matter to you, and as the proverb γλαῦκος εἰς Ἀθήνας[118] has it, so in this school of rhetoric, as in the whole of Greek and Arab medicine, you could continuously expand *ad infinitum.*

Yet I ask indulgence if, in pursuing my purpose and establishing it on very positive grounds, I shall have introduced to the discussion some points argued particularly by both parties. Thus the leaders of both groups contend above all that the blood must be dispersed in *dolor lateralis.* They affirm on the authority of the most distinguished physicians that there is not much difference whether you incise the former or the latter vein in diseases. Next, ⌈B2 (r) p. 11⌉ following Galen,[119] they also establish a triple evacuation of blood, two of which are known as aversion. They tell us that the first, which is known in Latin as *revulsio* and in Greek, to be sure, as ἀντίσπασις, is to be made at a distance and on the opposite side. By this procedure they draw away and evacuate on the opposite side the blood which is collecting or about to collect somewhere or other.[120] The second variety of aversion they call *derivatio*, or

117. The Latin text has *summam manum.* Following ancient anatomical tradition, Vesalius uses *manus* alone to signify the entire arm and *summa manus* for the hand proper, cf. the classical usage of *manus* as a branch of a tree. This terminology, sometimes confusing, is common in the sixteenth century since it may also be found in Lodovicus Vassaeus, *In anatomen corporis humani tabulae quatuor* (Venetiis, 1544), p. 7; *Hippocratis Coi medicorum omnium longe principis opera quae apud nos extant omnia. Per Ianum Cornarium medicum physicum Latina lingua conscripta* (Lugduni, 1545), f. 457 r and v, at "A" and "E"; Paré, Lib. VI, cap. XX.

118. "Owls to Athens," an expression still current in Greece and the equivalent of our "carrying coals to Newcastle." Cf. Liddell and Scott *Greek lexicon,* γλαῦκ' Ἀθήναζε, γλαῦκ' εἰς Ἀθήνας. Servetus uses the Latin form of this phrase in the dedication of his second edition of Ptolemy.

119. This is perhaps a reference to Galen, *De curandi ratione per venae sectionem,* cap. 16.

120. "Indeed, the precept of revulsion to a contrary direction is common in all such . . . if a woman is suffering in the uterus or the region of the pudenda, you will not provoke the menses for her, but you will always produce revulsion at the parts which are most distant," Galen, *Methodus medendi,* Lib. XIII, vol. VI, col. 311B.

παραχέτευσις, by means of which the blood from a phlegmon[121] localised in some region is let out at the nearest healthy part.[122] They designate as a third type one in which the evacuation from the same involved region is performed in a nowise contrary manner. Indeed this is done when we incise with the scalpel, even at the outset, certain types of inflammations, the nature of which may lead to a gangrene, phagendena or carbuncle. For from these we often liberate blood by scarification of the affected region, sometimes applying in addition to section of the part, leeches, cupping-glasses or, in place of them, fire horns,[123] lest of course the blood, having collected in the part and weakening and overwhelming the nature of the member, induce the severest symptoms, or when we desire, as in bubonic plague, a greater flux to the affected side. As to the first two types of evacuation, physicians are in fact of the same opinion in the present controversy, since no one incises as in suppuration, the affected side in the beginning of an illness. [⌜B2 (v) p.12⌝] In this connection, however, I understand by evacuation a sensible removal of blood; since revulsion or derivation is not accomplished by light cupping, by rough friction, by painful chains,[124] by immersion of the part in hot water or by hot plasters or unctions.

121. A phlegmon, in the humoral pathology, was classified as a praeternatural tumour and is due, strictly speaking, to the local accumulation of the natural humour, blood, which offends "rather in quantitie than in qualitie." The excess of blood was then thought to sweat through the "pores" of the vessels into the loose spaces of the tissues thus causing the tension, heat and throbbing pain. An excess of one of the other humours, phlegm, choler or black bile gives rise respectively to oedema, erysipelas or a scirrhous. Corruption of the humour with alteration in its quality leads to the false phlegmons, such as gangrene, phagadena or carbuncle. Cf. Galen, *Methodus medendi*, Lib. XIII; *De tumoribus praeter naturam, passim;* Paré, Lib. VII, capp. VIII ff; Barrough, Lib. V, capp. IIII ff.

122. Derivation from the phlegmon is derivation from the parts surrounding the phlegmon, Galen, *Methodus medendi*, Lib. IV, vol. VI, coll. 105C-106B. Galen bases this on his reading of Hippocrates' *On humours* and *On ulcers*.

123. *Cornua cum igne* or "fire-horns" were a type of cupping-glass fashioned from horns which were flamed before cupping. There use and application are often found in sixteenth-century "bath-house" illustrations. A modified type, "horns without fire," is shown by Paré, Lib. XVII, cap. lxi, at the apex of which a hole was bored for oral suction and is described in a spurious work of Galen appended to the Giunta edition of his works.

124. Fricton or massage, based on readings from Hippocrates, *On the physician*, III, and Galen, *De tuenda sanitate*, Lib. II, was graded as mild, medium or rough. The "painful chains" we take to refer to a method of producing rough friction. A square of chain mounted on cloth and about the size of the palm of one's hand was often used in the bath in place of a back brush by army officers during the last century. The hot plasters and unctions are hot in the humoral, not physical sense. Cf. Fuchs, *Inst. med.*, Lib. II, sect. iii, cap. iii.

In addition, each group declares that revulsion must be carried out at a distance; in truth, the leaders of the second brigade are eager to persuade their adversaries from the thirteenth [book] of Galen's *Methodus Curandi*, a place in Hippocrates' book *On the Nature of Man* and from Galen's *Ars Medicinalis*, that "distant" in the definition of revulsion is to be understood "at the greatest distance and opposition."[125] What then these individuals will not accept, is the statement of Galen in the thirteenth [book] of the *Methodus*[126] which in the same place continues to the effect that, at the beginning of an inflammation of the liver, the inner [basilic] vein of the right elbow and not the popliteal or the ankle [small saphenous vein] or even the left cubital vein is to be opened. Moreover, they assert that that part of Hippocrates' book, like that of Galen, is corrupted and that the *Ars Medicinalis* of Galen spoke of prophylaxis not however, of disease or of the curative part of the art.[127] Wherefore certain of them contend that for revulsion as

125. The appropriate passages from Hippocrates and Galen read: "Bleeding then should be practiced according to these principles. The habit should be cultivated of cutting as far as possible from the places where the pains are wont to occur and the blood to collect. In this way the change will be least sudden and violent, and you will change the habit so that the blood no longer collects in the same place," Hippocrates, *Nature of man*, tr. W. H. S. Jones, (New York, 1931), IV, p. 33. "For whatever superfluities are contained in the primary veins [portal veins] are evacuated more readily through the belly. Moreover, those among them which are in the liver, through the channel of the urine, but those throughout the whole body through the sweat: as those of the head through the palate, or the nose or through both. Those which are in the lower spaces of the chest, through the throat together with a cough; those which are in the kidneys or bladder, through the urine. But the common method of attracting from all places to opposite parts is to the greatest distance; derivation, however, to a neighboring region," Galen, *Ars medicinalis*, "Lib. Isogici," col. 264B.

126. "In like manner, therefore, the internal vein of the right elbow having been opened, the blood which flows to the liver must now be revulsed, now led forth, because it has relation with that which is called the vena cava, both in line with and by an ample passage. This not apparent, the median must be cut. If this does not display itself, the remaining and third must be opened. You will discover the manner of evacuation now from the manner of redundancy, now from other things which we mentioned above, age, nature, time of year, region, and habit; in addition to these, when the strength itself suffers. For these things are all in common. This is indicated whether it is from the internal, or median or malleolus or popliteal; that is, from the suffering part," *Methodus medendi*, Lib. XIII, vol. VI, coll. 314 A-B.

127. Following Hippocratic tradition a sharp distinction was drawn between those measures considered necessary for the preservation of health and those employed in the treatment of disease. This was necessitated by humoral conception with its division into the natural and non-natural types. The term prophylaxis is here used in its ordinary and less restricted sense. For a good summary of current views, cf. Fuchs, *Inst. med.*, Lib. I, sect. i, cap. iii.

much contrariness suffices as Hippocrates indicates in that well-known [B3(r) p.13] aphorism of the fifth book: "For one suffering pain in the back of the head it is helpful to cut the straight vein [supra-orbital vein] in the forehead." They assert on the testimony of Galen that Hippocrates spoke in that place of revulsion, and are amazed at their adversaries for being so obtuse, who contend that a proper site for revulsion, according to Avicenna,[128] is such distance as exists from arm to arm. Whence they infer that section of the vein of the elbow in pleurisy, when the side has developed a phlegmon, is in nowise inconsistent with the conception of revulsion. Although, the occasion demanding, as in the preventative part of the art or in external inflammations, the leaders of the first opinion withdraw the blood, which has scarcely collected or is about to collect at the site, to the most distant point (from a significant vein, however).

As to the second type of evacuation, they disagree little among themselves, for both believe that in derivation the blood must be diverted from the affected member through the nearest healthy part. But owing to the above controversy on revulsion, another proposition is argued among them, namely whether or not revulsion and derivation can on occasion be performed simultaneously on the same divided vein. The first group, as I have pointed out previously, maintain, as though fully established by the consent of all, that this can be done provided the blood which is collecting or about to collect is withdrawn by revulsion and [B3(v) p.14] that which has gathered in the lesion is evacuated by derivation. Therefore, on the ground that *morbus lateralis* is an acute and immediately fatal disease, when a vein is considered suitable for the purpose, they recommend that this be promptly done, with very excellent results. The others assert the contrary, adducing as their reasons that if there is only a suspicion of a future *morbus lateralis*, that acute disease might be but a minor inflammation of the leg or arm. For we see that certain of the leaders of the second sect are so ensnared by their own opinions that they do not hesitate to do three venesections in *morbus lateralis*, opening first a vein of the foot which is in line, secondly, one of the opposite elbow and finally, that of the elbow in line with the suffering side. However, in the present controversy I am more than astonished, apart from

128. *Avicennae Arabum medicorum principis canon medicinae. Quo universa medendi scientia pulcherrima & brevis methodo planissime explicatus . . .* (Venitiis, 1523), Lib. 1, Fen 4, doctrina 5, cap. 1, vol. 1, p. 196.

many others, at Manardus, elsewhere diligent and not without sagacity, who left to posterity two letters[129] on venesection in pleurisy which were certainly not perfunctorily written and which indeed were very highly esteemed by the author himself. Then there is Fuchs, sedulous and ever zealous in correcting the errors of physicians, who now publishes an example of his singular erudition, his fourth or fifth on venesection in *morbus lateralis*,[130] and those things which I shall now say, he has borrowed from Manardus.

By direct section of the internal [basilic] vein of the elbow in inflammations of the internal parts, it is undoubtedly impossible [B4(r) p.15] to induce in any way both revulsion and derivation simultaneously, and such section of the vein is certainly not derivation. Indeed they seem to me to pay little attention to those things which they quote so learnedly on the authority of Hippocrates and Galen and to have forgotten their own definitions of revulsion and derivation. For they write from the second [book] of the *Methodus . . . ad Glauconem*[131] that revulsion is curative while the humours are still flowing to the site, and derivation, when once they have accumulated there. They say, in addition, that revulsion is an evacuation of the humour at a distance and on the opposite side, and derivation, when the blood is withdrawn from a spot nearest to the affected part. Moreover, they argue with their adversaries acrimoniously but very reasonably, that venesection attempted at the elbow in line with the affected side is an adequate substitute for revulsion in pleurisy, and also that that same venesection (as the blood flows more profusely) evacuates the humour which has collected and is collecting at the site of the inflammation. What else does this indicate, I ask, but that such a venesection brings about both revulsion and derivation—undoubtedly revulsion while the blood is still flowing and derivation of that contained in the affected part.

While they attempt to persuade their adversaries that section of the vein on the same side suffices for revulsion and evacuation, lit-

129. For the two letters of Manardus on venesection in pleurisy, cf. note 100.

130. Since Vesalius is not specific, it is uncertain to which of Fuchs's several works he refers. Cf. note 101.

131. The passage referred to reads: "The indication furnished by position can no longer be disregarded. It is this, in fact, which chiefly teaches in what way one must evacuate, in what manner and where. Thus the treatment of humours still in motion is revulsion, a name given by Hippocrates; and of those which have already invaded the part, derivation. He advises these two types of evacuation by the common veins." Then follows a number of specific examples. *Ad. Glauconem*, Lib. II, cap. iv.

tle do they perceive that [B4(v) p.16] following the Galenical usage, they always employ, in place of derivation, the term evacuation. Whereas derivation is considered as nothing other than an evacuation as close as possible to the site congested with the humour, which Galen unquestionably signified in the above mentioned discourse as evacuation, for revulsion was also considered as a variety of evacuation. But they will perhaps object that such an evacuation of the humour contained in the part which is still in a state of flux must not be called derivation because it is not carried out from the nearest healthy region, since the near part is perhaps interpreted by them without any limitations as the nearest to the affected site. Nevertheless, they forbid their opponents to understand distant part, in the definition of revulsion, as meaning other than "most distant."

