PICTURING THE BOOK OF NATURE

Image, Text, and Argument in Sixteenth-Century Human Anatomy and Medical Botany

SACHIKO KUSUKAWA

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For Keith M. Ball

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INTRODUCTION

In the sixteenth century, it became common for medical students across Europe to learn about plants in the summer and to attend dissections in the winter. Though today we may regard botany and anatomy as distinct disciplines, in the past they both belonged to the study of medicine. As other historians have already noted, medical botany and human anatomy came to striking prominence in the sixteenth century as descriptive studies emphasising firsthand experience.[1] The establishment of new locations of learning—the botanical garden and the anatomical theater—attests to the status these fields attained at universities.[2] Furthermore, handsomely illustrated books such as Leonhart Fuchs's *De historia stirpium* (On the history of plants, 1542) and Andreas Vesalius's *De humani corporis fabrica* (*On the Fabric of the Human Body*, 1543) brought visible prominence to the study of plants and of anatomy. These two landmark publications and several other printed books form the bases of this study, which is concerned with the role of pictures in printed books in the formation and establishment of new knowledge about nature.

It may seem rather obvious to expect pictures in books about medical botany and anatomy to have something to do with the descriptive and observational character of those fields. Yet the connection between observational, descriptive, and pictorial practices in the development and production of scientific knowledge is far from simple or transparent.[3] It is impossible to argue, for example, that the increase in the number of illustrated books in the fields of medical botany or anatomy in the sixteenth century is an indication of the rise in the number of observations, given the copying practices of printers in that period. Pictures are of course visual, but understanding what exactly they have to do with observation or description requires careful investigation.

It is not my aim here to be comprehensive: there already exist several compilations and catalogs surveying such genres of illustration as "botanical," "anatomical," or even "scientific."[4] Those catalogs, useful as they are, were not compiled for the purpose of asking how images, texts, and objects were related in the original publications, nor for finding out how pictures might have been useful for the scientific and scholarly ambitions of a sixteenth-century student of nature. These are the questions I address in this book.

I focus on printed books in this study. Though books were not the only means by which knowledge could be acquired or disseminated in the sixteenth century, they were the primary medium by which learned physicians learned about their subject, and they in turn expressed the views of those physicians. The printed book became not just an emblem of their training and status, but also a necessary means for them to present their arguments in medical botany and anatomy, even when they had directly observed plants and dissected bodies. In the first part of this volume, I discuss the various factors that governed the material production of the printed book. Without understanding the basic conditions that had to be fulfilled for any book to be successfully printed at all, it will be difficult to appreciate fully the determination and effort needed for authors such as Fuchs or Vesalius to bring their projects to fruition. Moreover, as I discuss in parts 2 and 3, the fact that learned scholars envisaged their knowledge to be presented in printed books affected the way they devised text-image relations, and more crucially, the way they set up their arguments and even their methods of study. Books cannot be treated as mere containers of ideas.

A comprehensive discussion of scientific imagery would ideally draw on images from a range of media, sources, and disciplines. What I offer here is a study from the perspective of one group of people (university-educated physicians), one type of medium (printed books) and investigations into a relatively small part of the natural world (plants and human anatomy). Even within these parameters, I have been unable to discuss every illustrated book on medicinal plants or on anatomy published in the sixteenth century. Nor have I dealt with every university-trained physician who could draw well, or with every medical author who did not approve of pictures.[5] Instead, I have chosen authors who wrote down explicitly (and thus helpfully for us) their views about the usefulness of pictures for knowledge—views that were invariably articulated through debates and controversies which, in turn, highlight the variety of positions that were available in the sixteenth century regarding the usefulness and function of pictures in scholarly books about nature. The benefit of focusing on a few examples is that it allows me to examine closely the specific ways in which pictures became integral to the object, method, and authority of scholarly knowledge about nature in the sixteenth century.

Parts 2 and 3 are centered, respectively, on Fuchs's *De historia stirpium* and Vesalius's *De fabrica*, which were published within one year of each other. I have chosen these books not only because they are the best known among the illustrated books of the period, but also because the authors are, to the best of my knowledge, the first in the period to write explicitly about the usefulness of pictures for forming knowledge about nature *and* to actually make their pictures integral to that knowledge. This was certainly not the first time that printed books about medicinal plants or anatomy included pictures, but what was remarkable about these books was the extent to which the authors made pictures central to their understanding of nature such that without the images, their claims about knowledge would not have made sense. Nor would the images have stood alone with transparent meaning. A skillful combination of text and image led to the creation of a generalized object of study; it reflected the authors' method of investigation and lent authority to their points of view. Fuchs and Vesalius developed, I suggest, a "visual argument" in their pursuit for knowledge.

I discuss works on medicinal plants in part 2, and part 3 is centered on books about human anatomy. This division should not be regarded as an indication of mutually exclusive specializations in botany and anatomy, however. After all, Vesalius was interested in elucidating the medicinal virtues of the "China root," and he sent a sample of the "rha ponticum" to Fuchs (see fig. 6.3); Fuchs, in turn, compiled a textbook on anatomy, drawing largely on Vesalius' *De fabrica*.[6] Medical botany and anatomy were among the myriad of topics a university-educated physician had to master.[7]

There are, in fact, striking similarities between the works of Fuchs and Vesalius. Both works arose out of earlier controversies with other learned physicians—in Fuchs's case, a controversy with Sébastien de Monteux (1518–1559) over the use of external features called "accidents" (see chapter 5 in this volume); for Vesalius, it was the debate on bloodletting triggered by Pierre Brissot (1478– c. 1525; see chapter 9). Both Fuchs and Vesalius then used pictures to make generalizing arguments, discuss complete or ideal objects, and claim authority in matters of knowledge (see chapters 5 and 10). Their use of pictures was then criticized by other university-educated physicians such as Janus Cornarius (1500–1558) and Jacques Dubois (1478–1555; see chapters 6 and 11 respectively). Such a parallel indicates that medical botany and anatomy underwent similar developments—which should not be surprising, given that they were both part of medical knowledge and were both being discussed by university-trained physicians.

As a counterpoint to Fuchs, I discuss in part 2 the work of Conrad Gessner (1516–1565), whose drawings for the unpublished *Historia plantarum* afford us a glimpse into the use of pictures in the process of forming knowledge of plants before publication (see chapters 7 and 8). Here again, the printed book remained an important unit of knowledge for Gessner and shaped the way he used and organized his drawings. In part 3, Bartolomeo Eustachi (1514–1574) offers an interesting contrast to Vesalius's pictures of idealized bodies, as Eustachi's engravings of individual organs embodied instances of general "laws of nature" (see chapter 11). The use of pictures in scholarly books could be motivated by other concerns, such as a desire to become the most authoritative judge of a "botanical republic," as in the case of Pietro Andrea Mattioli (1500–1577), or to offer a tabular reading of Vesalian anatomy, as in *De corporis humani structura et usu* (On the structure and use of the human body) by Felix Platter (1536–1614; see chapters 6, 8, and 11). The many different attitudes toward the value of pictures for knowledge about nature and the various and sometimes ingenious uses of pictures for that purpose suggest that there was not yet a single visual regime for scientific studies of nature in this period. Rather, it was a time of experimentation and rich plurality.

Just as medical botany and human anatomy had much in common during the sixteenth century, so are there also some caveats and premises that apply to both. It is worth spelling them out here: the kinds of inferences we should be wary of making about the images themselves, the historical categories that are relevant to pictures of nature in this period, and points about knowledge and learnedness that were accepted by the majority of university-educated physicians. It is important to bear these points in mind at the outset, since they clarify why—despite the fact that I deal extensively with images, many of which are naturalistic—my discussion does not center on artistic styles, on the actual objects observed, or on dramatic breaks from the past.[8]

"Naturalism" in Art

This period is noted for its spectacular "naturalism" in works of art. Naturalism, the representational technique claiming to match optical experience based on the rules of perspective, is characterized by features such as points of view and shading.[9] Its historical origins have been variously debated, but art historians are generally agreed that caution is needed when drawing inferences from pictures and drawings that deploy naturalistic techniques.[10] Take, for example, a drawing by Leonardo da Vinci (1452–1519) of a dissected female (c. 1508; fig.