Properly speaking, by this reasoning those interpreting nearness in this way will be seen to be not only less fair to their adversaries, but also, having forgotten their Galenical dogma, will stand convicted because they profess that revulsion and derivation must be performed through the ordinary larger veins.[132] Although they deny that derivation can be performed by section of the vein of the same side, nonetheless derivation must be undertaken in pleurisy, nowise differing from the application of cupping glasses alone or of hot emplasters to the surface of the affected side. [C1(r) p.17] For, as an example of derivation in pleurisy they offer the use of cupping glasses or the application of hot emplasters. However, I have not denied that in pleurisy cupping glasses alone are sometimes able in the young or more feeble to produce derivation or, for that matter, even revulsion. But is it not clearer than the noonday sun that in almost all internal inflammations of the whole of the trunk of the body derivation must be carried out by venesection? What vein, I ask, do they prescribe for incision under these circumstances unless it be the vein of the healthy part nearest to the injured member?

But none lies nearer to the afore-mentioned inflammation than the inner [basilic] vein of the elbow, for which reason it must be incised to bring about derivation, as remains to be fully proved. Unless they argue, in addition, contrary to the opinion of the most responsible physicians, that perhaps the external jugular must be opened, section of which is difficult because of the very insecure

132. A reference to Galen's *Ad Glauconem*, II, 4. Cf. Fuchs, *Inst. med.*, Lib. II, sect. v, cap. v, pp. 386ff.

sealing of the operative wound, or a vein of the chest, excessively small for a rapid evacuation.

On the contrary, who will deny that that which they seem to prove to themselves as sufficiently distant for revulsion is also sufficiently near to the affected part for derivation, since nothing nearer can be found suitable for venesection in inflammation of the internal parts. [C1 (v) p.18] But what is the point of advancing anything in corroboration of this subject of "nearness" when they openly acknowledge, following Galen,[133] that in diseases of the pelvis, kidneys, uterus and bladder, section of the popliteal [small saphenous] or ankle veins is perfectly adequate for derivation, and to such an evacuation they apply, not for the first time, the term derivation, ignoring the fact that the ankle is separated from the uterus by a greater interval than the axillary [basilic] vein at the elbow from the upper intercostal space. Furthermore, lest I should seem to insult in your presence the most erudite defenders of ancient medicine, I shall myself concede before leaving this argument that revulsion and derivation do not occur simultaneously in the same venesection. In truth, I am of the opinion that revulsion is carried out as long as the blood which is still collecting or is about to collect in the diseased organ (which usually occurs, notably at the beginning of an illness) is led out of the vein, while correctly, as the blood which has been discharged into and has accumulated in the lesion is drained by the same venesection, derivation is accomplished. And so in the whole of my succeeding discussion I am going to use the terms revulsion and derivation in this way.

An expression of Hippocrates, κατ' ἴξιν quoted by Galen in the second [book] *Ad Glauconem* and very frequently elsewhere, and, in addition, another, κατ' ἐνθύ,[134] of the same meaning as the former, enters into this argument among the adversaries. I believe that the meaning of these words has up till now [C2 (r) p.19] been little appreciated, and the manner in which the authors of each faction understood them indicates how difficult it was since no one, for fear of a snare, has attempted to render an opinion as to their meaning. Accordingly, as some of their contentions and disagreements have been omitted for the present, I shall append in passing

133. Galen, *Methodus medendi*, Lib. XIII, cap. X, vol. VI, coll. 315A, *Renibus vero, & vesica, & pudenda & utero sic habentibus, eas quae in cruribus sunt sitae, ac potissimum quae circa poplitem sunt.*

134. Cf. Introduction and note 97.

that which I myself have always understood. First, it is undoubted that this expression κατ' ἴξιν, like κατ' εὐθύ, which are translated as "in line" signify "according to the straightness."[135] However, from where these expressions have been taken is not very clear. I suppose they were first derived from the continuity and straightness of the fibres. For that divine man Hippocrates knew that the structure of the vein and artery, undoubtedly consisting of definite fibres, not haphazardly arranged, by which these vessels must execute their natural action and motion,[136] corresponds to the structure of the stomach and intestines, of the uterus, heart and bladders.[137] For we see that the function of attraction has been attributed principally to these organs, composed predominately of straight and long fibres, such as the oesophagus created by the Supreme Artisan chiefly for the attraction of food from the mouth to the stomach. Moreover above all, the faculty of dispersion and propulsion[138] is common to these instruments,[139] for they have been

135. *Rectitudo* is nearly always translated "straightness" in contemporary English. Cf. Paré, Lib. VI, cap. xxi.

136. In the humoral doctrine "natural action and motion," derived from Aristotle and from Galen's term κίνησις, is a precise technical expression. An action or function is defined as an active motion proceeding from one of the three principal faculties, animal, vital or natural, cf. note 140, which in turn depended upon the temperament of the part. Such actions were further classified as either natural or voluntary. The natural, so called as they were regarded as being provided by the laws of nature, are almost the equivalent of involuntary functions and included both the movements of the heart as well as of generation, growth and nutrition. The tissues being endowed with these specific powers, nutrition, therefore, depends upon their ability to attract, retain and expel food and its products. These subsidiary functions were supposedly effected by the straight, oblique and transverse fibres respectively, making up the coats of the organs. Brock in his translation *On the natural faculties* (New York, 1916), p. 262, believes that Galen refers not to the muscular coats of the organs, but to the longitudinal *rugae* in the case of the oesophagus and stomach and the circular *valvulae conniventes* in the case of the intestine. Vesalius, however, believes that the walls of the veins are made up of these three layers of fibres and so illustrates then in the *Fabrica* (1543), Lib. III, cap. i, pp. 257-259. Later, he discarded this notion, *Falloppii examen*, p. 794; cf. note 143. The succeeding passage follows Galen, *Nat. fac.*, fairly closely. Natural action and motion here, therefore, means the involuntary subsidiary functions of nutrition. Cf. Galen, *Nat. fac.*, Lib. III, cap. viii, and *passim*.

137. "bladders," i.e., both gall and urinary bladders. Galen frequently uses the plural in this way, cf. *Nat. fac.*, Lib. I, cap. vi, and *passim*.

138. The faculty of dispersion and propulsion is a reference to two of the stages which comprise what Galen calls ἀνάδοσις and διάδοσις. These include the process of transmission of nutriment from the alimentary tract to the liver, its delivery or yielding to the tissues and its distribution. Cf. Galen, *Nat. fac.*, Lib. I, cap. ii, Lib. II, cap. vi, pp. 13 and 163.

139. An instrument (*instrumentum*) is Aristotle's term, ". . . instruments or or-

interwoven by numerous transverse fibres. The intestines may be considered of this group, [C2 (v) p.20] serving excretion particularly and for this reason composed of many transverse fibres.

Indeed, we have established from dissection of bodies that the uterus is rich in oblique fibres since it retains the genital seed for a long time, harboured for the renewal of the race; and it must either attract this [seed] or expel the foetus at birth. Furthermore, nature, creating nothing in vain, has endowed in equal and similar fashion the heart, stomach and both bladders with three types of fibres, since they need to possess in almost equal amount the powers of attraction, expulsion and retention. To be sure, it is a most valid theorem of Galen, Herophilus, Marinus and other professors of dissection that in the natural motions of the body attraction is accomplished by the straight fibres (or as others call them, *villi*), excretion by the transverse and retention by the oblique. But at present I regard retention, attraction and excretion as those powers by which the above mentioned structures serve the whole body, not those by which they attract, digest and hold suitable nourishment until it has been elaborated. Again, these three types of fibres and the three natural functions which the veins enjoy from the liver onward, Hippocrates emphasizes should not be neglected, since he said that the vein must be cut according to its straightness, whether you employ derivation or revulsion. [C3 (r) p.21] He very skilfully indicates by straightness, I say, the preservation of the straightness and continuity of the fibres, so that if, in a more distant section, the straightness has been preserved in this way, a better revulsion of the humour collecting or about to collect in the diseased part would occur and, in a nearer division, a more efficacious derivation of the suffering region. No one of sound mind will agree that in venesection you may corrupt the natural faculties[140]

gans are needed for all functioning, and . . . the bodily parts are the instruments or organs to serve the faculties . . ." *De generatione animalium*, Lib. I, cap. ii, tr. Arthur Platt, *Works of Aristotle translated into English*, v (Oxford, 1910), 716A. According to Galen, instruments are those parts of the body capable of carrying out a complete action; thus the arteries, veins and nerves are collectively instruments for the distribution of the vital, natural and animal spirits; the eye, the instrument of sight, etc. The term "organ" (*organum*) is usually, but not always, synonymous, *Methodus medendi*, Lib. I, cap. vi. Cf. Fuchs, *Inst. med.*, Lib. I, sect. v, cap. i, p. 143; Blancardus, *Lex. med.*, p. 466.

140. As mentioned above, note 136, there were three principal faculties or powers, animal, vital and natural. "A faculty is the cause of the activity . . ." Galen, *Nat. fac.*, Lib. I, cap. iv. The animal faculty had its seat in the brain and was distributed by the nerves, subserving sensibility, motion and the mind; the

by which the veins serve the whole body in the administration of blood, and render them sluggish and useless; nor that both painful ligation and friction or hot water greatly assist the veins directing the blood toward the operative wound by their straight and transverse fibres. Finally, the method of flux which Galen imputes to pain in inflammations ought to be obvious to everyone. For these are his words, especially in that place in the thirteenth [book] of the *Curative Method* on the generation of inflammation from external cause. "But what is painful is also observed to develop into a phlegmon from pain, but the cause of this is not altogether clear and in no way provable. Such, indeed, is our opinion. We have taught in that work which we have published *On the Natural Faculties* that there is one natural faculty which we have called excretory. This, then, serves its function [C3 (v) p.22] when it experiences some irritation; that is to say, one of those things which may irritate it. This cause, whatever it may be, excites the pain. Therefore, while it hastens to eliminate this, it sometimes stirs up a phlegmon in that part, for when nothing is brought about by its first efforts, attacking more violently the involved region it simultaneously discharges some blood and spirit from the surrounding into the affected part."[141] Nay, unless we take it for granted that the afore-mentioned excretory function is carried out in the discharge of blood by means of its fibres and is attracted to the aid of the part, it will be extremely difficult and altogether impossible to conceive of the way in venesection by which the blood flows from below upward and from right to left. For who will argue that everything is accomplished by means of a vacuum when, after complete removal of the chains, or hot water or on ceasing friction, the blood escapes scarcely more profusely from the vein.[142] In addition, the

vital, in the heart, distributing innate heat through the arteries; and the natural, in the liver, from whence the blood was formed and the veins had their source. The natural faculty was divided into the nutritive, generative and growing, and the nutritive by further subdivision into the attractive, retentive and expulsive. Cf. Galen, *Nat. fac.*, Lib. I, capp. vi-xi, especially; *De usu partium*, Lib. I, cap. xvi, Lib. IV, cap. xii: *De locis affectis*, Lib. III, capp. v ff; *De venarum et arteriarum dissectione*, cap. i.

141. The Froben text and that of Vesalius differ only in minor and unimportant details. The meaning is exactly the same in both, cf. *Methodus medendi*, Lib. III, vol. VI, col. 306B.

142. An oblique reference to Galen's argument when he railed against Erasistratus who denied the existence of an attractive faculty and propounded the vacuum theory. Vesalius would seem to have in mind the discussion in Galen's *Nat. fac.*, Lib. II, cap. i, on the demonstration of Erasistratus concerning the passage of material from the veins. Cf. *Nat. fac.*, Lib. I, cap. xvi, Lib. II, cap. vi.

first group of physicians, when they very religiously forbid section of the vein through two diameters, tell us nothing more than that by such a section the straightness and continuity of the fibres is destroyed. Now, in truth, if any other interpretation must be sought in this dogma of Hippocrates by which [C4(r) p.23] I could credibly construe that Hippocrates held any opinion other than the continuity of the fibres, none offers itself which will not immediately have reference to this straightness to which I now refer. For if anyone ignorant of the present affair should concede this straightness to be a straight line, he would, perhaps, obviously imagine a straightness to exist from the right side of the head to the right foot; but there would be little or absolutely none to the right hand.