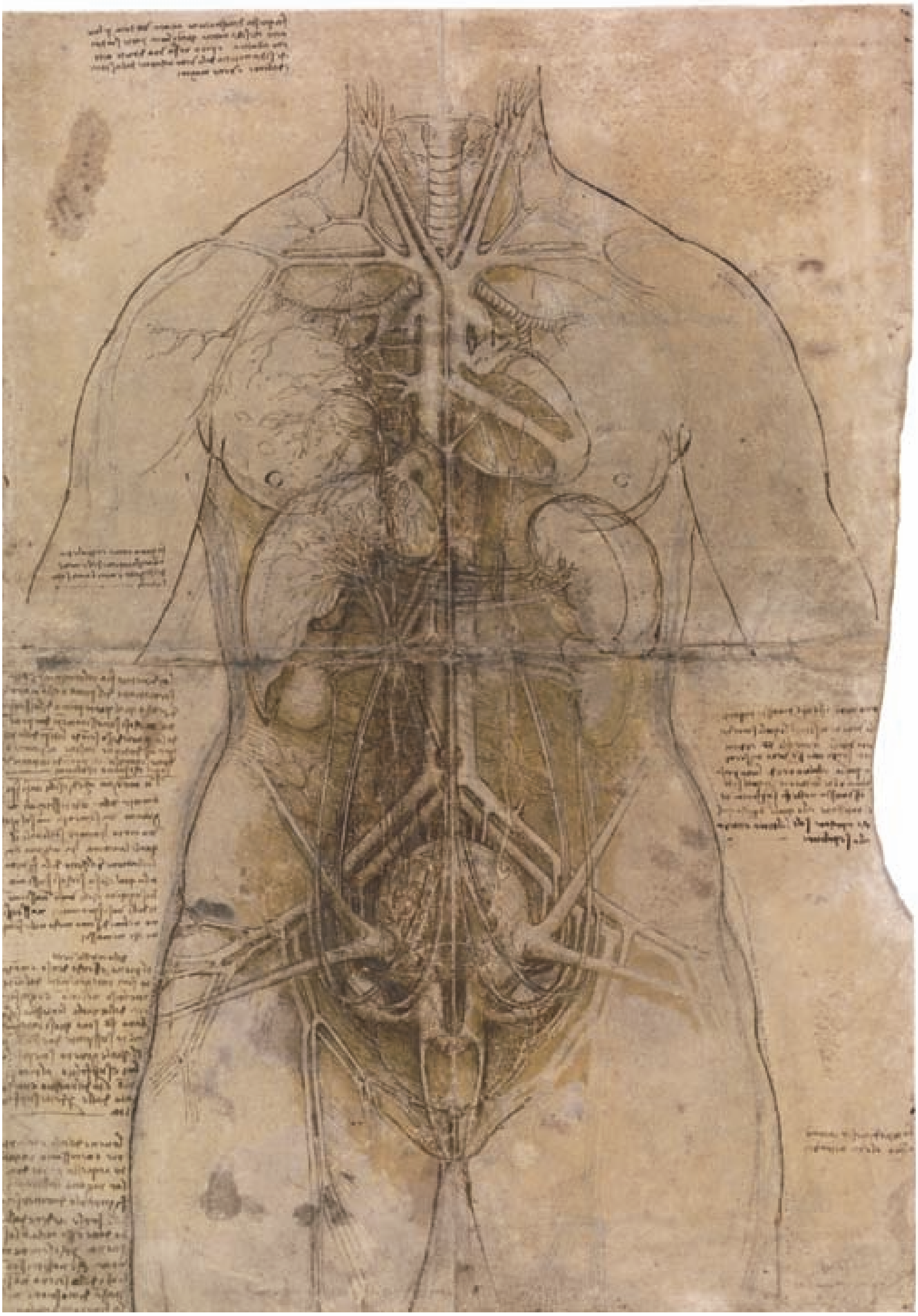


Fig. 0.1 Leonardo da Vinci, *A Dissection of the Principal Organs and the Arterial System of a Female Figure* (c. 1508). RL 12281r, Royal Library, Windsor Castle. All rights reserved © 2011 Her Majesty Queen Elizabeth II. The sixteenth-century physician Girolamo Cardano called Leonardo's anatomical drawings "very beautiful and most worthy of such a famous artist, but indeed useless."

0.1).[11] A modern evaluation of the anatomical accuracy of this drawing runs as follows:

> It is quite impossible that Leonardo could have drawn this illustration at a time of making or viewing a dissection, or even from memory. Much of the anatomy is fanciful, and some is certainly derived from that of animals, such as the tributaries of the superior vena cava, the relative positioning and shape of the kidneys, the banding in the heart ventricles, and the arrangement of the branches of the aortic arch. . . . The iliac vessels are poorly portrayed, being scarcely human. . . . Perhaps what strikes one as the most puzzling part of this illustration are the two clearly delineated structures originating from a common attachment either side of the uterus. These are a triumph of imagination, or perhaps dogmatic belief, over reality. They are too prominent to be round ligaments, which in any case are not bifid.[12]

Though the sketch is rendered naturalistically—indeed, superbly so—the anatomical details depicted as such cannot have been "real" in the sense that Leonardo had actually encountered such a dissected female body. What was represented on paper was guided by what he thought the inside of the body of a pregnant woman ought to look like; it was an anatomy seeking to visualize the inner workings of the microcosm.[13] Although we do not know precisely which drawings he had in mind, the contemporary physician Girolamo Cardano (1501–1576), who had seen some of Leonardo's anatomical sketches, described them as "very beautiful and most worthy of such a famous artist, but indeed useless; he did not even know the number of the intestines. He was a pure painter, not a *medicus* or a philosopher."[14] Cardano, of course, would not have known Leonardo's interest in geometric proportions and harmony, his quest for the mechanical principles underlying nature, or his efforts to apply nature's principles (as he understood them) to art.[15] Leonardo, furthermore, combined his perspectival and naturalistic skills in various ways for imaginative play, knowledge production, and visual record.[16] This is all the more reason why we should be cautious in inferring what "naturalistic" drawings, even by one of the most brilliant artists of the time, might represent.

Roughly contemporary to Leonardo's anatomical sketch is a watercolor (fig. 0.2) by Albrecht Dürer (1471–1528) commonly known as the *Large Piece of Turf* (1503).[17] As Karen Reeds observed:

> The plants are observed from the vantage point of, say, a hare, close to the ground, peering upward at the tallest grasses. The botanical clarity of the scene is enhanced by what is not there: Dürer had tidied away the usual litter of dead grasses, leaves, and moss. The muddy ground from which the plants spring

Fig. 0.2 Albrecht Dürer, *Large Piece of Turf* (1503). Watercolor, 40.8 × 31.5 cm, inv. no. 3075. Albertina, Vienna.

> is rendered with a loose wash that makes the controlled brush and pen lines of the plants stand out all the more distinctly. Using a technique found in his woodcuts and etchings, Dürer models each plant in its own shadows—none casts a shadow on any other, even where the low sunlight catches the rosette of the unfolding plantain. The clarity of the composition and the perfection of each plant within it support the argument... that Neo-Platonism had strongly influenced Dürer's vision.[18]

Dürer's sketch shares with Leonardo the technique of "hyperrealism" by emphasizing key features and selecting out potential optical confusions.[19] Such a selection, in Dürer's case, was directed by a sense of something beyond appearances in nature, as he believed that a good painter should render visible the Platonic idea latent in his mind.[20] Dürer also had an interest in understanding the patterns underlying the workings of nature; he studied proportional relations in the human body, and sought to put the artist's craft on a more certain foundation in geometry.[21]

Leonardo and Dürer were superb masters of "naturalistic" techniques that could be deployed for various purposes; they were curious about the principles underlying nature, and they sought to establish art on a more generalized footing. In short, these were skilled and informed draftsmen of nature, but neither their techniques nor their subject matter (the human body and plants) guaranteed that the object depicted was observed directly and represented faithfully, or that the pictured object existed at all. It would simply be unwise to presume that "naturalistic" pictures are transparent windows onto nature and natural objects of the past. They are not the premodern equivalents of photographic shots of actual, individual specimens, which record specific moments and accidental details like torn leaves, bent stems, grit or dirt, without correction or omission.[22]

"Counterfeit"

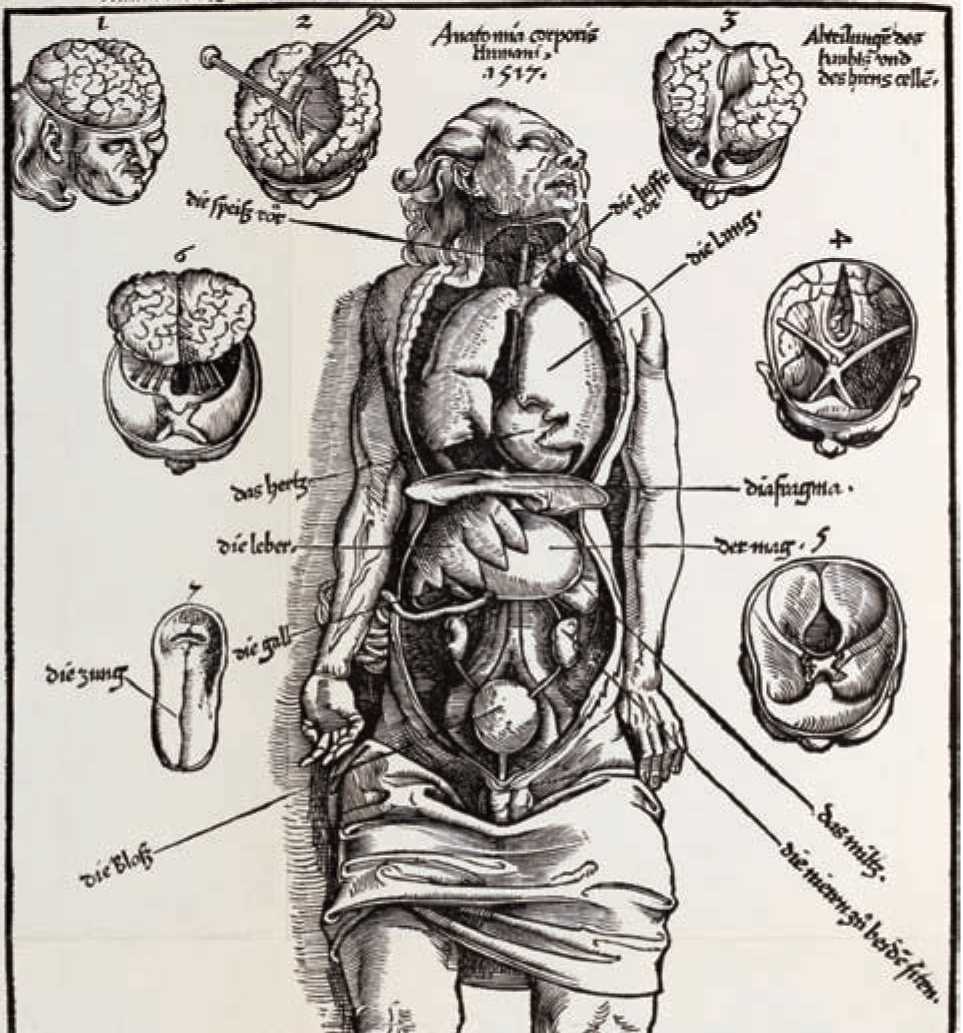
The fact that painters' skills and techniques are not necessarily reliable registers of observation or of actual objects does not mean, however, that nobody depicted individual objects, or that there was no discrimination about types of representation in this period. As Vincenzo Danti (1530–1576) noted later in the sixteenth century, there were two ways of depicting nature: "The difference . . . between imitation and *il ritrarre* [simple copying] will be that the latter presents things perfectly as they are seen and the other perfectly as they ought to be seen."[23] The type of picture depicting the details of a single object "as they were seen" was often called "counterfeit." Counterfeit, Peter Parshall has argued, was a type of portrait that became popular around 1500 in northern Europe and was frequently found in printed broadsides.[24] This type of portrayal is better defined by its function than by its style or object: it claimed to convey the truth of a particular person or event from which the viewer was separated in space and/or time. The inscriptions that accompanied the image frequently gave particulars of the time, place, and specific details of the object or event described. Such provision of details was meant to work perhaps in a manner akin to that of what was known as *enargeia* in classical rhetoric, in which the vivid, particular details helped the listener feel as if they were firsthand witnesses to an event.[25] Though such printed broadsides of singular events and unusual objects became increasingly popular and were avidly sought in the sixteenth century, the impact of "true" singular objects or occurences on the study of nature was to some extent limited.[26]