Because if he were to extend the hands in the form of a cross, he would measure the straightness from the clavicular region to the elbow, nay even, from the right hand to the left; but it will be extremely difficult to fashion the straightness of the liver with the right elbow or of the spleen with the extremity of the left hand. But if, perchance, anyone maintains that there are also these differences of straightness in what way, I pray, does he establish a straightness in the most acute angle of the whole body and in the greatest distance to his ribs? There is a triangle of this sort of which the first angle is above the beginning of the sacral bone, the second, in the right popliteal [region] or on the inner side of the ankle of the right foot, the third, at the left knee or foot. And so this triangle arises by necessity if the right foot is afflicted and you were to cut the vein in the left leg or to scarify some part on its inner aspect. And thus, [C4(v) p.24] in this way it is necessary that we confess that a straight line has to be understood from Hippocrates as the most acute angle and, contrary to the dictates of common sense, is "straightness."

The principle of the following argument, now devised for the first time by a certain very celebrated (as he himself says) professor of medicine at Bologna,[143] will be rejected for similar reasons;

143. The professor of medicine at Bologna was probably Curtius, cf. note 102. The earlier friendship between the two men seemed to have cooled over a discussion on the question of fibres, cf. *Falloppii examen*, p. 794: "I recall what a bitter controversy I once had with Matthaeus Curtius at Bologna over these things since I doubted whether in section of bodies the fibres of the veins were apparent to the senses, and I offered no slight opportunity for opposing the fibres to Curtius and his disciples who had recently expressed their conclusion. For when I had rent the substance of the veins in various ways for

forsooth, by "straightness" a unit of the body must be understood in the manner in which Hippocrates taught that the body was δίδυμος [144] (bi-lateral): namely, two eyes, two ears, two kidneys and, that I may be brief, he says that those on the right correspond to those on the left, and on account of this, those on the right gain a "straightness" among themselves, and those on the left, with themselves; indeed, no kind of "continuity" or "straightness" obtains of the right with the left. And that this view may be strengthened, I shall add that the dorsal medulla immediately from its origin (which I believe to be from the cerebrum and not from the cerebellum) is unpaired. As half of it may be attacked by a paralysis,[145] the remainder being unharmed, there is agreement with but one side.

How does he attain his goal, I ask you, for in addition to these things which he proposes, it is also necessary for him to invent a sort of septum to divided the blood in the length of the vein. Nor does it necessarily follow because the body is twin that the right veins share a mutual "straightness" with the right, and the left, with the left; [D1 (r) p.25] but because the fibres may have been ar-

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the sake of finding the fibres, and I dissected it raw and dried, by Hercules, we were able to assert, that I may confess truly, that the fibres had come rather from the imagination of the authors than that they existed in the nature of things. To a degree that finally since I therefore began to doubt concerning the fibres and rejected it as a certain common opinion rather than my own, I wrote elsewhere that not much ought to be attributed to the fibres and . . . you contend that our opinion concerning what vein ought to be opened in the withdrawal of blood is in large part goat's wool." "Goat's wool" was a favorite expression equivalent to the modern "horsefeathers." Vesalius uses it elsewhere, cf. note 174. Roth, p. 119, n. 5, remarks that the friendship with Curtius had cooled is indicated by that fact that he is not mentioned in the *Fabrica* (1543). Cardanus places the blame for the quarrel on Curtius, *De vita propria*, cap iv.

144. It does not appear that Hippocrates used the term δίδυμος. However the idea expressed by Vesalius, that there is continuity between the various organs and members of each side is given by Hippocrates in the *Epidemics*, Lib. VI, sect. 2, cap. 11, Littré ed. v, 283. The term δίδυμος is, on the other hand, used by Galen, *De Usu partium*, Lib. VIII, cap. xiv, speaking of the testicles, and it is possible that Vesalius obtained the word from Galen and then applied it in the case of Hippocrates; cf. *Fabrica* (1543), Lib. v, cap. xiii, p. 521. *Testium itaque in viris situs nulli non conspicuus est, ut & binarius ipsorum numerus, unde δίδυμοι & gemini appellantur.*

145. The Latin has *resolutio* which is the palsy by which was understood loss of either movement or sensation or both. Its cause was envisaged as being due to the local accumulation of phlegm which stopped the flow of animal spirit in the nerves. A variety of conditions were grouped under the term such as hemiplegia, peripheral nerve lesions, etc. Cf. Barrough, Lib. I, cap. xxii, p. 35; Blancardus, *Lex. med.*, pp. 480, 551; Paré, Lib. IX, cap. xii, p. 332.

ranged by nature in such a way, so I shall demonstrate in the course of this discussion, it may nevertheless be false that the vein supplying nine or ten (or if for the moment you wish, eight) lower ribs of each side observes any "straightness" with the vein of the left elbow or of the left leg. At least, as the body was made equally heavy on both sides, nature desired it to be twin and, the aorta being carried below the thorax near the left side of the spine, furnished, as it were, the equilibrium of the accompanying vein, so requiring that vein to rest upon the right aspect of the spine. Furthermore, he disapproves of Galen's section from the right ankle or popliteal towards the left, Hippocrates' from the occipital towards the frontal, venesections which are performed, however, according to the "straightness" of the fibres. Moreover, he will find fault much more with an incision which is carried out in a phlegmon of the right hand towards the left or of the left, towards the right. However, in such an incision the "straightness" and "continuity" of the fibres is best served if he were to incise in those bodies in which the axillaries [subclavian veins] arise from the cava before the great bifurcation at the thymus.[146]

The truth of the matter is so clear as scarcely to merit lengthier refutation. Anyone might convince himself more quickly if he were [D1 (v) p.26] to imagine the whole body clothed in fancy dress such as students are accustomed to put on at a mask or in carnivals to impersonate naked demons. Now, if one were to attempt to pull out a thread from below the right arm he will see that it pulls straight up to the point of extraction from the right side of the chest and, what is more, from the sole of the left foot.[147] If, indeed, he were to evulse a thread from the upper part of the arm, the thread will be drawn to the point of extraction from the right side of the head. The arrangement is the same on the left side. Likewise, if he were to draw a thread from the inner side of the right leg, he will observe the thread to extend under the perineum from

146. The great bifurcation is the division of the superior vena cava into right and left innominates. The innominate veins were either not recognized at all or regarded as the roots of the internal jugulars. The distinction was not generally drawn until the eighteenth century. For "thymus" Vesalius uses the word *glandium*, a term long employed for either thymus or pancreas, . . . *in glandium, quem thymum Graeci nominant*, Galen, *De venarum et arteriarum dissectione . . . ab Vuesalio . . . recognitus*, vol. I, col. 183B. Cf. *Fabrica* (1543), Lib. III, p. 382 [282]; Joseph Hyrtl, *Onomatologia anatomica: Geschichte und Kritik der anatomischen Sprache der Gegenwart* (Wien, 1880), pp. 241, 544, hereafter cited as Hyrtl, *Onomatologia anatomica*.

147. Obviously a *lapsus calami* of Vesalius; should read "right foot."

the inner side of the left leg. Then, if he were to draw the thread from the middle of the right arm, it will come from the left hand. However, if he sought to pull out a thread from the right hand or foot, none will be moved from the left side of the chest towards the right and much less from the right to the left side. Indeed, as art in the above example can hardly imitate Nature in the arrangement of the veins, it behooves each and every physician to observe these things from the anatomy of bodies and not like our Aesculapians, relying solely on a pile of authorities and without exact knowledge of the veins to be sectioned in disease, to fight and brawl with their adversaries like the Andabatae.[148] I know, among others, a certain person[149] who ⌜D2 (r) p.27⌝ had the temerity to write against the opinion of Galen on venesection in *dolor lateralis* before he had seen an anatomy, even in a dream, although he has recently attended one, and only one, performed perfunctorily by myself. Accordingly, with due regard for your accurate judgment, my opinion will be with Hippocrates that for a more successful and favorable section of the vein, whether derivation or revulsion is to be undertaken, the vein must always be incised according to the continuity and straightness of the fibres.

To this axiom I shall add the exact distribution of the vein in the thorax which I have observed to be arranged most often in this manner. The trunk of the vena cava coursing upwards from the gibbus of the liver, pierces the diaphragm and communicates two, sometimes three, obvious branches to that septum. Then each ramifies as small branches, very similar to capillary veins, in the two membranes lining the thorax (which the Greeks called διαφράττοντα).[150] If you carefully lift away the said membranes from the pericardium, you will find almost none, or a very slender venule, communicated by the cava. The cava on reaching the base of the heart

148. The *Andabatae* were Roman gladiatorial combatants, generally believed to have fought on horseback and to have worn helmets with closed visors. Vesalius used the term again in the *Fabrica* (1543), Lib. v, cap. xiii, p. 521, . . . *ac differentibus argumentis eosdem autores sua placita Andabatarum modo confirmasse.*

149. There is no definite identification of this "certain person." However, in 1536-1537 Vesalius held a public anatomy in Louvain. According to him there had been none held there for the previous eighteen years, cf. *Fabrica* (1543), f. * 3r. It is therefore possible that this is a reference to Brachelius, cf. notes 98 and 109.

150. Blancardus, *Lex. med.*, p. 230, defines the *diaphrattontes* as the membranes lining the interior of the thorax, called the pleura and forming the midline a septum commonly named the mediastinum. "The pleura and mediastin."

and its right auricle[151] is opened on its medial aspect into the right sinus [right ventricle] of the heart and a portion of the wall [tricuspid valve] of that vein is insinuated into it. Before it entirely ends in the sinus[ventricle] it gives off a vein [coronary sinus] [D2 (v) p.28] which encircles the base of the heart like a crown and which ramifies throughout its whole substance. While dissecting we have observed it to be occasionally double just like the two coronary arteries. This divarication of the vena cava into the right sinus [right ventricle] of the heart occurs above the fifth thoracic vertebra on which it is asserted by anatomists that the base of the heart is laid.

These extensions having been given off, the vena cava, attached very firmly to the right auricle of the heart, ascending a little, frequently the width of a single vertebra, distributes a vein [azygos vein] from its right side, which compares in apes, dogs and other animals closely to that in man. This vein interconnecting the right spinal region is reflected downwards all the way to the last thoracic vertebra and the first and second lumbar and gives off, on both sides, to each of its corresponding costal intervals distinct single branches. When Galen, in the second commentary of the tenth aphorism in the *De victus ratione in morbis acutis*[152] taught (meantime I'll pass over in silence the false place in the book *De venarum sectione*)[153] that this vein arises from the region of the right auricle, perhaps someone, little versed in anatomical observation, doubted whether the same arrangement of the vena cava in this region is met with in man and in other living quadrupeds, or whether the vena azygos is given off by the cava under the base of the heart [D3 (r) p.29] or from that portion of the vein where it opens into

151. In Vesalian and contemporary usage, right auricle is never right atrium (B.N.A. terminology) but right auricular appendage only. The right atrium is regarded as a part of the vena cava, hence "its right auricle." The heart was regarded as a two-chambered organ. Cf. *Fabrica* (1543), Lib. VI, cap. xiv.

152. In this commentary, too extensive to quote here, Galen describes the course of the vena cava and its branches. The vena azygos, he says, ". . . arises in certain animals above the heart, in others however, as in men, it emerges from that part of the vena cava which just reaches the auricle of the heart," and is distributed to the lower eight ribs. The upper four ribs are nourished by veins which branch off ". . . from the vena cava before it is separated into the jugulars." The passage is anything but clear as to the meaning. *Hippocratis aphorismi et Galeni in eos commentarii*, Lib. II, aph. x, vol. VI, coll. 442f.

153. Attention is drawn to the specific passage in a marginal note added by Vesalius who edited this book for the Froben edition of Galen. *De venarum arteriarumque dissectione liber . . . ab . . . Vuesalio . . . recognitus*, coll. 183A-B.

the right sinus [ventricle] of the heart, or even before the cava reached the heart. In my opinion Galen in the above mentioned commentary has twice indicated this last arrangement.

To this question of the origin of the vein I can add no other testimony except ocular belief. However carefully and industriously I have studied the branches of the vena cava I constantly find the vena azygos given off in men, no differently than in dogs and apes, above the auricle of the heart. But I wish you to understand, as so stated by me above, the normal position of the auricle, its highest point extending not one finger's breadth higher. I do not ask that the faith of my eyes alone be accepted, but of all who at Paris, at Padua and at Louvain and elsewhere were present many times at my public demonstration[154] when I dealt thoroughly with this part of anatomy in order that we might obtain a true understanding of venesection. Meanwhile I assume that all the ribs, in bodies of both sexes, are supplied by this vein as I pointed out before a very crowded gathering of the most learned spectators at Padua,[155] when the duty of publicly demonstrating and dissecting had been recently asked of me.

We read that this [D3(v) p.30] particular vein lacking a mate was usually called, not without reason, *sine pari* in Latin, ἀζυγή in Greek. For it deserved to be so named as no vein corresponding to it chances to exist on the opposite side which would undoubtedly occur if it were to be propagated from the region of the right auricle, just as that [small cardiac vein] which extends to the right sinus [ventricle] of the heart, to which the coronary vein is believed the mate. But no one who has either engaged in the task of dissecting personally or who has observed a dissection will allege

154. At Paris Vesalius held at least three public anatomies, possibly in 1535-1536, *Fabrica* (1543), f *3r, *ut ipse . . . tertiam cui umquam mihi adesse obtigit sectionem . . . et sodalium et praeceptorum hortatu adductus publice administrarem.* There may have been other public anatomies, as there were certainly other dissections, cf. Guinter, *Institutionum anatomicarum . . . libri* (1536), pp. 32f. In Louvain Vesalius held a public anatomy, 1536-1537, cf. above page, and note 134; *Fabrica* (1543), f* 3r. Possibly there was another public anatomy in Venice, 1537, although it is difficult to understand how Roth, p. 78, n. 2, can thus with certainty interpret "and elsewhere," cf. *Epistola Chynae*, p. 13. In Padua Vesalius held public anatomies as a part of his teaching duties, Roth, cp. 428, *Anhang* III, *Urkunde* III (1539); *Fabrica* (1543), f *3r.

155. . . . *sinistris costis ramos offerat, illa quam sine pari venam nuncupamus dextras costas duntaxat alente . . . Adeo ut siquando in publicis sectionibus haec [vena sine pari] observo, Fabrica* (1543), Lib. III, cap. vii, p. 280; Roth, p. 85, n. 6.

that it arises under the base of the heart or before the vena cava reaches the heart. I have drawn attention to these things that I may show that this [vein] above the auricle of the heart and that distributed to the heart arise from the cava, even in man, above the fourth and almost at the end of the third metaphrenic [thoracic] vertebra.

There is another feature concerning the origin of the above vein which must not be carelessly overlooked. It undoubtedly arises, as I have also previously suggested, from the right side of the cava but does not derive (as perhaps some one ignorant of anatomy and deceived by the corrupted passages in Galen's little book *De venarum sectione*[156] might assert) from the left side or from the middle of the cava where it faces the spine.

But if any one should be tainted, I shall present in his presence and before his eyes, the most faithful witnesses, or if deprived of these and needing other testimony, he through me or by the sense of touch alone [D4(r) p.31] will be set aright if he does not disdain to be present when I am dissecting, or decline to agree with the judgment of the most eminent men. For the rest, you may perhaps wonder why I discuss the origin of this vein so conscientiously. For no other reason, to be sure, than that you may grant me that nine and sometimes ten of the lower ribs of either side are nourished by it and that you concede that it is given off on the right side of the vena cava; especially since I know a human body will not be available on the spot from which you could observe these things (if you should consider this unreasonable). Hence the force of my argument must be considered.

But let us return to the remaining branches of the vena cava. The vena cava after it has distributed the azygos vein, continues on to the thymus where it is soon divided into two trunks [innominate veins]. The right (similarly the left) gives off a vein [subclavian] which, resting upon the first rib, runs on under the clavicle to the axilla. Near its origin from the vena cava, a vein [superior intercostal vein] is distributed to the upper three ribs of the right side, which becomes so slender as to be immediately lost to sight; nay, more often you will find it to be absent since frequently nourishment is adequately supplied to those small ribs from the overlying axillary [subclavian vein]. This trunk [innominate vein], after

156. The other "corrupt passages" noted by Vesalius in the Froben edition are coll. 182A, 181D, 192A. They have nothing to do with the present argument, however, and Vesalius is referring to the one given above, note 153.

distributing these veins, ascends, and the right internal jugular and the vein [vertebral vein] extending to the transverse process of the vertebrae of the neck derive from it. [D4(v) p.32] The rest of it terminates in the external jugular from which at that level the humeraria[157] [cephalic vein] is a branch. At the thymus, where the bifurcation mentioned a little while ago occurs, two veins [internal mammary veins] arise which run one on either side of the sternum and by which nourishment of the chest and breasts is principally distributed. These are [the veins][158] which anastomose with the veins of the uterus under the rectus abdominus muscles. And so the azygos, the two veins [superior intercostal veins] to the intervals of the upper three ribs and the two veins [internal mammary veins] carried to the sternum nourish the whole thorax.

We have already noted in our tables of dissection[159] how this great bifurcation of the cava at the thymus is first seen immediately below the branching of the axillary [subclavian] veins.

Now I shall add what may have influenced Galen, why he mentioned the azygos and the rest of the veins of the body rather obscurely, contradicting himself in the same place, and why he has reviewed elsewhere almost παρέργως (cursorily) veins omitted and properly belonging to the discussion on veins (if one is permitted to doubt his pronouncements in this way). One may read in the second [book] of Hippocrates, *The Regimen in Acute Diseases*, tenth aphorism, as follows:

157. The cephalic vein is almost always referred to by Vesalius as the *vena humeraria*. According to Hyrtl, the word cephalic was not, despite κεφαλή derived from the Greek, but was introduced by Armegandus Blasius de Montepessulano, the translator, from Avicenna, where the Arabic reads alkifal. Translation of this term into *cephalica* was justified, however, as this vein was usually opened in affections of the head. Vesalius translates the Greek ὠμιαίη correctly *humeraria*. Hyrtl, *Anatomie*, p. 96; *Onomatologia anatomica*, p. 103.

158. The anastomosis between the internal mammary (superior epigastric) and inferior epigastric veins was regarded as of great importance as the route by means of which the uterus and the breasts were brought into physiological relationship with one another for the elaboration of milk and the menstrual blood. In the later months of pregnancy it was supposed that that portion of the menstrual blood in excess of foetal requirements was drawn to the breast to form milk. For this reason it was long believed that the inferior epigastric veins sprang from the uterus. Cupping of the breasts was a standard therapeutic method in menorrhagia. Galen, *De usu partium*, Lib. VII, cap. xxii; Lib. XIV, cap. viii; Hippocrates, *Epidemics*, Lib.II, sect. iii, cap. xvii; *Aphorisms*, Lib. V, nos. 37, 39, 52.

159. "This bifurcation of the vein in the thymus sometimes appears a little lower just as if from the other branch of the axillary [subclavian], and in such manner the humeraria [cephalic]," *Tabula*, II at the top of the right margin.

"When therefore pain extends to the root of the neck [Ei(r) p.33] or severe pain afflicts the arm, the breast or parts which lie above the diaphragm, the internal vein of the elbow must be cut." Then a little later Hippocrates adds: "And if the parts which are under the diaphragm suffer pain, but it does not ascend to the root of the neck, then the intestines must be purged with black hellbore or peplium."[160] Galen comments on the present aphorism as if Hippocrates had taught that in a phlegmon affecting the upper ribs in *dolor lateralis* blood-letting must be employed. When, however, a patient is tormented by an inflammation of the lower ribs, he must be remedied by a purgative drug. Galen therefore, inquiring why Hippocrates had preferred an evacuating drug rather than the withdrawal of blood, pointed out the distance of the veins, and his opinion has almost reflected the commonplace conclusions of our physicians by which it is taught that bad blood from the affected part must not be drawn at all through the more noble part,[161] as though by section of the internal [basilic] vein of the elbow, blood from an inflammation occupying the false and lower ribs must necessarily be carried through the region of the heart. However much he always and very conscientiously avoided contradicting Hippocrates, Galen, regarding these methods of little value, finally, however, tacitly suggests what Aegineta[162] later more openly advocated: [E1(v) p.34] that venesection rather than a purgative drug must undoubtedly be used because of the perturbation[163]

160. Black hellbore (*veratrum niger*) and peplium (*euphorbia peplis*) were standard drastic purges and emetics used in the treatment by "inanition," cf. *In libros sex Pedacii Dioscoridis Anazarbei de medica materia commentarium secundum auctum Petri Andreae Matthioli* (Venitijs, 1558). Lib. IV, capp. 153, 170.

161. The more noble parts were those such as the heart, lungs, liver, etc., which had first call on the nutriment. The less noble, bones, tendons, fat, hair and nails, etc., received nourishment from the "superfluities" (*excrementa*) from the more noble. Cf. Fuchs, *Inst. med.*, Lib. I, sect. vii, cap. v.

162. Book III, sect. xxxiii, "If the pain shoot to the clavicle, we must straightway open a vein; or if to the hypochondrium, we must purge downward. Physicians of late, in all cases, have recourse to venesection, apprehending, I suppose, the disturbance occasioned by purging." *The seven books of Paulus Aegineta, translated from the Greek by Francis Adams*, I, (London, 1844), p. 497. However he was not entirely opposed to the use of purges as Vesalius would have us think.

163. Perturbation had a far more precise meaning than it has now. The perturbations or passions of the mind include joy, love, fear, anger, sorrow, shame, envy, etc., and an agony which is a mixed passion of strong fear and vehement anger. These so-called "accidents of the mind" are caused either by the effusion or withdrawal of the vital forces and blood to or from the periphery. Such sudden motions of heat and spirits may exhaust the vital humour and

which a purging drug usually causes, and because we do not know what drug was once employed in place of venesection.

So Galen, with what moderation he could, restrained himself in order that he might seem to recede as little as possible from the sanction of Hippocrates. Therefore, more easily to accomplish it in the manner which I have described, he has forcibly led the azygos vein straight to the mark as if the azygos vein were too far separated from the incised veins. This view, contrary to the opinion of Hippocrates, all the most eminent physicians embrace, and the authors of both sects also agree with Galen in this. Although I am aware that certain individuals incorrectly interpret Hippocrates' word *συμβαίνει* (increase) as the flowing of the humour to a higher level rather than as an extension of pain, I am allowed, I pray, setting aside all prejudice, to examine for you, the greatest lover of truth, the utterance of Hippocrates.

If nearly the whole side from the clavicle to the iliac bones continuously was meant by Hippocrates, I am convinced that in the former part of the sentence Hippocrates would seem to indicate the part of the side enclosed by the twelve ribs, and in the latter, that which [E2 (r) p.35] extends continuously from the circumference of the diaphragm to the iliac bone below. But he considers the extension and production of tensive pain but not the phlegmon, an area of sharp pain. Under whatever part of the membrane lining the ribs the inflammation might lie, it is absolutely certain that because of continuity, the tension necessarily extends all the way to the root of the neck and clavicles. We know, to be sure, that in inflammation of the liver the tension affects the root of the neck, for no other reason than because the weight of the liver pulls down the diaphragm, the upper surface of which gives attachment to the membrane lining the ribs, and may be simultaneously stretched. Therefore the right side, owing to the continuity of the whole lining membrane, is attacked by the feeling of tension all the way to the root of the neck. For it is impossible that a more tightly drawn and tense membrane, stretched by nature to the utmost, may be further stretched in a localized part by inflammation without the whole participating in the tension of that part.

cause sudden death, putrid fevers and bodily wasting, hence such expressions as "to die from joy." Perturbations are diagnosed largely from the appearance of the facies; thus the paleness and sweating from violent purgation or immoderate bleeding are regarded as producing perturbations akin to fear, which may endanger life. Cf. Fuchs, *Inst. med.*, Lib. I, sect. vii, cap. iiii; Lib. II, sect. vi. Paré, Lib. I, cap. xviii; Lib. XXII, cap. iv.

Does not what he said at the beginning of the second sentence, ὑπὸ τὰς φρένας but not μετὰ τὰς φρένας,[164] confirm what I have proposed? For that passage hides from no one the significance of "under the diaphragm." I do not understand fully why the lower ribs deserve to be called "underlying." [E2 (v) p.36] For the diaphragm, takes origin from the end of the sternum where it terminates in the xiphoid cartilage, attaches to the ends of the false ribs one after another, and finally reaches the eleventh thoracic vertebra adjoining the beginning of the twelfth where it is connected by very strong ligaments to the latter and to the first lumbar vertebra. Wherefore if we imagine a man to walk, sit or stand, no rib will lie entirely below the diaphragm. Should one desire an individual to lie supine, then he might claim that this is "under" the diaphragm; whatsoever is placed from the level of the origin of the upper part of the diaphragm down to the position of the spine is "under" the diaphragm and will of necessity be denoted, whatever its position, by the same term "under." Although in this way no more than two or three vertebrae and their ribs would be below the diaphragm for I would estimate the higher part of the origin of the diaphragm to be at the level of the ninth thoracic vertebra. Wherefore, any one understanding Hippocrates' pronouncement in this way will necessarily modify the common meaning. Furthermore, it followed from the opinion of Galen, as he believed eight ribs of either side are nourished by branches of the azygos vein, that Hippocrates advised the letting of blood in inflammation limited to the upper four ribs. However, if [E3 (r) p.37] we adapted the aphorism of Hippocrates to my meaning, then at last the distance in position of the veins is going to be the reason why a purgative drug must be preferred to venesection. For nothing in the body can be imagined to be more remotely separated from the veins to be sectioned than the loins, in the proper sense lying "under" the diaphragm. Added to this fact that infrequent and not particularly large venules are distributed by nature to the stomach, spleen, kidneys, uterus, bladders and other viscera. No one will gainsay then that as the loins are nearest to the stomach and intestines, the action of the drug will be rendered easier. Finally, if we accept as proved the distance of the veins, following Galen's interpretation of Hippocrates, then it is inferred that in the practice of Hippo-

164. "Below the diaphragm" and "under the diaphragm" in the following passage are illustrations of the confusion resulting from the failure to standardize the position of the body in descriptive anatomy.

crates the blood ought not to be evacuated when a phlegmon attacks the spleen, stomach, kidneys or uterus. To strengthen further this opinion I might advance several aphorisms from Hippocrates' book, *The Aphorisms*, if it were not that your exceptional knowledge of medicine is known to me. It does not worry me that perhaps some one more contentious might contend that where I have included under pleurisy, pain in the loins or ilium [pelvis][165] I am using the expression "pleurisy" incorrectly. To him I shall reply that [E3 (v) p.38] the name of this disease belongs to the category of those which are derived from the position of the primary lesion such as nephritis, peripneumonia, ophthalmia and *coxendix*.[166] The name pleuritis will signify to me an affection of the whole side and not of the membrane lining the ribs alone, as many who ignorantly call that membrane the pleura believe.