The two publications on anatomy and medical botany that were noted for their naturalistic images prior to the works of Fuchs or Vesalius both belong to the category of "counterfeit." One was a broadside—in fact one of the earliest printed images—of a dissection, carried out in 1517 by Wendelin Hock; the other was Otto Brunfels's *Vivae eicones herbarum*, the German edition of which was entitled *Contrafrayt Kreütterbuch*.[27] It is worth reviewing these publications in some detail, as they helpfully highlight some of the limits posed by "counterfeit" images, and why Fuchs and Vesalius chose to go another way.

The broadside of the body dissected in 1517 (fig. 0.3) had the caption, "Counterfeit of anatomy of the internal members of man explained in Strasbourg by the learned physician and doctor of medicine, Wendelin Hock of Brackenheim, and explored in the presence of many barbers and surgeons."[28] Hock was most probably a surgeon who had studied medicine at Bologna and practiced possibly in Rome before moving to Strasbourg around 1513.[29] In a tract entitled *Mentagra*, published by Johannes Schott in 1514, Hock argued that the "French Disease" then ravaging the German lands was actually a compound disease, and that part of it could be identified with what Pliny the Elder had called "mentagra."[30] This was a typical choice of subject for a medical man with a university background, for the French Disease was a topic on which many a learned doctor had written since the 1490s. If Hock had expected that offering a new approach to its treatment might lead to preferment, as his dedication of the book to Duke Ulrich of Württemberg (1487–1550) suggests, his hope appears to have been in vain. Perhaps the next step for Hock was to attract further attention by staging a public dissection, just like the ones he might have attended in Bologna.[31] Strasbourg at that time had no university, so a student audience was out of the question.[32] Instead, as noted on the broadside, the dissection took place in the presence of barbers and surgeons, who would have been more comfortable with the vernacular language than with Latin. This image is one of the earliest recorded cases of a public dissection in the German lands. The positioning and

Ein contrafact Anatomy der inneren glyderen des menschen

durch den hochgeleerten physicum und medicine doctorem Wendelinū hock von Brackenaw/zů Straßburg declariert/und eygentlich in beysein viler Scherer und Wundärtzt gründtlich durchsůcht.



Ein spiegel biñ ich gschickter ärtzt/
  Eröffnet sonder allen schmertz/
Zů gůt/welichem underrichte
  Des menschen inner glyder pflicht.
Uff dz mit läßß/purgatzen/tränck/
  Sirup/latwergen/pillul gschwänck/
In wundartzneyung desßglich mer/
  In pflaster/salbē/wund/stich/gschwär/
Materialien mercklich vil
  Nit überschest dich in zyl/
Erlernest vor start/art/natur
  Eins yeden glyds. als mein figur
(Mit gzeügnuß sag ich dir fürwor)
  Hans wächtlin hat recht bey eim hor
Ab contrafayt kunstlich und wol.
  Den hirnschedel man teylen sol

Und sägen noch der rondigkeit/
  Zwey fell dañ findest wol bereit
Dorīn das hirn behalten ist.
  Sein cell und hölen merck zůr frist/
Gemein vernunfft/ imaginier
  Im vordern teyl rů went mit zier.
Im mittel ist bedächtlich krafft.
  Memory würt dahinden bhafft.
Der geist hat wunderbarlich gäng/
  Vil adern ußgond mit eim gdräng/
Als uß eine wurtzel prossilent schößß.
  Das hirnmarck hat auch sein gefößß
Und stigt ab von der hindern cell
  In ruckgrot do es hat sein quell.
Die zung der sibent zyffer zal
  Uff beyden speyß und lufftrör fal

Ir mundtloch/und den lüppel hat/
  Ir würckung wunderbar/und statt/
Als von der böß/gůts gode uff/ab.
  Lung/hertz mit brustripp seint vergrabē/
Beschlossen mit diafragmate.
  Mag/leber/miltz/gall/und dorzů mer
Zwen nyeren beyder seyten glich
  Der blossen thůnd vereinigen sich/
Der moß verordnet all mit ein/
  Dz keins one ander stand allein/
Geb leblich krafft/hilff/würckung do.
  Als dañ klorlich anzöigt Guido/
Dē liß verteütscht im Feldtbůch frey/
  Danckbar würst sein sey wie im sey.
    Gedruckt zů Straßburg
      durch Joannē Schott.

shading of the head and arms contribute to a naturalistic portrayal of a dissection scene, to which are added the German names for the esophagus, windpipe, lung, heart, liver, diaphragm, stomach, gall bladder, spleen, kidneys, bladder, and tongue, together with depictions of six different stages of the dissection of the brain. By introducing into the German lands the custom of dissection of one of the most distinguished medical faculties in Europe, Hock was advertising with this broadside his accomplishments, as confirmed in the caption: "learned (*hochgelehrte*) doctor."[33]

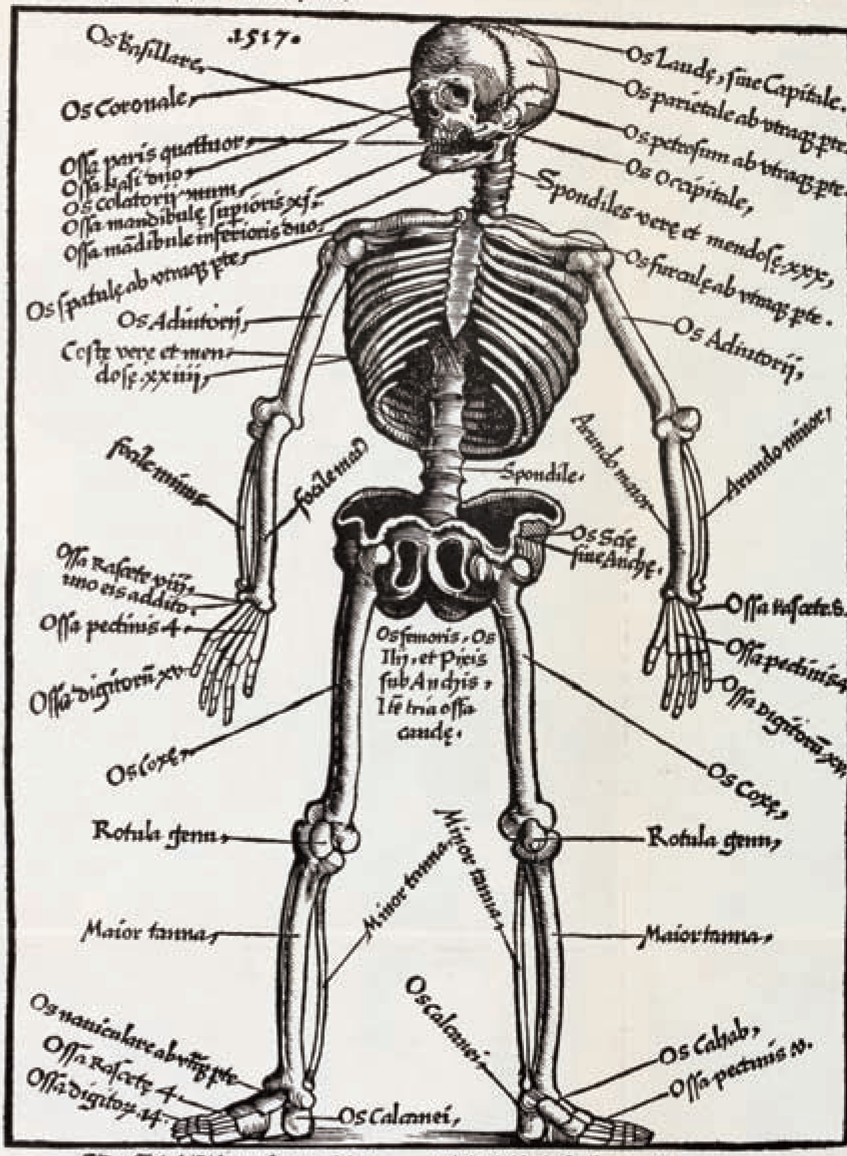
This print formed a pair with a broadside of a skeleton, entitled "Counterfeit of Death" (fig. 0.4). This picture was not drawn after an actual skeleton: the caption explained that it had been taken from a stone carving by Nicolas Hagenauer on the memorial in Saverne (Zabern) of Prince Albrecht, bishop of Strasbourg.[34] Albrecht, who was bishop between 1478 and 1506, may have commissioned the carving from Hagenauer, better known to us for his sculpture for the Isenheim altar.[35] The broadside gave the German names and numbers of the bones of a human skeleton, most likely based on an earlier broadside associated with Richard Helain, who had been dean of the faculty of medicine at the University of Paris and physician to Charles VIII in the late fifteenth century.[36] This is a good example of how a "counterfeit" could be copied from other representations rather than having to be drawn directly from the original object.[37] This "counterfeit" of the skeleton was a more traditional image than that of Hock's dissection scene. The text under the picture of the skeleton offers a moral reflection on the transient nature of life through contemplating the suddenness and inevitability of death. Skeletons were a common symbol for death, as typified in the motif of the "dance of death," and so the message warning of the suddeness of death would have been familiar to many.[38] The traditional image of death was made familiar and concrete through its association with the sculpture for Albrecht's tomb in nearby Saverne, perhaps to keep up a balance with its counterpart of a more recent, local death.