In addition, the name pleurisy derived from the ribs, also called πλούραι, because they form the side, by no means indicates a primary position since the ancient Latin writers called the disease *dolor lateralis* rather than *costalis*. As Galen has written obscurely on this vein, I therefore repeat what I have indicated in the margin of my tables in order that I might show it to have been the opinion of Hippocrates that whatever part of the membrane lining the ribs is involved by a phlegmon, venesection rather than a purging drug should be used. But lest I appear to you over anxious to labour these things, returning to our theme, to begin with I shall fight side by side with the authors of the first sect (with whom you were always at one) who prescribe venesection from the elbow in line with the affected side, during the initial phase. Their particular opinions and axioms [E4(r) p.39] I shall assume to have been approved by those authorities of Galen and of other very distinguished physicians as the best and most accurate and, what is more, for the best of reasons. Therefore, you hold that revulsion and der-

165. Charles Singer, *The evolution of anatomy* (New York, 1926), p. 140, states that the modern use of the term "pelvis" dates from Realdus Columbus (1516?-1559).

166. *Coxendix* is sciatica, not in the modern sense, but pain in the hip-joint and often classified under arthritis. *Coxendix* is the equivalent of *os coxae*. Barrough, Lib. III, cap. lxv, p. 205. "Ischias in Greeke, properly is called a most grievous paine, which is wont to chance about the ioynt which the Greeks do call *Ischion*, the Latines *Coxa*, in English the huckle bone .... The Barbarous sort call this disease *Sciatica* .... It is caused through a grosse and flegmaticke humour, which being congealed, abideth in the ioynt of the huckle bones ... and unmeasurable using of venerious acts ...." Cf. Fuchs, *Inst. med.*, Lib. II, sect. i, cap. v; Blancardus, *Lex. med.*, p. 198.

ivation can be carried out on the same vein as the most valid theory; that is, provided that the condition of the patient remains unchanged, it is possible in a single section to revulse at a distance the humour which is flowing and thus evacuate it, and then to derivate at the near point the blood contained within the inflammation, and so it is simultaneously withdrawn. When you pointed out that this sometimes was allowable, you afterwards added that this must be done especially in *dolor lateralis* since this disease may be so acute and lethal as to require immediately these two simultaneous evacuations; nor does it offer relief to perform these evacuations at succeeding intervals. I shall add that the vein of the elbow in line with the affected side is sufficiently remote for revulsion alone if, with the blood still flowing and because of constitutional debility, we are compelled to perform this only. Further, for derivation you consider no vein which is in line with the diseased side is near for convenient section.

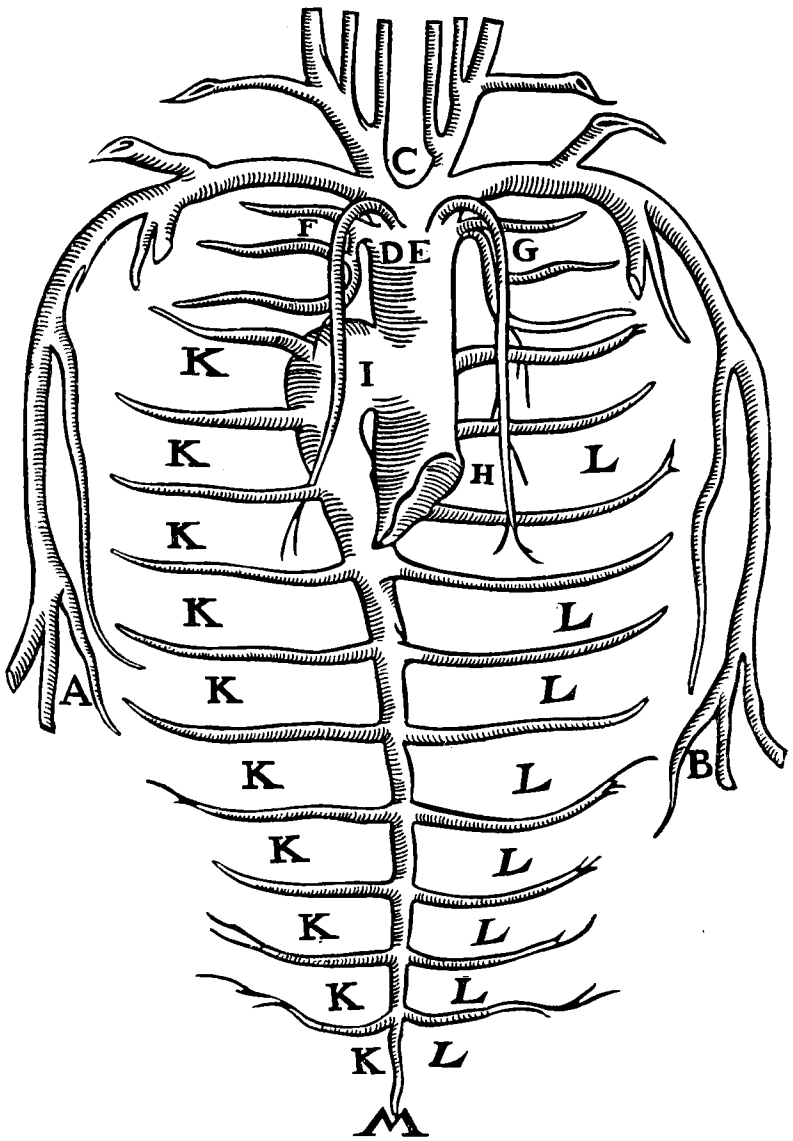
Finally, we have fully demonstrated above that each type of aversion must be made according to the straightness and continuity of the fibres. [E4(v) p.40] From these considerations it will be concluded that when any one suffering from plethora of the body and abundance of juices is attacked by a phlegmon in the upper three ribs of the right side, however robust the constitution, the blood must be withdrawn from him at the onset from the right axillary [basilic] until it flows more red or becomes livid in place of clear and red; for either, Hippocrates asserts, may happen.[167] Should the inflammation be established in the left upper ribs, the left axillary [basilic] will be opened without hesitation by the same reasoning. And so I agree with you in all these matters. Indeed, that I may place the affair before your eyes a little more clearly, I shall, in passing, delineate the thoracic veins, and thus we may attack the matter in the manner of mathematicians.[168]

167. Cap. 7, *On regimen in acute diseases*, Adam's translation (New York, n.d.), I, p. 240. *Oeuvres complètes d'Hippocrate, trad. par E. Littré*, II (Paris, 1840), p. 272 for the Greek text.

168. We infer that this presentation "in the manner of mathematicians" was the subject of attacks, for Vesalius is elsewhere vehement in the defence of mathematics in medicine, cf. *Epistola Chynae*, p. 40. Cuneus, *Apologiae Putei examen*, p. 862, tells us that Fernel was mathematical preceptor to Vesalius.

[F1(r) p.41]

VENAE THORACEM NVTRIENTES



[F1 (v) p.42] In this accurate, although somewhat rough figure, the letter A, signifies to us the axillary vein [basilic] of the right arm extending all the way to the elbow and there cut off; B, denotes the left axillary [basilic] and C, the great bifurcation at the thymus or root of neck.[169] D, and E, are the two veins [internal mammary veins] creeping under the sternum to the anterior thorax. F, is the small vein [superior intercostal vein][170] nourishing the three upper ribs of the right side; G, the vein [left superior intercostal vein] supplying the three higher ribs on the left. H, the trunk of the vena cava dissected free where the cava touches the right auricle of the heart and enters its right sinus [ventricle]. I, is the vena azygos arising from the cava. K, K, etc., are nine branches of the axygos vein nourishing nine right ribs; L, L, etc., indicate the branches of the same vein supplying nourishment to the nine lower ribs on the left. M, then, the termination of the aforementioned vein which runs all the way to the lumbar vertebrae through the inferior foramen [aortic hiatus] of the diaphragm through which the artery descends.

So, consider F, the site of the disease. I shall cut A, inasmuch as I am going to maintain by that section sufficient contrariness, distance, straightness of fibres and finally proximity. And because of this, provided that I am appropriately about to revulse and simultaneously derivate at a single letting, I shall have withdrawn the blood flowing to the injured part and that already inherent in the affected site; or, if [F2 (r) p.43] about to revulse alone, I shall evacuate just that which is flowing. Thus, for a like reason, if G, is afflicted with a phlegmon, I shall resort to B, prepared to employ the same method as in venesection at A, with the lesion at F. The principle is the same for the veins of the chest, for with D, involved, A, is opened; and so with E, attacked by an inflammation, B, is sectioned. And thus far I agree with you; yea further, if I, should suffer, I shall open the vein A. Thus if any of the intercostal parts denoted by K, shall have begun to be seized by inflammation, I sayA, must be incised. For A, preserves the straightness with them and is sufficiently distant for revulsion and no nearer vein is more conveniently present for the purpose of derivation.

169. *Jugulum*, "the hollow of the neck" in contemporary English, but often used for "the clavicle."

170. The right superior intercostal vein is here incorrectly shown draining into the equivalent of the right innominate instead of the vena azygos. Vesalius's account in the *Fabrica* (1543), Lib. III, cap. vii, p. 282, is more accurate and corrects this error.

Indeed, in what I may differ from you, consider the following: if one or other of the veins signified by L,[171] that is to say some part of the intercostal region of the ten lower ribs is implicated in a phlegmon, will you not, having disregarded your axioms established by Achillic reasoning, cut the vein B, that is, the left axillary [basilic], undoubtedly having decided that you are going to observe the straightness and continuity of the fibres and to incise the nearer vein? It will be proper, by Hercules, that perceiving these things you cut not B, but A. For blood impacted at L, can be lead nowhere except to I, with which all the fibres of L, are in continuity and lie closest. But when I, is involved, A, is opened: and therefore [F2 (v) p.44] one of the veins at L, being afflicted, we must resort to the vein A, for revulsion or derivation alone, or it may be proposed that either be undertaken simultaneously from one or other arm. However, both types of aversion, as we have shown, ought to be performed through continuity and straightness of the fibres, of which there is none of L, with B. Besides the nearness from L, to B, which is principally observed in derivation, is not so great as from L, to A, because I, we see, is nearer to A, than to B. Therefore L, is necessarily even closer to A, than to B.

Consequently, from these considerations it follows that whether we revulse or derivate simultaneously from the arm or whether because of constitutional weakness we seek just to revulse and then, after some interval of time, to derivate, we must always section the right axillary [basilic] vein of the elbow, unless, perhaps, some inflammation should have involved the three upper ribs of the left side. For then I agree with you that the left axillary [basilic vein] must be opened, provided by such a section the nearness and straightness are observed. Further, if some one of the first sect declines in a more debilitated individual to carry out revulsion and derivation at the same time, because of the reduced strength of the patient, and consequently is of the opinion that the vein of the foot must be sectioned to produce revulsion alone, he will always cut a vein at the right ham or outer ankle unless a phlegmon [F3 (r) p.45] attacked some part of the upper three ribs of the left side. This I do not doubt you will easily infer without a more extensive demonstration. For this physician will open by such a section a far distant vein and respect the straightness and conti-

171. Vesalius shows in his figure no hemi-azygos system, the absence of which in no way alters his argument. The hemi-azygos is fully illustrated in the *Fabrica* (1543), Lib. III, cap. vii, p. 280.

nuity of the fibres. Nevertheless I believe it little matters whether he opens the outer [small saphenous] veins or the inner [great saphenous] veins of the ankle, howevermuch the fibres of the outer ankle vein may agree more fully with the azygos vein. Since all acknowledge that both types of aversion ought to be made through the ordinary and larger veins, I have far preferred for satisfactory section the vein of the hams [small saphenous vein] from which we see physicians of today entirely withhold their hand because of the incompetence of the barbers. We have now opened this vessel many times without greater difficulty than the axillary [basilic] or the humeraria [cephalic] in the elbow, and a fine flow of blood followed. Nor shall I discuss with you whether it is useful to cut for revulsion alone, abstaining from derivation on account of the patient's constitutional weakness, confining the section to the right axillary [basilic] rather than to the vein of the right ham [small saphenous], as each part of the question can be strengthened by the best arguments and rational supports. Of course, when supported by various reasons and aided by positive indications, [F3 (v) p.46] I do not hesitate to open sometimes the former, sometimes the latter vein.