Fig. 0.3 Broadside, printed in 1517, entitled "A Counterfeit Anatomy," with German text and Schott's monogram underneath. The shading along the contours of the limbs, the organs, and the folds of the loincloth adds to their appearance of three-dimensionality and is consistent with the light source being to the right of the image, as suggested by the shadow cast along the left outline of the body. The tilt of the head to the side, the hollow facial expression, and the awkwardly stretched right arm are additional details that bring vivid concreteness to the image of a dead man's body. The figures around the body depicting different stages of a brain dissection suggest that the artist was present to follow the process. From H. von Gersdorff, *Feldtbuch der Wundtartzney* (Strasbourg: J. Schott, 1517); before a1r, Leopold-Sophien-Bibliothek, Überlingen, shelfmark O6*.

The verses printed under Hock's dissection scene also advertised a book that the printer Schott was about to publish, namely the *Feldtbuch der Wundartzney* (Manual of surgery).[39] Written by Hans von Gersdorff (d. 1529), who had been a medical assistant to the Strasbourg troops in the 1470s, the book dealt with the treatment of wounds, leprosy, and human anatomy mostly based on the work of Guy de Chau-

Ein contrafacter Todt mit sein beinen fugen vnd glyderen

vnnd gewerben/vß beuelh loblicher gedächtnüß hertzog Albrechts bischoff zů Straßburg/durch meister Nicklaus bildhawer/zů Zabern worlich in stein abgehawen/vnd noch anzöig rechter gewisser Anatomy mit sein latinischen namen versificiert.



❡Der Todt biñ ich grausam vngstalt/
  Vnd doch des lebens vffenthalt.
Wann ich fleisch/ adern leblich trag/
  Behalt all glyder vest on klag.
Allein so ich stand offenbor
  Beraubt blůts/fleischs/hut/dotzů hor/
So hatt all welt ein schüh an mir.
  O mensch betracht dein werd gezyr/
Wie hoch du bist geschöpfft von Gott/
  Vnd dich so ellend würffst ins kot
Fleischlicher bgird/der laster vil/
  Zergängklich als der schnee mit wyl.

Kein bleiblichs hast vff erden nit/
  Rychtumb/schön/gwalt/vnd all fürbit
Dich mögen bhalten in kein weg/
  Vom leben müst zů todes steg.
Der du bist was ich/iung/schön/starck/
  Werd/edel/rych/lig hye on marck/
On leblich krafft der würmen oß.
  Erkenn dich mensch on vnderloß/
Glaub mir/erschrocklich biñ ich zwor/
  Vnd trag dir doch gůt warnung vor.
Eer Gott/dein acht/ die welt vernicht.
  Dein seel ewig/der leib verblicht.

liac (c. 1300–1368).[40] The immediate audience for this book must have been precisely those local barbers and surgeons who might have attended Hock's dissection; the "counterfeit" sheets of his dissection and skeleton were inserted in some copies of the *Feldtbuch*.[41] There is little indication that Hock's dissection led to any new insight into human anatomy. In fact, as a picture included in a printed book, the woodcut of Hock's dissection scene is quite similar to an image (fig. 0.5) Schott had included earlier in Gregory Reisch's *Margarita philosophica* (The philosophical pearl, 1503).[42] Both images show gross anatomy of the human body by indicating the relative positions and shapes of the main organs. Furthermore, both show (erroneously) a multilobed liver clasping the stomach like a hand with fingers, as described by Mondino de' Liuzzi (d. 1326).[43] As an illustration of human anatomy inserted in a book, the Hock woodcut shows continuity in content and function with an earlier image, rather than being a dramatic break from the past.

Hock's dissection scene was the model for a smaller full-length woodcut in the *Feldtbuch* (fig. 0.6), which accompanied a chapter called "*Augenschinliche Anatomy*" (Anatomy evident to the eyes).[44] There, Hock's dissection was reported:

> Such anatomy was investigated and studied in the year 1517 after the death of Christ in the blessed town of Strasbourg in the presence of several learned and worthy physicians, learned men, surgeons, and barbers through the dissection of a dead man, sentenced to death by hanging, who had been prayed for. Explained expertly by the experienced and highly learned doctor of medicine Wendelinus Hock von Brackenaw, the anatomy of man was immediately drawn as a *contrafact* in all its form, colours, and in an accurate representation [*wahrer Anzeige*] as you will find in the figure below.[45]

This figure does not give the names of the limbs or organs, but instead shows the whole body with its bloodletting points, as confirmed by the inscription, "*Contrafacter Laßman 1517*."[46] Apart from this report of Hock's dissection, there is no further discussion in the book about the findings relevant to bloodletting that Hock might have made. Again, this "counterfeited bloodletting man" appears to function in a way similar to that of earlier figures indicating points for venesection (fig. 0.7).

Fig. 0.4 Broadside entitled "A Counterfeit Death," which formed a pair with the "counterfeit" anatomy (see fig. 0.3). Text and the printer's monogram appear underneath the woodcut, which includes traditional names of bones such as *focilia* (radius and ulna), *rasceta* (carpus), and *os cahab* (talus). The shading along the bones indicates their three-dimensionality and the curvature of the ribs. The dark shading in the pelvic bones seems to indicate two sets of cavities, but the bones' precise overall shape and connections are difficult to work out; it is also unclear how the back of the ribcage connects to the spine. Such visual confusion suggests that this image was copied from another (poor) representation. From H. von Gersdorff, *Feldtbuch der Wundtartzney* (Strasbourg: J. Schott, 1517); before a1r, Leopold-Sophien-Bibliothek, Überlingen, shelfmark O6*.

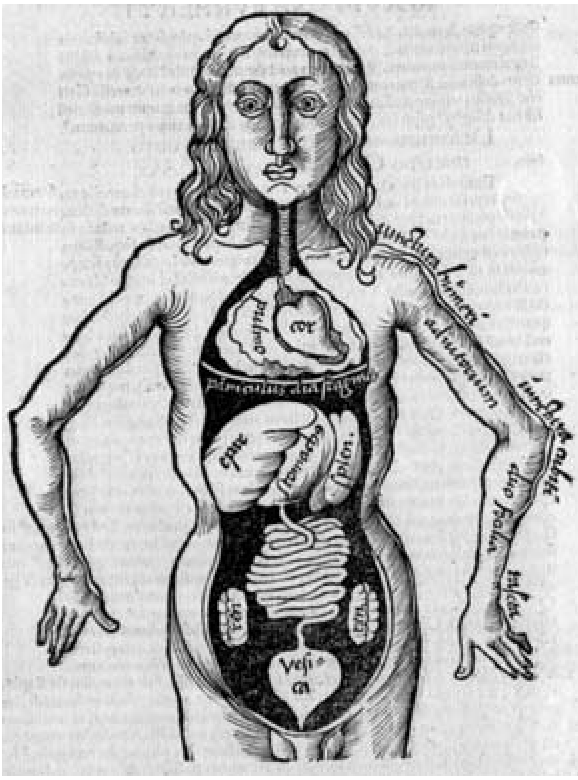


Fig. 0.5 This woodcut shows such internal organs as the heart, diaphragm, lung, liver, stomach, spleen, and kidneys, and the names of bones of the arms, much in the way that Gersdorff's woodcuts do (figs 0.3 and 0.4). From Reisch, *Margarita Philosophica*, also printed by Schott in 1503, Fiiv. Bayerische Staatsbibliothek, München, Res/4Ph.u. 114.

Fig. 0.6 "A counterfeit bloodletting man," based on Wendelin Hock's dissection figure (compare fig. 0.3) but extended to include the legs so as to show all the bloodletting points. Strictly speaking, the depiction of internal organs was not necessary for showing the bloodletting points, but it provided an occasion to advertise Hock's dissection. From H. von Gersdorff, *Feldtbuch der Wundtartzney* (1517), XIIIIr. Woodcut 19.7 × 12.8 cm. © The British Library Board, C.31.c.12.

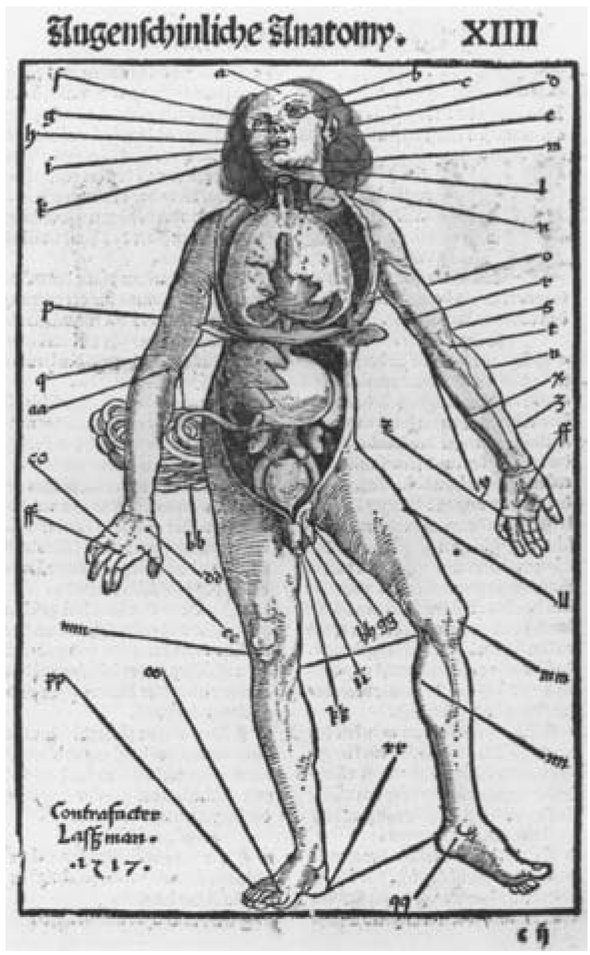


Fig. 0.7 A chart describing the bloodletting points and the ailments for which blood should be let from them. The alternating use of red and brown ink allows for easier reading. From a fifteenth-century volume of miscellaneous tracts, including calendars. Page size 17.3 × 13.5 cm. Trinity College, Cambridge; MS O.1.57, 16v.

The main point of a "counterfeit" image was that it depicted a singular object or event. When the broadside was transferred into the book, the particularity of the object depicted in the "counterfeit" did not affect either the picture's traditional function or the book's content. The naturalistic rendering of the dissected body may, of course, have served as a memory aid to local surgeons and barbers who had attended the dissection and were now reading the *Feldtbuch*. The "counterfeit" image could thus have a sense of immediacy and vividness while fulfilling fairly standard functions in a vernacular surgical manual for wound surgeons. Such vividness may in turn have helped readers memorize

Fig. 0.8 *Lappa* with broken stems and withered leaves. From Otto Brunfels, *Herbarum vivae eicones* 2 (1531): 61. Woodcut 25.5 × 15.5 cm. Cambridge University Library, CCA.47.26.

anatomical terms or bloodletting points. The "counterfeit" broadside of Hock's dissection may be remarkable in antiquarian terms as the first of its kind, but there was nothing dramatically new in its impact on anatomical knowledge or practice.

The impact of a naturalistic "counterfeit" was similarly limited when it was used for the study of medicinal plants. In 1530, Schott brought out a book comprising the first extensive series of naturalistic images of plants, Otto Brunfels' *Vivae eicones herbarum* (Lively images of herbs, 1530–36). The images were drawn and cut by Hans Weiditz and others.[47] As the title of the German edition,

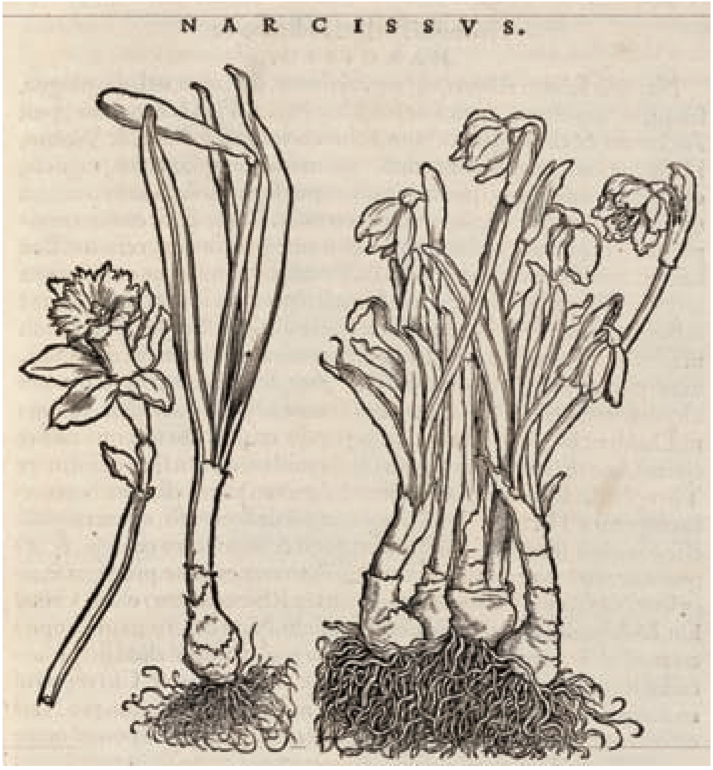


Fig. 0.9 Narcissus. From Otto Brunfels, *Herbarum vivae eicones* 1 (1530): 129, detail. Woodcut 14.2 × 14 cm. Cambridge University Library, CCA.47.26. This naturalistic depiction contrasts starkly with the one in fig. 0.10.

Fig. 0.10 Narcissus for memorization. From the *Hortus sanitatis* (1491), Viiir, detail. Woodcut 10.5 × 7 cm. Cambridge University Library, Inc.3.A.1.8[37].

Contrafayt Kreütterbuch (1532), suggests, the images include every detail of the individual specimens, including torn and wilted leaves (fig. 0.8).[48] It would be difficult to disagree with the impression that Weiditz's naturalistically rendered picture of the narcissus (fig. 0.9), for instance, is superior to the woodcut of a narcissus printed almost forty years earlier, in the *Hortus sanitatis* (1491; fig. 0.10).[49] But the *Hortus sanitatis*, a folio-sized book comprising more than 450 leaves and including sections on naturally occurring medicinal material (plants, animals, birds, fishes, and minerals) and medical diagnosis through urine and other indicators, was probably never intended to be a field guide or to be taken out on herborizing trips.[50] It was more likely used as a reference on the medicinal virtues of plants. The skeletal figure of the narcissus is reminiscent of the figurative images in alchemical herbals, but it probably functioned as a pictorial reminder to the reader of the origin of the name of the plant explained in the accompanying text.[51] Quoting from Isidore of Seville, the text explained that the name *narcissus* was derived from a youth of the same name who was transformed into that plant after falling in love with his own image in a reflection on water.[52] Though there are some other figures in the *Hortus sanitatis* that are reasonably plausible images of actual plants, a stark representation of some unique characteristic—for instance, embedding a heart shape on the leaves of the *incensaria* (fig. 0.11) indicating the heart-like shape of the leaf—suggests a function to help recall memory in the manner of a striking mnemonic picture, or an "active image" (*imago agens*).[53] Such mnemonic pictures could certainly help the reader to identify the name, origin, form, and use of a plant without having to venture outdoors with a weighty tome.

Although the pictures by Weiditz were all superbly naturalistic, they did not always help Brunfels, the author of the text. Brunfels's stated aim in *Vivae eicones plantarum* was to revive the ancient knowledge of the plants through solid and firm descriptions of pristine authors, accompanied by vivid and accu-

Fig. 0.11 This image of the *incensaria* with heart shapes embedded in the leaves was probably intended to remind readers that the plant's leaves were initially heart-shaped. From the *Hortus sanitatis* (1491), P8r, detail. Woodcut 10.5 × 7 cm. Cambridge University Library, Inc.3.A.1.8[37].

rate pictures drawn anew.[54] He quoted various authors, both ancient and medieval, though not indiscriminately, since he understood that some authors were less reliable and their views needed to be carefully assessed. He nevertheless saw the value even in the most "barbaric" authors, and received information on plants from painters and little old women (*vetulae*).[55] He called "naked" a plant whose classical name he could not determine (*nuda herba*), but he also discussed several such plants whose medicinal effects were well established—such as the *Sanct Jacobs Blum*, which could prevent a fistula from spreading.[56] Brunfels had intended to gather at the end of the book plants whose Latin names could not be established, but instead he had to include them in the text as the woodcuts became ready, so as to keep the presses occupied, because those doing the drawing (*deliniatores formarum*) and the cutting (*sculptores*) were behindhand.[57] In the German edition, Brunfels complained that he was given the plant pictures as the artist finished drawing them, which caused confusion in the description and ordering of the text, as well as leaving many plants undepicted.[58] Here, Brunfels's role appears to have been that of helping Schott compile *Vivae eicones* at the publisher's convenience, rather than that of an autonomous author.[59] His dependence on Schott is not so surprising, since Schott, who was an early supporter of Martin Luther, had provided Brunfels with a livelihood as author and editor after Brunfels had left the Carthusian monastery to embrace Luther's cause.[60] As in the case of the Hock broadside, the vividness of the "counterfeit" images may well have been a striking way to enhance the reader's memory, but Brunfels's case shows how the publisher's effort to include naturalistic images of plants disrupted the author's own project of reviving ancient knowledge of medicinal plants and the ordering of the text he had in mind. The difficulty authors experienced in keeping control of their illustrated scholarly publications was not unique to printed books with "counterfeit" images (see chapters 3 and 4), but Brunfels's case provides a stark contrast with those of Fuchs and Vesalius, who in their books were able to introduce specific text-image relationships that enriched their arguments.

"Looking" and "Learnedness"

The inclusion of naturalistic "counterfeits" in printed books on surgery or medicinal plants thus did not signal new developments in anatomical or botanical knowledge, nor did it necessarily reflect any new observational attitudes of their authors. I am not, however, claiming that people in the sixteenth century refused to look, or did not appreciate the importance of experience. I have no doubt that Hock, Brunfels, Fuchs, Vesalius, Gessner, and many others of their time did look at the bodies and the plants they encountered. "Looking," however, as E. H. Gombrich has shown through various analyses of art, is a complex act that involves some active process of selection and pattern-matching with reference to what is known or expected.[61] Pictures are one way in which this process of "looking" can be made concrete and visible. Through a picture, an object can be visualized and understood, and one of my main concerns in this study is with uncovering the assumptions and expectations of such a pictorial understanding among university-educated physicians in the sixteenth century.

As Ludwik Fleck once wrote, "We look with our own eyes, we see with the eyes of a collective body."[62] What bound the physicians I discuss in this book into a collective body was their university education. They read and wrote in a common language, Latin, and shared assumptions about authority and hierarchy of knowledge. They agreed on the importance of classical authors as authorities in matters of knowledge. Although they all broadly subscribed to the value of studying the works of the ancients, they could and did disagree on which authorities to follow, how best to interpret or understand their texts, who was qualified to do so, and so on. This is how the disagreements that Fuchs had with Monteux and Cornarius, and that Vesalius experienced with Dubois and Eustachi, should be understood. Each of these humanist physicians had a different idea, furthermore, of how to resolve discrepancies amongst the ancients as well as between the ancients and their own contemporaries: Vesalius and Fuchs used pictures, while their opponents made recourse to philology, history, or morality.