If I have convinced you that inflammation in *dolor lateralis* very rarely settles in the three upper ribs of the left side, as you had asked me, I believe that you are in full agreement with what I shall later discuss very briefly with the leaders of the other sect, and which I shall incidentally add. Therefore, in order that I may swiftly dismiss them from my mind and clearly show that they in no wise follow their own principles, one must return to the veins supplying the thorax depicted above, and for the sake of the argument their principles must be assumed to be true. These principles are approximately as follows: when the humours are flowing or about to flow to the diseased part, revulsion ought to be carried out which, according to them, is an evacuation at the greatest distance. Humours which have accumulated and are inherent in the diseased part necessitate derivation, that is, an aversion of the humour from the affected site through the nearest healthy region and consequently an evacuation. Then they add: since these types of evacuation are suitable in all defects arising from fluxions,[172]

172. "Defects" (*vitia*) are collections of noxious humours. They may occur from fluxions or defluxions. A fluxion is a catarrh believed to arise by condensation through coldness of the brain of vapours, distilled crudities of the first digestion or concoction, arising usually from the liver. *Si fluat ad pectus,*

necessarily they must also be regarded as of value in the inflammation of pleurisy. So much so that above all one provides for revulsion when the blood is still flowing and the affection increasing, and after an interval of time, for derivation when it has collected in the suffering part. Accordingly, when about to revulse, [F4(r) p.47] they cut at the elbow the vein opposite to the implicated side, then after the lapse of some time, that which is in line with the affected side, little mindful, by Jupiter, of their premises. As the veins of each foot and the humerariae [cephalic] veins of both arms are more remote from the site of inflammation than the axillary [basilic] of the opposite elbow, they do not evacute the former from the body and with less benefit than the latter.

Therefore, to clarify the subject let us suppose that a youth, the body turgid with blood, whole in strength, is seized by an inflammation of the right side; one of them will immediately prescribe for this that the blood must be discharged from the left axillary [basilic] on the next day, or when he believes the flux to have ceased, he will divide the liver vein[173] [median basilic] of the right arm. And so if the inflammation is in one of the veins F, first they open B, inasmuch as the vein is more distant than A, and then when about to derivate, and as though they were going to cut a nearer vein, they divide A. Likewise, if at G, first at A. Now then if one of the veins of the lower nine ribs of the left side is seized by an inflammation, that is at L, they immediately open A, and after a time, B, infamously forgetting their own principles. Since at the onset [of the illness] the more distant vein, which is B, must be divided according to their view but not A, which is the nearer vein. Meanwhile I shall add nothing here on the straightness of the fibres especially since [F4(v) p.48] distance and nearness more than sufficiently confute and convict them. For I, is more distant from B, than from A, but blood cannot be led from L, other than except through I. Therefore, in the letting of blood L, is necessarily closer to A, than B, which is very readily seen from the preceding figure.

dicatur Rheuma Catarrhus. Ad Fauces Branchus, ad Nares esto Coryza. Blancardus, *Lex. med.*, pp. 138, 220; cf. Levin Lemnius, *De habitu et constitutione corporis* (Francofurti, 1604), Lib. II, cap. ii, p. 125; cap. iii, p. 130; Fuchs, *Inst. med.*, Lib. II, sect. v, cap. viii, p. 407.

173. *Iecoria vena* or liver vein may be the basilic or in practice usually the median basilic. It was so called as it was the vein selected for phlebotomy in liver affections. The more peripheral radicals between the little and ring fingers were also called liver vein and preferred by the Arabs. Cf. text, page 66, and note 175; Paré, Lib. VI, cap. xxi, p. 149.

Accordingly, lest I delay longer in refuting their nonsense, out of their false principles I introduce the following axiom. In whatever part of the side within the thorax an inflammation may be, except in the two intervals of the upper three ribs of the left side, because they believe above all that the further and then the nearer [vein] must be sectioned in pleurisy, the left axillary [basilic] must be divided first, and then the right. Or to the leaders of those factions who recommend initially section of the foot rather than of the contrary side I say, the vein of the right foot must always be opened first, then the right axillary [basilic], unless the two intervals of the above-mentioned ribs are seized by inflammation. But perhaps they will object, why do we in so great a distance pay attention to so trifling an amount of nearness as suggested by you, while at the same time they turn a deaf ear to our discussion on the straightness of the fibres. The leaders of the first sect, denying the straightness of the fibres could also bring this forward. Moreover, I shall reply that [G1 (r) p.49] there is greater nearness to the heart for me, in opposition to them, than there is less contrariness for them, in opposition to their adversaries. In the recent bitter and shrewish dispute over the distance of a thumb's breadth and the pretences and disagreements raised among so many of the leaders of our age, I ask whether they may say that I have brought forward, in addition to the straightness of the fibres, the question of greater nearness? But I am going to show beyond all cavil their insanity, provided that one is now allowed to inspect the table of veins simultaneously.

Therefore, the inflammation is at D, E, F, G, K, or L: that is, in whatever part of the thorax, the distance of one [of these] inflammations, at least in the part from the region corresponding to it, to A, or B, will exceed the nearness of the other by as little as a thumb's breadth. To be more precise, if the inflammation is at F, A, itself is no nearer F, than the vein B, except by the width of the vena cava, which is crystal clear if one directs his attention to the vena cava at the root of the neck. Because the blood must flow from F, to C, that is, to the root of the neck, then from C, to A, or to B, depending upon whether the former or the latter vein is incised. Moreover, this is seen to be related only to derivation in which the nearness of the affected part to the incised vein is most preferably observed. Come, therefore, let us consider [G1 (v) p.50] the distance associated with revulsion. If one of the veins at F, commenced to be seized by inflammation, they will be of the opinion

that they would be incising the more distant vein if they open B, rather than A, notwithstanding that from any point of the veins F, B, is separated no more remotely than A, except by the intervening width of the vena cava, which at the thymus in a man of average build happens to be perhaps the width of the thumb. It is true, unless I am crazy, that this nearness and distance depends upon an exact knowledge of the veins. Wherefore, unless the authors of each heresy admit that the straightness and continuity of the fibres must be preserved in each type of aversion, who does not know that recently they brawlingly debated on the wool of a goat and the shadow of an ass.[174] Because they have striven to teach their adversaries by the expenditure of so much paper and oil that either the distance or nearness of a thumb's breadth must be observed in the length of one and a half, or of two and sometimes of three cubits. Although a skilful manual workman should he so desire, is going to consider three times this distance or nearness in venesection. For I have observed nothing untoward, whether I divided the axillary [basilic] above the elbow or whether I attempted incision one and a half a palm's breadths below the elbow joint, provided that, when the blood flows, ⌜G2 (r) p.51⌝ I compressed the median [median cephalic][175] with the finger lest blood also flowed from the humeraria [cephalic]. On the contrary, together with my fellow-students we have opened in patients of our teachers for the sake of practice and experience two sections in the branches of the axillary [basilic] vein below the middle of the elbow, when by a more remote venesection at the elbow we sought to evacuate the blood more successfully and freely.

Hence, if in venesection in *dolor lateralis* distance or nearness at the elbow alone was the point of the argument under examina-

174. *De lana caprina asinique umbra*, "goat's wool," is a slang expression equivalent to the modern "horse-feathers" and which Vesalius uses elsewhere, cf. note 143. It is of classical origin, and the expression, conveying the same idea, that is, a dispute over a matter of no importance; it is to be found in Horace, *Epistles*, I, xviii, 15. "The shadow of an ass" refers to Demosthenes's story of contention over trifles concerning a man who hired an ass to take him to Megara. The day being hot, the traveller dismounted at noon and rested in the animal's shadow. When the owner appeared on the scene he claimed the right of sitting in the ass's shade, saying that he had let out the ass for hire, but there was no bargain made about the ass's shade. A dispute arose which led to blows. A passer-by told the traveller to move on and leave the owner to walk in the beast's shadow as long as he thought fit to do so. The expression is still current in northern Italy.

175. This precaution is also advised by Paré, Lib. VI, cap. xxi, in blood-letting from the basilic vein.

tion, whatever part of the thorax inflammation had invaded, I should incise the vein of either one or other elbow nor compromise by a hair's breadth. Therefore, by rejecting that noble teaching of Hippocrates on the straightness and continuity of the fibres, do they not seem to you to growl and bark just like dogs among themselves? So much so that by public edict in Spain venesection in line with the affected side has been forbidden physicians. For after tedious debates held on this matter at Salamanca, those who yielded complained to the most illustrious senate of Spain (as you write) that venesection which was "in line" causes no less a disaster to the human body than the schisms of the Lutherans to the human soul. I await the outcome with the greatest avidity [G2 (v) p.52] whatever the decision is going to be in this quarrel; whether or not his Imperial Majesty wishes it to be upheld and confirmed. While you were negotiating peace in Liguria,[176] they have presented to him their opinion opposing such great evils, as they say, whereas you the ἀρχίατροι of Spain might have decided this matter by your own judgment. Meanwhile my father[177] has informed me that certain individuals have strenuously pleaded the affair before the most steadfast clemency of the Emperor by means of supplicating petitions, so that by the sublime authority of his prerogative they may with wall and rampart securely protect their doctrines and opinions against the attacks of their adversaries. He will neither gratify them the least in this nor yield from his ruling because he still preserves deeply impressed on his memory the truly sad death of a prince of

176. In March 1536 the French under Francis I had invaded the Savoyan territory of Duke Charles III, an ally of the Emperor Charles V. The precarious state of peace between the two monarchs was thus ruptured, and thence hostilities continued until an armistice in November 1537. Through the intervention of the pope negotiations were entered into at Nice in June 1538, although there were no personal dealings between king and emperor, and resulted in a ten-year truce. Finally, in the following month the two monarchs were personally reconciled at Aigues-Mortes. Vesalius is, of course, referring to the earlier negotiations at Nice, concerning which he might have been informed by his father, cf. note 177. Cf. Stanley Leathes, "Habsburg and Valois," *Cambridge Modern History*, II (1907), pp. 70-73.

177. Andreas Vesalius, the father of the anatomist, was the attendant apothecary of Charles V, and in this capacity was with the emperor at Valladolid in 1517 and at Mainz in 1521. He appears to have taken part in the third war with the French (1536-1538), and it was during the period of the truce of Nice, cf. note 176, that he presented his son's *Tabulae Anatomicae* to the emperor and opened the way for him to court service, cf. note 94. He died some time before the composition of the *Epistola Chynae* (June 1546). Cf. *Fabrica* (1543), f. *4r; *Epistola Chynae*, p. 197; Roth, p. 60.

Piedmont[178] whom the physicians have lost as the courtiers murmur on the quiet, by dividing the vein at the elbow of the opposite side. For it is reported that intending to revulse and evacuate a moderate amount (that the blood might be reserved for derivation) they induced from what was said to be a simple pleurisy, a double, considering not at all that by such a section more damage was done to the prince, a man worthy of longer life, than if they had inspired that called by themselves a heresy, since some priest or monk perhaps [G3(r) p.53] might have been able by his exhortation to rectify the latter, but not even the whole divine chorus of Asclepiades, the former.

However, give heed, I pray, lest you yield to the opinions of your colleagues. Nay rather, point out to his Majesty the Emperor that so many men of outstanding erudition in Italy, Germany and France who have dispersed the darkness of ancient ignorance are of the opinion that the vein must be divided on the affected side. I am fully confident that you are going to do this, you who are the one and only physician of the leaders of the kingdom, and most beloved of the illustrious of Spain. Perhaps some contentious individual might urge that you zealously promote the affair otherwise, believing that among the affairs of mortals there is nothing more fatal or damnable for the human race than the perverse precepts of physicians. One of the most facetious of our professors somewhat amusingly illustrated this not so long ago at a medical meeting. There was a Swiss priest who canvassed the medical degree of Padua, which, because of the man's ignorance (for never had he saluted medicine, even from the threshold) was refused by the other very dignified professors, examiners of his application. The facetious professor said, on behalf of the priest: since everybody knows that the Swiss people are our enemies,[179] what, I ask, can be

178. The story, as given by Moreau in his edition of Brissot's treatise, and as quoted by many later writers, makes this prince Charles III, Duke of Savoy. However, Sprengel, III, p. 40, pointed out that Moreau was obviously in error since Charles III did not die until 1553 and suggested that the "prince of Piedmont" was the elder son of Charles III, who died around the year 1525. We believe, however, that since Vesalius places the dispute around the time of the truce of Liguria that it is not only a question of seeking a different prince but of moving forward the entire incident. There are two other princes of Piedmont, much more likely as the dismal candidate, Philip II, founder of the House of Nemours, d. 1533, and Ludovico, son of Charles II, d. 1538 in Madrid, cf. Dominico Carutti, *Storia della diplomazia della corte di Savoia*, I (Torino, 1875), p. 285.

179. That Vesalius had a personal feeling of animosity against the Swiss is very doubtful, especially so when it is recalled that he favoured the printing offices

of greater advantage to us and more deadly and calamitous to them, than if we were to slay, in safety to ourselves, [G3(v) p.54] some eminent apostate with a splendid title which we ourselves had deigned to grant?

That I may place a colophon to the argument, it remains for me to demonstrate that the two intervals between the three upper ribs of the left side are very rarely attacked by a phlegmon. Physicians unanimously assert that inflammation preferentially seizes that part which is more open, loose and larger, which receives more numerous and larger veins, and which is otherwise more susceptible, particularly if it should be closer to the more noble parts. That all these [conditions] occur at the intervals of the intermediate ribs, that is, the fifth, sixth, seventh and eighth, who will deny? For it is clear from an anatomy that at these ribs the lining membrane is less firmly attached than at the lower and upper ribs and is more easily elevated, wherefore this region must of necessity be considered more open and loose. Nothing remains to be said on size because one of the sixth order is considered to be larger and longer than two of the upper. Furthermore, reason apart from dissection suggests that they are furnished with more and larger veins. For larger bodies require larger instruments to administer nourishment. Then, that these are more susceptible than the other ribs is deduced thus: in [G4(r) p.55] this specific region those ribs to which great functional activity is entrusted are considered the most robust. That this has shielded the upper and lower more than the intermediate ribs, no one will deny who has seen the attachment of the diaphragm, the most noble muscle of the whole body, to the lower ribs, and the many prominent muscles, unconnected with the intermediate, to the upper. Since the more susceptible are nearer to the heart and lungs, it is not surprising that they suffer from a fluxion more swiftly than the others and so are liable to phlegmon. In addition, certain physicians to diagnose the affected site in pleurisy

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of Basel for his own publications. However, as a young man seeking court preferment it was politic for him to record some such statement as an indication of his good intent from the imperial point of view. The Swiss with their desires for independence had been a thorn in the imperial flesh from the time of the Emperor Wencelaus, and the completion of the Swiss Confederation in 1513 certainly did not lessen the imperial animosity. The Swiss religious revolt, beginning in 1518 under the leadership of Zwingli, the consequent internecine struggle with the Swiss catholics and finally the rise of anabaptist groups, looked upon in their day as extreme radicals, merely provided a new basis for dislike. Cf. J. P. Whitney, "The Helvetic Reformation," *Cambridge Modern History*, II (1907), pp. 305 ff., and bibliography.

apply small bags[180] and emplasters principally to stimulate the middle of the thorax, and in *morbus lateralis* patients are conscious of a sharp pain in the middle of the side, which is a positive indication of the region of the phlegmon. I won't delay over the tension perceived in the root of the neck since we have previously demonstrated that this is also felt here whatever part of the membrane lining the ribs is tense. As you know, I can offer no experience in corroboration of the present topic since in my time the few so far attacked by this disease I have visited only with instructors.[181] However, all [G4(v) p.56] I have correctly diagnosed to be suffering from this disease I have observed to be chiefly affected around the middle of the side, and never have I noticed the patients to have been conscious of a sharp pain in the root of the neck. Nor do I think that the body of the inflammation is more extensive than two intervals of the intercostal region. If, perhaps, some one should say that more intervals are affected simultaneously, I shall reply that a single inflammation never occurs in the upper three ribs on the left, but that the lower parts below are simultaneously affected by it. Wherefore, it will then be no less true that inflammation will occur at L, as well as in the veins G, and therefore, necessarily, venesection in inflammations of these upper ribs is of doubtful value to the physician.

Consequently, resting upon the principles of the first sect, I shall present to you: In All Inflammations of the Sides of the Thorax or of the Thoracic Vertebrae, If the Disease Should necessitate the Letting of Blood, the Right Axillary [basilic] Must Be Cut, which is what I had contended I had to prove. For this opinion of mine on venesection in pleurisy, conceived by no one previously, I might strive to extract from the statement of Hippocrates in the second book of *The Regimen in Acute Diseases* [H1(r) p.57] except it too pointedly contradicts the authority of Galen, which I am

180. *Sacculi* "which are made of the floures of Cammonmill, Dill, Meliot, *Tapsus barbotus*, seed of Flaxe, Fenugreek, *Milium* and bran mixed together, the decoctions of the herbs afore-said being put into bladders, or some other devices," Barrough, Lib. II, cap. viii, p. 83.

181. Clinical instruction in the hospitals of Europe was first undertaken, *circa* 1543 by Vesalius's friend and colleague J. B. Montanus (Della Monte) (*c.* 1489-1551) in the hospital of St. Francis at Padua. Before this date the student could acquire practical experience only when permitted to accompany some physician on his rounds. Vesalius tells us in the *Epistola Chynae*, p. 12, that he so visited the sick in Venice. Apparently Italy was noted for this method of instruction which is highly praised by Reiner Solenander (1524-1601), for many years personal physician to the Duke of Cleves, who studied under Montanus, *Consiliorum medicinalium* (1596), *Praefatio*. Cf. Cervetto, *Giambatista Da Monte* (Verona, 1839).

afraid of disputing almost no less than if in our very sacred religion I were secretly to doubt the immortality of the soul. Indeed, Hippocrates wrote in that book: "When, therefore, the pain extends to the root of the neck, or severe pain afflicts either the arm or breast or parts which lie above the diaphragm, the internal vein of the elbow must be cut."[182] I agree with Galen that this is a genuine aphorism of Hippocrates, but that which is read in the fourth [book] of *The Regimen in Acute Diseases,* where the author of this book contends that the vein of the affected side must be divided "in line" is not Hippocratic,[183] just as I claimed that not the whole book is Hippocratic. I therefore considered that this opinion (as have many others on this book) must be regarded as unworthy of Hippocrates because Hippocrates taught in the second book that the right axillary [basilic] must be cut.

With what objection, I pray, should it be held in less faith that Hippocrates, very studious of brevity, in which the majority of the Greeks and Arabs and all of us today are very remiss, so spoke? For Galen, perpetually explaining himself, [H1 (v) p.58] Paulus, Aetius, Alexander, Oribasius, Rhazes, Avicenna and others of the Arabian cohorts, frequently urge that the axillary [basilic], common median and humeraria [cephalic] must be cut, but do not add right,[184] when nonetheless they unquestionably desire that to be opened. And when they prescribe section of some or other vein on the left, they sometimes add of the left elbow or of the left foot. Besides, in the genuine books of Hippocrates we never find "right" added unless to distinguish "left" with great certainty; however, when he himself indicated "right" we are sure of it. Furthermore,

182. Cf. note 167 for reference to the Hippocratic text.

183. "... if the pain pass upward to the clavicle or the breast, or the arm, the inner vein in the arm should be opened on the side affected . . . ." *The genuine works of Hippocrates,* I, p. 269; Littré, II, pp. 458, 459. While Littré considers this "fourth book" or appendix as nearly or altogether the work of Hippocrates, Adams considers it the work of a disciple who composed it from fragments remaining and from materials collected from the other works of Hippocrates. In addition, to the criticism made by Vesalius, it should be noted that contrary to the rule laid down in the *Regimen,* and to the rule followed by all the other ancient authorities, it directed that venesection should be carried *ad deliquium animi.* Moreover, in inflammatory diseases bleeding should precede purging or any other measure of treatment. Cf. *The genuine works of Hippocrates,* I, pp. 254-255.

184. The significance of "right" axillary had occurred to Vesalius earlier. As pointed out by Roth, p. 95, he went to the length of interpolating the word "*dextra*" in his *Paraphrasis* (1537) whenever Rhazes had called for section of the *vena axillaris.* Cf. capp. 2, 13, 15, 57, 58, 75, for instances of Vesalius's earlier interest in the question of venesection.

our physicians of today write for barber-surgeons very ignorant of illness and the diseases of man: "Let the basilic, median or cephalic[185] be opened for four or five vascula,[186] or (as others say) for nine or ten ounces," whenever they have in mind division of the "right," not the "left."

I might rationally add several things which strengthen my opinion, such as the passage in the book *Of Diseases*,[187] where the author discussing inflammation of the lungs in the *dolor lateralis* without sputum, orders the liver or splenic vein[188] to be opened in the arm whatever part may be καθ' ὁποτέρον ἂν εἴη τὸ νόσημα that is, [H2(r) p.59] wherever the disease occurs. I might make this clearer except that you, very studious of Galen, might consider me rash and impious and particularly since I have likewise to disagree with him again when taking up the origin of the haemorrhoidal veins. At the end of the first table on the veins, when I was reviewing the branches of the vena porta, I wrote in passing that this (speaking of the larger division of the portal) is widely distributed between the membranes of the mesentery and runs to the intestine from which not the least part extends to the rectum. In fact, whether the veins which we call haemorrhoidal are distributed from this [vessel] or from the cava I dare not state positively. However, it will not, perhaps, seem absurd to the observer that the melancholic juice is purged through the branches of the portal reaching to this region.[189]

185. One of the few occasions on which Vesalius employs this terminology. Cf. notes 90 and 173.

186. A vasculum or bleeding-glass was of variable capacity. Vesalius would seem to have in mind one of from two to three ounces but they were often much larger. It was customary among Italian families, especially the Venetian, for each to possess a bleeding-glass which was passed on from father to son as a treasured heirloom. Many of these are exquisite examples of the glass blower's art.

187. "Des maladies," Lib. I, cap. 28, Littré ed., vol. VI (1849), pp. 196, 197. Littré considers it a writing of the School of Cos, of the contemporaries or disciples of Hippocrates. Adams, *op. cit.*, p. 78, suggests the possibility of Cnidian origin.

188. i.e., the right or left basilic vein respectively. Cf. notes 90 and 116.

189. The discussion which follows on the origin of the haemorrhoidal veins and the melancholic juice would seem to the modern reader entirely unrelated to the subject of pleurisy. To the humoral pathologist, however, they are closely associated because of the Hippocratic statement to the effect that those who suffer from haemorrhoids are not attacked by *dolor lateralis* or inflammation of the lungs. Cf. *the epidemics*, Lib. VI, sect. iii, cap. xxiii. It was universally believed that these veins were branches of the vena cava but the subject was not settled for several years when both the internal and external haemorrhoidal veins were described.

In the previous year, while more carefully investigating the haemorrhoidal veins, that I might gratify the wish of an assisting friend, at times[190] troubled by that sickness, I first dissected out three arteries which we clearly found arising from the aorta where it lies on the sacrum. The students standing by asserted that these were elsewhere pointed out as the haemorrhoidals. Indeed, they appeared to be veins because of the large quantity of spiritous blood [H2 (v) p.60] which had gathered in them. For, as you know, frequent compression during dissection of the aorta lying above the os sacrum results in its neighboring branches being distended like veins and rendered of the same colour. Truly, he[191] who in the past was often in the habit of demonstrating these in place of the haemorrhoidals, we can easily show to have been mistaken. For not only are they arteries, but they terminate in the foramina of the sacrum and not in the terminal rectum. For this reason, on approaching the branches of the vena cava, because while at Paris and at Louvain and as yet less skilled in dissection, I believed they gave origin and distributed the haemorrhoidals, I investigated them carefully. But after I had pursued the matter more thoroughly I found the branches were dispersed into smaller and hair-like veins which were finally buried in the skin of the region and the muscle called sphincter. While applying leeches I have often seen larger veins in a man not at all melancholic,[192] and so I did not believe these branches to be the haemorrhoidal veins; therefore I began to wonder whether the haemorrhoidal veins came from the branches of the portal, and soon I followed a branch of the portal, which still remained in the cadaver with the rectum [H3 (r) p.61] and noticed that it clearly extended all the way to the end of this region, however, not in a straight line but following the windings of the intestines to the anal intestine embracing the

190. It was generally held that the melancholic juice was purged at fairly regular intervals from these veins; according to some, at monthly intervals and to others, every three or four months. Cf. Fuchs, *Inst. med.*, Lib. II, sect. v, cap. xxx, p. 480; Barrough, Lib. III, cap. xx, p. 135; Paré, Lib. XIII, cap. xxiv; Lib. XXIV, cap. lxi.