Humanist phyicians knew the two famous passages from the ancients that seemed to cast doubt on the usefulness of images. Galen, in *De simplicium medicamentum facultatibus* (On the faculties of medicinal simples), had written on the *abrotanum* (6.1) that "it is not necessary to describe the forms of plants after the fashion of so many men."[63] Pliny the Elder, in the *Historia naturalis* (*Natural History*, 25.4), wrote that the method used by Crateuas, Dionysius, and Metrodorus of depicting plants with their properties noted underneath the pictures was attractive, but problematic:

> But not only is a picture misleading when the colors are so many, particularly as the aim is to copy nature, but besides this, much imperfection arises from the manifold hazards in the accuracy of copyists. In addition, it is not enough for each plant to be painted at one period only of its life, since it alters its appearance with the fourfold changes of the year.[64]

According to Pliny, the difficulty of copying images with color and the variability of a plant's appearance were reasons why writers after the time of Crateuas offered only verbal accounts of plants. This is virtually the only passage in which Pliny was negative about images, since elsewhere he prizes likeness with nature as a mark of good art.[65]

The last sentence in Pliny's passage above echoes Dioscorides's preface to *De materia medica* (On medicinal material), where he explained that a proper knowledge of plants must be based on a familiarity with plants in all their stages:

> Anyone wanting experience in these matters must encounter the plants as shoots, newly emerged from the earth, plants in their prime, and plants in their decline. For someone who has come across the shoot alone cannot know the mature plant, nor if he has seen only the ripened plants can he recognize the young shoot as well. Great error is occasionally committed by those who have not made an appropriate inspection, as a result of the changes in the form of the leaves, the varying sizes of stems, flowers, and fruits, and some other characteristics.[66]

Dioscorides did not, however, write explicitly against the use of pictures. Capturing the form of plants in all its stages was something that did become a task for people like Fuchs and Gessner. What is important to note here is that those sixteenth-century scholars who wanted to use pictures in the study of nature had to tackle the misgivings expressed by authorities such as Galen, Pliny the Elder, and possibly Dioscorides.

In the preface to *De materia medica*, Dioscorides famously used the word *autopsia*—to see for oneself—to criticize an earlier writer, Niger, for taking "his evidence not from his eyes [*autopsia*]" and to describe himself as having "exercised the greatest precision in getting to know most of my subject through direct observation [*autopsia*]."[67] *Autopsia* was also a term found among Greek historians, whose works—such as the account of the plague of Athens by Thucydides—were well known to Renaissance physicians.[68] This, as it turns out, is *not* a term found abundantly in the works of Galen, however. Galen, in *De sectis* (On the sects, 2), characterized the "Empirical" school of medicine as relying on an "imitative" kind of experience—namely, imitation of what had turned out to be beneficial many times in the past; members of this school called an accumulation of such experiences *autopsia*.[69] Galen was critical of the Empiricist school, mainly because of its rejection of causal as well as anatomical investigation, and this may account for the relative infrequency of Galen's usage of the term *autopsia*, though he did advocate in *De anatomicis administrationibus* (*On Anatomical Procedures*) the importance of frequent firsthand dissection.[70] Although it may be counterintuitive to us, the idea of firsthand experience or observation thus had well-known classical roots, and it was scholars like Fuchs and Vesalius, who took their ancient authorities seriously, who also took up the recommendation of firsthand experience with enthusiasm in the sixteenth century.[71]

Another common assumption among the physicians studied here was an Aristotelian definition of knowledge as being divisible into three types—productive (for making something), practical (as a guide to virtuous conduct), and theoretical—and of theoretical knowledge being further divisible into metaphysics, physics, and mathematics.[72] Theoretical knowledge, or *scientia*, was knowledge of causes that was necessary, demonstrative, and universal.[73] Hence, "that there is no science of the accidental is obvious; for all science is either of that which is always or of that which is for the most part."[74] Fuchs's opponent, Monteux, certainly agreed with this point.

In contrast, the study of medicinal plants or of anatomy traditionally fell under the descriptive subject of *historia*. Within the Aristotelian scheme of knowledge, *historia* was regarded as a descriptive type of knowledge, preparatory and inferior to the demonstrative, causal knowledge of *scientia*.[75] This is one of the reasons why studies of anatomy and of plants were limited in medieval universities, despite the vibrant traditions of herbalism and surgical knowledge among healing practitioners outside the university walls.[76] At a medieval university, plants were studied as embodiments of the "vegetative" soul in natural philosophy or cited as components of medicinal remedies.[77] Although public dissections of criminals had been conducted at universities since the time of Mondino for the benefit of medical students, they appear to have been sporadic and only tangentially relevant to the identity of a university-educated physician.[78] Medical botany and anatomy shared this feature of being *historia*, but they gradually became significant parts of learned medical knowledge in the sixteenth century. Fuchs, Vesalius, and Gessner were aware that they were dealing with topics that traditionally belonged to *historia*, not *scientia*, and they were all interested in making their knowledge more general, causal, and "scientific." This explains why they eschewed focusing on details that were incidental to a particular specimen, which was the object of "counterfeit" portrayals. Their efforts to transcend mere description of the singular are encapsulated in their use of the adjective *absolutus* for their images, as I shall be discussing in parts 2 and 3. Just as the disagreements Fuchs, Vesalius, and Gessner faced arose from within the classical tradition of how best to revive the ancients, so also were they inspired by classical concepts—accidents, forms, canon—to develop their visual arguments.

The learnedness of physicians meant that their use of pictures rarely fulfilled the didactic function frequently associated with Gregory the Great (540–604)—namely, the use of images to teach or remind the illiterate of what they could not read in words.[79] Fuchs, Gessner, Vesalius, and other learned physicians fully expected their readers to read the Latin text accompanying the pictures. Indeed, without the relevant training in Latin, a smattering of Greek, the university arts curriculum, and medical courses, the significance of their pictures would have been lost. A pertinent point was made by John Dee (1537–1608), who felt that it would be difficult for novices to imagine three-dimensional shapes on the

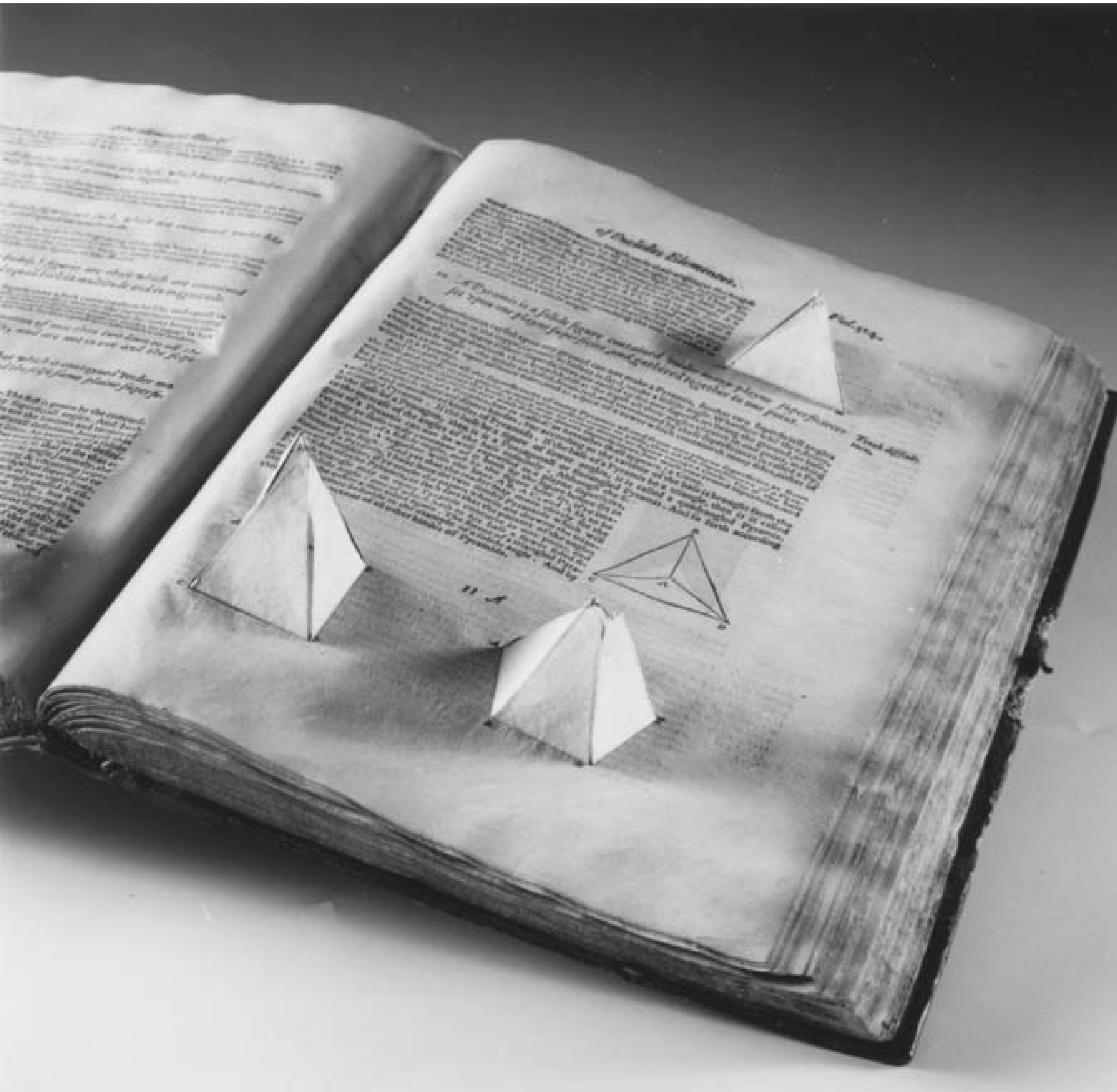


Fig. 0.12 "And yet that the reader may more clearly see the forme of a Pyramis, I have set two sundry Pyramis [at the bottom of the page] which will appear bodilike, ... The forme of a tri-angled Pyramis ye may before beholde in the [top] example of a solide angle. And by these may ye conceave of all other kinds of Pyramids." John Dee instructs the reader on how to grasp the forms of pyramids from images on a page with the aid of "pop-up" shapes. From Euclid, *Elements* (1570), 314r. Cambridge University Library, Syn.3.57.4.

basis of geometric figures on a page, and suggested that books contain "visual aids" including cut-out shapes and pop-ups (fig. 0.12).[80] One had to learn how to "read" pictures, which in turn made the text indispensable for understanding them. Visual arguments thus presupposed a certain amount of learnedness in their readers.

One point on which learned physicians of the sixteenth century did not have a common position concerned who should make their images. There was certainly no consensus that a learned author or physican must also be able to draw well, despite the well-known Plinian testimony that since the time of Eupompus, drawing had become a liberal art that children of free birth should be taught.[81] Aristotle had counted drawing as a traditional branch of education alongside reading, writing, and gymnastics (*Politics* 8.3). Referring to these classical precedents, Baldassare Castiglione (1478–1529) extolled the virtues of drawing in his *Il cortegiano* (*The Courtier*), but it was some time before drawing became an acceptable pastime for gentlemen.[82] The usefulness of drawing in education was praised by Desiderius Erasmus (d. 1536) in his *De recta pronunciatione* (*The Right Way of Speaking*) as a way to improve a child's writing skills.[83] Similarly, drawing formed part of a virtuous education in Georg Wickram's *Der Jungen Knaben Speigel* (Mirror of a young boy, 1555), which described how a nobleman's foster son, Fridbert—in contrast to the dissolute Willibald, the same nobleman's natural son—went outdoors, asked his teacher the names of plants, was given them in Latin, inscribed their names on his writing tablet, and diligently drew pictures of plants.[84] Although some texts in the sixteenth century did promote drawing as a desirable skill alongside the ability to write, and despite the publication of several drawing manuals, instruction in drawing appears not to have become essential for those who did not intend to make a living out of graphic skills.

We have little evidence that Fuchs drew, though Vesalius and Gessner did; we do not know how the latter two learned to draw, however. Oronce Finé (1494–1555) is one of the few authors who is credited with the designs and even the cutting of various geometrical diagrams, but again, very little is known of his artistic training.[85] Though it is generally acknowledged that the artistic skills Galileo Galilei (1564–1642) acquired in Florence helped him interpret the contours of the surface of the moon and the spots on the sun observed through the telescope, this was far from typical.[86] This suggests that draftsmanship was not an absolute requirement for scientific studies of nature. Supervision of artists hence became an important task for those who wanted to integrate pictures into their knowledge about nature, and it remained so well into the eighteenth century.[87]

Instead of treating pictures in books as evidence of observations or observed objects of the past, this study examines pictures as part of a book about knowledge of nature. I study the role and function of pictures *alongside* the text and *within* the printed book, a book written in Latin by university-educated physicians who were concerned with reviving classical medical knowledge. In this pursuit of classically inspired knowledge of nature, some learned physicians made pictures integral to interpreting their own experiences, presenting their own discoveries, and elevating the status of their study with some claim to generalization and universality. In the process, they developed a visual argument through skillful and at times ingenious combinations of text and image. It was not the case that their arguments were expressed sufficiently in the text, and that the pictures were helpful but nonessential additions to "illustrate" some point already made in it.[88] Both image and text were integral parts of their arguments in shaping and presenting their knowledge about nature. Such visual arguments presupposed the existence of the printed book, and it is the conditions that governed the production of this medium that I shall now review.

PRINTING PICTURES

PART I

By the sixteenth century, most university-educated physicians believed in the importance of the printed book: it was the primary medium by which they learned about their subject and the opinions of the ancients, and it was also the means by which they expressed their views about their subject and commented on classical authors. A few physicians came to insist that their books had to have pictures in them. Although by then a printed book containing pictures was not uncommon, such a book, like any artifact, did not come into existence out of thin air. Not only did the author's labor, hope, and expectation go into its production, but there were also publishers, artists, and engravers whose skills, support, and cooperation were indispensable.[1] Thus, this part deals with the technical (chapter 1) and financial (chapter 2) aspects of book production, the practices of copying and coloring they gave rise to (chapter 3), and the means of control sought by publishers and authors in protecting the fruits of their labor (chapter 4). These were the conditions of the book's material production that authors, including Fuchs and Vesalius, who wanted to develop specific connections between their texts and their images had to manage and negotiate.

CHAPTER I

Techniques and Craftsmen

By the time Johannes Gutenberg printed the Bible using movable type, two means of replicating images were known: woodcuts and incised metal plates.[2] The new art of mechanically replicating texts soon incorporated both, with varying degrees of success.

Woodblocks

The technique of printing patterns on cloth using woodblocks, famously described in Cennino Cennini's (c. 1370–1440) *Il libro dell'arte* (*Book of Art*), appears to date from the fourteenth century.[3] Woodblocks were used to print devotional images on paper from the early fifteenth century (fig. 1.1).[4] Some manuscript books had such woodcuts pasted in, or carried decorative initials stamped with woodblocks.[5] In Roberto Valturio's *De re militari* (On military matters), printed in 1472, large woodcuts of military contraptions were stamped in after the text had been printed, which resulted in some variation in the appearance of a page (fig. 1.2).[6]

The greatest advantage of woodcuts for the printed book was that both they and movable type printed in relief—that is, parts that were left raised and not cut away formed the lines and letters to be printed—and thus could both be fitted into the same

Fig. 1.1 A hand-colored image of St. Jerome, of German origin, c. 1425–35. The saint's name is inscribed in four different hands, most probably reflecting a devotional practice. Woodcut 197 × 130 mm. © Trustees of the British Museum, London, 1872, 0608.315.

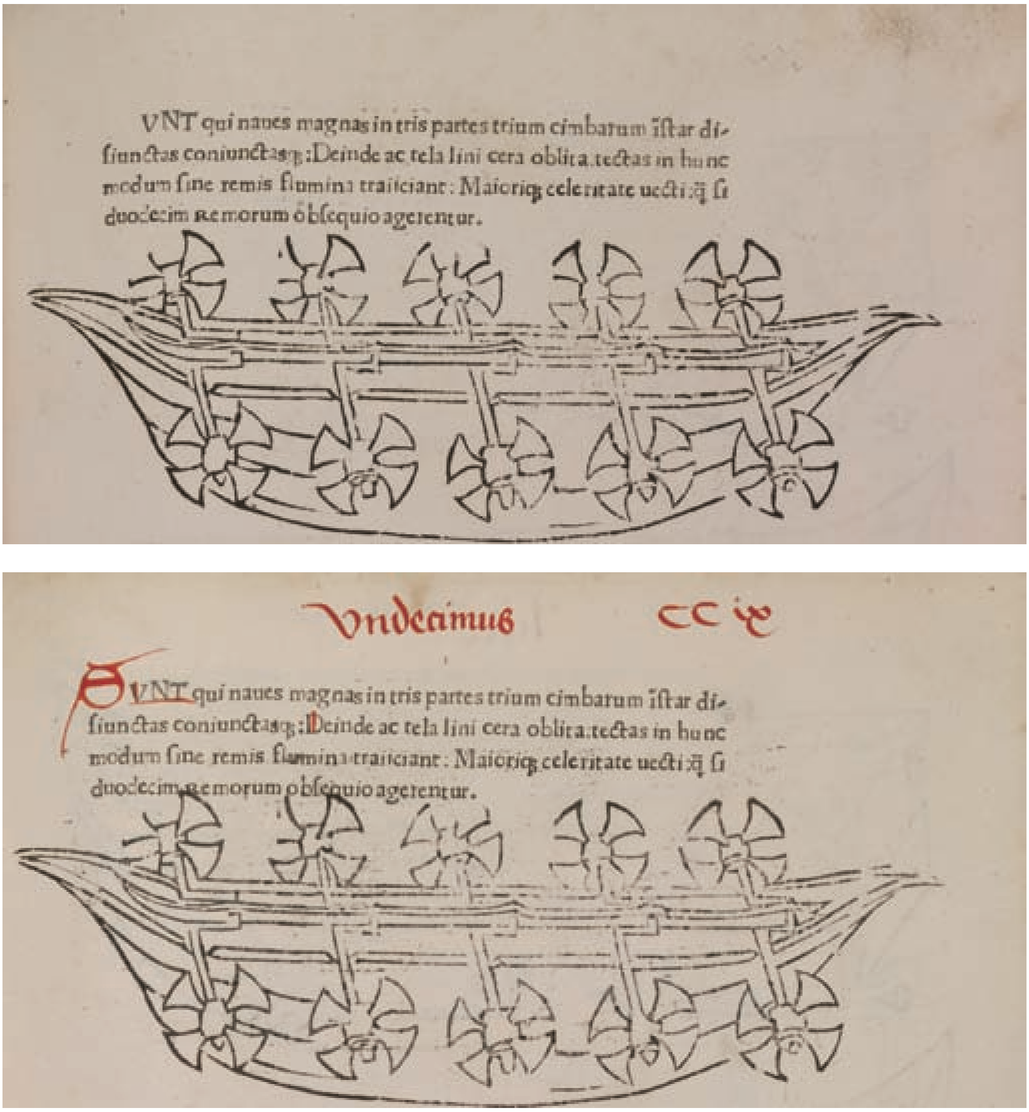
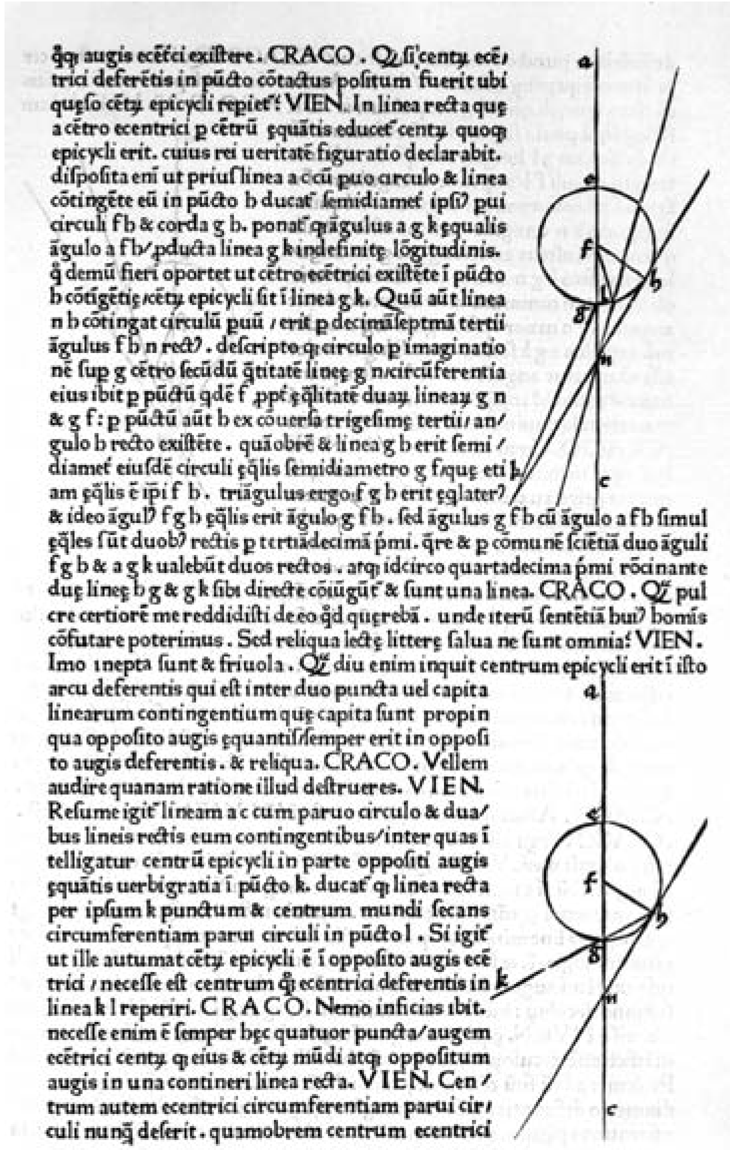