191. This may have been Sylvius (Jacques Dubois, 1478-1555). Paré, Lib. III, cap. xx, states that Sylvius wrote that the haemorrhoidal branch of the portal descended from the mesenteric.

192. Apart from the idea that an individual of melancholic temperament is prone to suffer from piles, his veins and arteries, because coldness has dominion, are small. "But," says Paré, "if at any time their veins seem big, that largeness is not by reason of the laudable blood contained in them, but from much windiness; by occasion whereof it is somewhat difficult to let them blood . . ." Lib. I, cap. vi, p. 11.

end of the rectum. Wherefore I shall remain fully convinced by that anatomy that the haemorrhoidal veins are branches from the portal, until such time as I shall dissect a body which I have surmised to have suffered before death from piles. For our body which we then had under our hands had not yet reached nineteen years and seemed to be of the best constitution and of very intact parts.

Then I carefully considered whether the method of an anatomy could corroborate speculation, and I deliberated whether or not the melancholic juice might be purged more easily and by a shorter route through the portal or through the cava. For if it were evacuated through the cava it would be necessary for it to flow back through the portal to the sinus of the liver [porta hepatis], then ascend through the minute orifices of the portal vein into the smallest branches of the cava (provided that it could crawl to the gibbus of the liver).[193] Moreover, from the origin of the cava and the gibbus of the liver it would have to gather at the sacral bone by a long course and from here into other venules, [becoming] a little smaller and smaller until it was excreted from the region. In addition, [H3 (v) p.62] it would be consonant with the scheme that those affected with haemorrhoids are almost always bothered by black bile. Next, if we believed it to be carried down by the branches of the portal, the route will be easier and certainly shorter. For in my opinion the melancholic juice is sent in this way from the spleen to the body of the stomach rather than to its upper os;[194] thus the spleen might also purge itself into the branch of the portal reaching the intestines along which that juice might flow straight down to the fundament below. Or if a defective spleen was unable to attract the juice, then to one assiduously engaged in dissection it will be obvious that the melancholic juice can fall straight to the fundament. In addition, in those in whom a similar flux of the veins is not suppressed in time, it very often drips down as subcutaneous fluid,

193. The spleen supposedly removed the melancholic juice from the blood. The argument therefore concerns the route of this excrementous humour from this organ *via* splenic vein to porta hepatis, hepato-portal anastomosis, to vena cava and finally to the rectum. The minute orifices or pores were those through which the blood was evacuated from portal to caval system in the digestive process. Cf. Galen, *Nat. fac.*, Lib. II, cap. ix.

194. A portion of the melancholic juice was thought to be discharged from the spleen into the stomach at the gastro-oesophageal junction *via* a mythical vein passing to this region. Vesalius devoted many pages in the *Fabrica* and the *Epistola Chynae* in order to disprove this contention. The black bile served to whet the appetite and strengthen its contractions.

that is to say, ascites or tympanites.[195] Perhaps for no other reason than because the cold juice unattracted by the spleen and by its abundance filling the portal, cools the liver and so the humour is dissolved in water or flatus and, in consequence, evidently induces that subcutaneous fluid.

Furthermore, if in a plethoric individual not subject to the defect of haemorrhoids we sometimes apply leeches to the site in order to revulse the blood, because of a bloody sputum or other eruption of blood from above, [H4(r) p.63] we have observed that this watery blood, such as is usually found in the portal, is separated. But in those affected by defect of the haemorrhoids it flows thick, black and entirely melancholic. As far as I am concerned these things seemed clear enough to me; however, I have noted them as fearfully as I could both in the tables and in the four books of the *Institutiones Anatomicarum*[196] of Johann Guinter which we re-issued with many emendations, as I preferred merely to touch upon the subject matter rather than to harp upon it like a certain scoliast, desirous above all, whether or not my opinion be accepted, that in the future students should consider it.

For similar reasons I also quietly expressed my doubts therein on the most positive theory of all physicians, whether the arteries and the heart beat with the same rhythm as the pulse, for the motion of the heart and the arteries appeared to me from several arguments clearly at odds and contrary. When the heart is contracted it diffuses the [vital] spirit into the aorta and the blood into the artery-like vein [pulmonary artery], and this motion of the heart is συστολή [systole]. When, however, the sinuses [ventricles] of the heart are dilated, the heart takes in air from the vein-like artery [left atrium][197] and blood from the cava, which motion of the heart is characteristically διαστολή [diastole]. [F4(v) p.64] But when the arteries are dilated, we believe that they distribute the vital spirit to the body and are themselves filled by that spirit from the heart.

195. Ascites and Tympanites were classified under preternatural tumours, and, due to incomplete concoction from dissipation of the native heat through some cold distemper, especially phlegm, an arrest of the metabolic process. Cf. Galen, *Nat. fac.*, Lib. I, cap. xi; Fuchs, *Inst. med.*, Lib. III, sect. i, cap. xxvi, p. 627; Paré, Lib. VIII, capp. xi and xii.

196. Vesalius, *Inst. anat.*, cf. Lib. I, pp. 19, 21, 31.

197. *Arteria venalis*, vein-like artery, is usually translated as pulmonary vein or veins. This is, however, not quite correct as the expression corresponds to what is now the left atrium. The heart was regarded as a two-chambered organ and the left atrium as the stem of the pulmonary veins. Cf. note 153 and *Fabrica* (1543), Lib. VI, cap. xii.

When, however, they are contracted, we consider it manifest that the sooty excrements[198] are expelled. Consequently it remains that the motions of the heart and arteries are contradictory and contrary. To a certain extent this can be put to the test by the dissection of living animals if one hand is applied to the artery lying on the sacrum and the other grasps the whole of the intact heart.[199]

I shall omit for the present the movement of the head as well as the muscles and nerves which at my modest suggestion students would do well to pursue. Indeed, the gods favouring, we shall personally discuss this subject more freely at another time.[200] Meanwhile it will be your task, learned man, to reflect in fairness and equity on these matters and with that same cheerfulness and penetration with which on other occasions you have received other matters of your Wesalius to defend, and as soon as they have been examined by your accurate judgment, to write me at once. However, I wish you to read this as written hurriedly and confusedly rather than with precise care, and you will notice it is communicated to you but not to all. Accordingly, if the discourse anywhere flows raggedly and seems disjointed in its several parts, you will forgive me with your singular humanity.[H5(r) p.65]

With regard to the rest of my studies, almost nothing remains for the present. We have now also finished the two tables on the nerves;[201] in the first, the seven pairs of cranial nerves[202] have been

198. Sooty vapors is the remnant of earthy nature derived from the air after its cold quality has been removed by the heart. This residue is expelled during expiration as a partially combusted and sooty vapor, cf. Galen, *De usu partium*, Lib. VI, cap. ii, col. 521D; *Methodus medendi*, Lib. V, cap. v, col. 204B.

199. This important observation in the early history of the circulation, that cardiac systole is synchronous with arterial expansion, is incorrectly ascribed by Singer, *The Evolution of Anatomy* (New York, 1926), p. 142, to Realdus Columbus (1516?-1559). Vesalius's earlier statement reads as follows, "For the heart is the origin and beginning of native heat, the pulses and the vital faculty whence it may be queried, not unjustly, whether the pulse of the heart and of the arteries be the same. Wherefore I say that the transmission of materials from the heart is certainly performed through contraction, as intromission through dilatation. Observation in the dissection of living animals also demonstrates this obscurely." Vesalius's experimental proof is presented with some hesitancy as it attacks one of the most solid dogmata of the Galenical physiology.

200. Vesalius fully discusses the movements of the head in the *Fabrica* (1543), Lib. II, capp. xxviiif and again in the *Epistola Chynae, passim*, for they were an important argument in the support of his opinion that Galen had not dissected man. This was also one of the points on which Sylvius, in his defense of Galen, violently attacked Vesalius.

201. The two illustrations mentioned are identified by Roth, p. 99, n. 2, as those found on pp. 319 and 332 of Lib. IV of the *Fabrica* (1543). The first of these

drawn, and in the other all the small branches of the dorsal medulla, expressed. I consider that these must be kept until we undertake the tables on the muscles and on all the internal parts. We have tried in the present year a plan by which this can be done very conveniently, but in such a crowd of spectators that it was entirely impossible to complete the task. If there existed here the opportunity for bodies which once could be obtained elsewhere, the studious would no longer need to work without profit, since so many celebrated men encourage and invite me daily to undertake the field. You may not easily believe that besides others on my behalf, Marcus Antonius of Genoa,[203] first professor of philosophy both at our Academy and of the whole of Italy, distinguished glory and ornament because of his most complete knowledge of

shows the "seven" cranial nerves in their entirety and the second, the distribution of the special nerves from the medulla. Otherwise there is nothing to suggest that these are the specific figures to which Vesalius has reference. We believe that Roth was misled by superficial appearances. At the end of Lib. IV, is a large figure printed on the *verso* of a double leaf carrying the signature p^4, unnumbered pp. 353 and 354. It is entitled *Nervorum delineatio, quae septem parium nervorum qui a cerebro et dorsali medullae initio pronascuntur, ortus proponit, et distributionem seriemque omnium quae a dorsali medulla in dorso complexa originem ducunt, pulcherrime refert, uti huius figurae characterum Index docebit.* In size this illustration corresponds closely to those of the *Tabulae Anatomicae* (1538). The style of the illustrations is more primitive and differs from others in the *Fabrica* (1543). On close inspection it is obvious that the brain carrying the "seven" cranial nerves has been cut from another block and added by inset to complete the figure. The wording of the title together with those features lead us to believe that the two figures here mentioned in the text have been combined to form this illustration of earlier type. In the text of the *Fabrica* (p. 388) it is stated that this oversize plate, together with that on m3, were prepared for the *Epitome*.

202. The classification, course and distribution of the cranial nerves were very confused until the end of the eighteenth century. Following Galen, the "seven" cranial nerves are approximately as follows: 1. optic; 2. oculo-motor and abducens combined; 3. and 4. the trigeminal; 5. the acoustic and facial combined; 6. glosso-pharyngeal, vagus and spinal accessory together; 7. the hypo-glossal. Cf. *Fabrica* (1543), Lib. IV.

203. Marc Antonio of Genoa, if we may trust Vesalius's judgment, was apparently a young man of considerable merit, and probably of engaging personality. That there is almost no information to be had concerning him may be due to the fact of his early death (1551) before he had gained fame outside the circle of his friends. His father Nicholas was a professor of medicine at Padua, and possibly this fact may have led to friendly relations with Vesalius. It is interesting to note that Marc Antonio was treated for pleurisy by Montanus, *Petri Foresti Observationum . . .* (Rothomagi, MDCLIII), Lib. III, Observat. XXVIII, scholia 6. Roth, p. 120, n. 5, quotes Scardoneus, *Historia de urbis Patavii antiquitate* (1559) as calling Marc Antonio the "prince of Peripateticians of this age," but this judgment, like that of Vesalius, appears to have been exaggerated. Vesalius speaks of him in the *Fabrica* (1543), Lib. I, cap. viii, p. 35; Lib. VII, cap. xvii, p. 651.

philosophy, medicine and letters, spurs me on to undertake this task and gives me inspiration. Indeed, unless I shall have complied with his wishes, I shall scarcely be able to vindicate myself from the charge of impiety and reproach [H5(v) p.66] because he, with singular candour of mind, is a most kindly man and very loving of foreigners, and welcomes me and conducts himself to me just as another parent. Wherefore, if the opportunity of bodies offers, and Joannes Stephanus,[204] outstanding artist of our age, does not refuse his services, I shall by no means evade that labour. Meantime, farewell, and love me greatly as you do.

Padua, from the house of the sons of the most illustrious
COUNT GABRIEL OF ORTEMBURG,[205]
January 1, 1539,

Most devotedly to your excellency
ANDREAS WESALIUS.

The End//

H6(r) p. [67]

BASEL
IN THE SHOP OF ROBERT
WINTER, MONTH
of April Year

H6(v) p. [68]

MDXXXIX

H7(r)

[Imprint]

[Blank]

204. Jan Stephan van Kalkar (1499-1546), the eminent pupil of Titian, was born in the duchy of Cleves and died in Naples. He made the illustrations for the *Tabulae Sex* and the *Fabrica* under the specific direction of Vesalius who at times found his artist difficult to handle although he never failed to recognize his ability.

205. Roth, p. 118, n. 8, states that "the house of the sons of Count Gabriel ab Ortemburg" was unknown to the directors of the Civic Museum in Padua. Likewise the late Harvey Cushing attempted with the aid of the civic authorities of Padua to identify the house and similarly failed. The first Count of Ortenburg (Lower Bavaria) was Rapoto I, d. 1190; however, the County of Ortenburg was not recognized as a sovereign state of the empire until 4 March 1573.

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