Fig. 1.2 A woodblock image of ships stamped onto the page, resulting in a varying of distance between text and image. In the top example, there is clearly a space between the last line of text and the blades of the first two oars from the left; in the bottom example, the same oar blades overlap the words "remorum" and "obsequio." From Roberto Valturio, *De re militari* (1472), 215r and CCIXr. Cambridge University Library, (a) SSS.4.14[2159] and (b) Inc.2.b.19.1[2158].

form.[7] This allowed printers to print images and texts simultaneously, and also to set figures and images within the text (fig. 1.3). Even in the seventeenth century, Edmund Halley recommended that Isaac Newton use woodcuts for the diagrams in the *Principia mathematica philosophiae naturalis* (*Mathematical Principles of Natural Philosophy*), so that they could be inset in the text.[8]



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ãgulo a f b/pducta linea g k indefinitę lõgitudinis.
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n b cõtingat circulũ puũ / erit p decimãſeptimã tertii
ãgulus f b n rect. deſcripto q; circulo p imaginatio
nẽ ſup g cẽtro ſecũdũ q̃titatẽ lineę g n/circũferentia
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& g f: p pũctũ aũt b ex couerſa trigeſimę tertii/ an/
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diamet eiuſdẽ circuli ęq̃lis ſemidiametro g f/quę eti
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augis in una contineri linea recta. VIEN. Cen/
trum autem ecentrici circumferentiam parui cir/
culi nunq̃ deſerit. quamobrem centrum ecentrici

Fig. 1.3 Woodcut astronomical diagrams inset into the text. From Johannes Regiomontanus, *Disputationes contra Cremonensia deliramenta* (1475), [7]r, Trinity College, Cambridge, VI.15.80.

Metal Plates

Another means of printing pictures using incised metal plates, usually of copper, had been available in Europe since the 1430s.[9] Two ways of incising a metal plate were known: engraving, using burins, and etching, using corrosive acids. Despite the fact that it was cheaper than engraving, etching was used in printed books relatively late and only sparsely.[10] As Bowen and Imhof have shown, there were various reasons for this, including aesthetics and longevity: around 1600 an engraved plate, with reworking, could provide more than four thousand im-

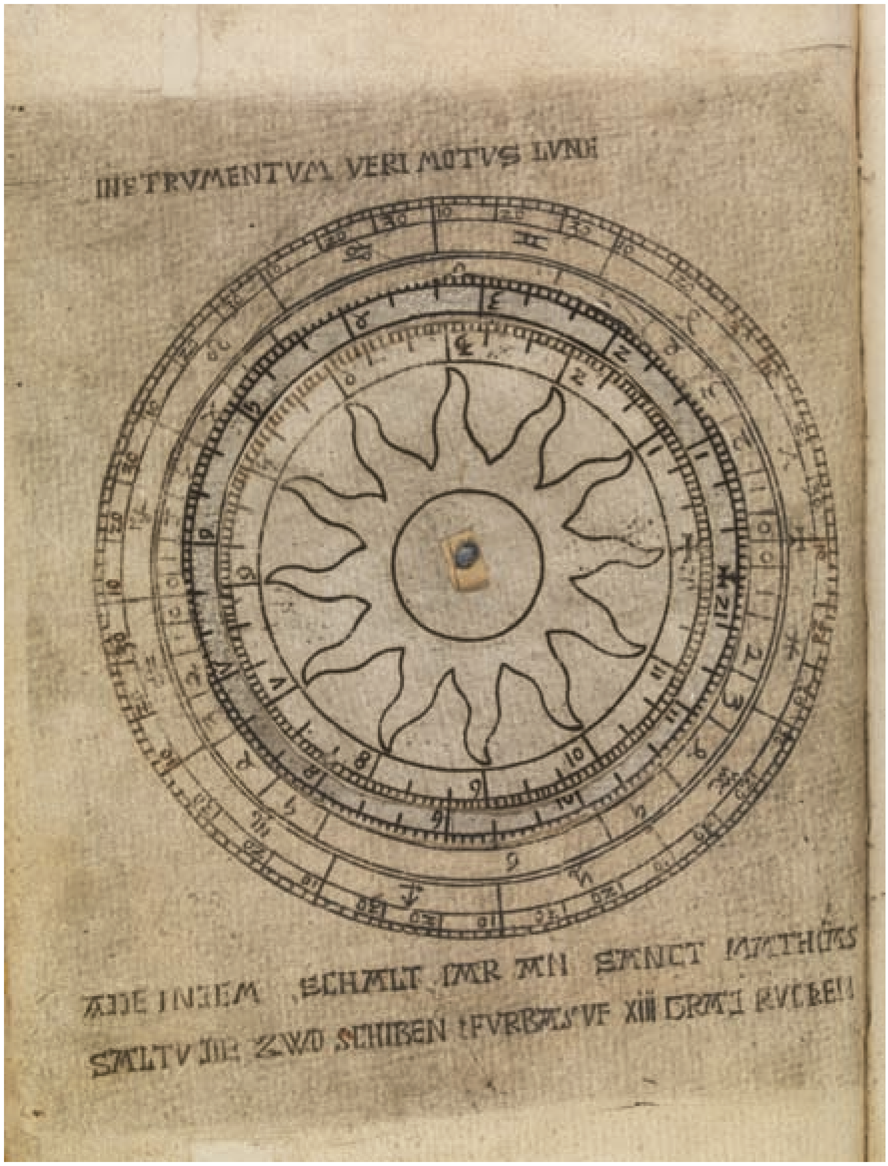


Fig. 1.4 An engraved paper instrument designed to work out the true position of the moon using two volvelles (paper discs) in conjunction with a thread (now lost) and tables printed elsewhere in the book. This kind of instrument required precision; each of the markings on the outer rim of a circle represents two degrees of arc. From Lazarus Beham, *Kalendarii duo* (1476), 45v. Cambridge University Library, Inc.5a.4.9[514].

pressions, and an etched plate only about three thousand.[11] However, according to David Woodward's calculation for maps, an engraved print could cost ten to twelve times more than a woodcut print of an equivalent size.[12]

Metal plates could be made to print in relief, making what were known as "dotted prints," as was the case with several early devotional images.[13] More commonly, metal printing was an intaglio process—the incised and therefore sunken parts of the plate forming the lines to be printed—and its ability to print fine lines and details may have been the reason for its early use in works that required fine graduation, such as astronomical volvelles (fig. 1.4) or cartography (fig. 1.5).[14] Intaglio prints, however, were awkward to use in a printed book because they had to be printed separately from the text, which was printed in relief. The technical difficulty of superimposing engravings often led to variable copies.[15]

More commonly, engraved intaglio images appeared separately as standalone images, maps, or title pages, printed on one side and inserted or pasted into a printed book.[16] In 1556, Antonio Salamanca and Antonio Lafrery, in Rome, printed Juan de Valverde's (c. 1525–c. 1588) Spanish anatomical tract *Historia de la composicion del cuerpo humano* (History of the structure of the human body) with engravings of anatomical figures (fig. 1.6) copied from Vesalius's *De fabrica corporis humani* (1543), with the text printed on the verso of the engravings.[17] This meant that the page was put through the press twice. The same publishers, when issuing an Italian version in 1560 (*Anatomia del corpo humano*; Anatomy of the human body), had the text printed in Venice and the engraved figures superimposed in Rome. This may well have had to do with the availability or quality of the presses involved, but the relative price of paper may also have been a

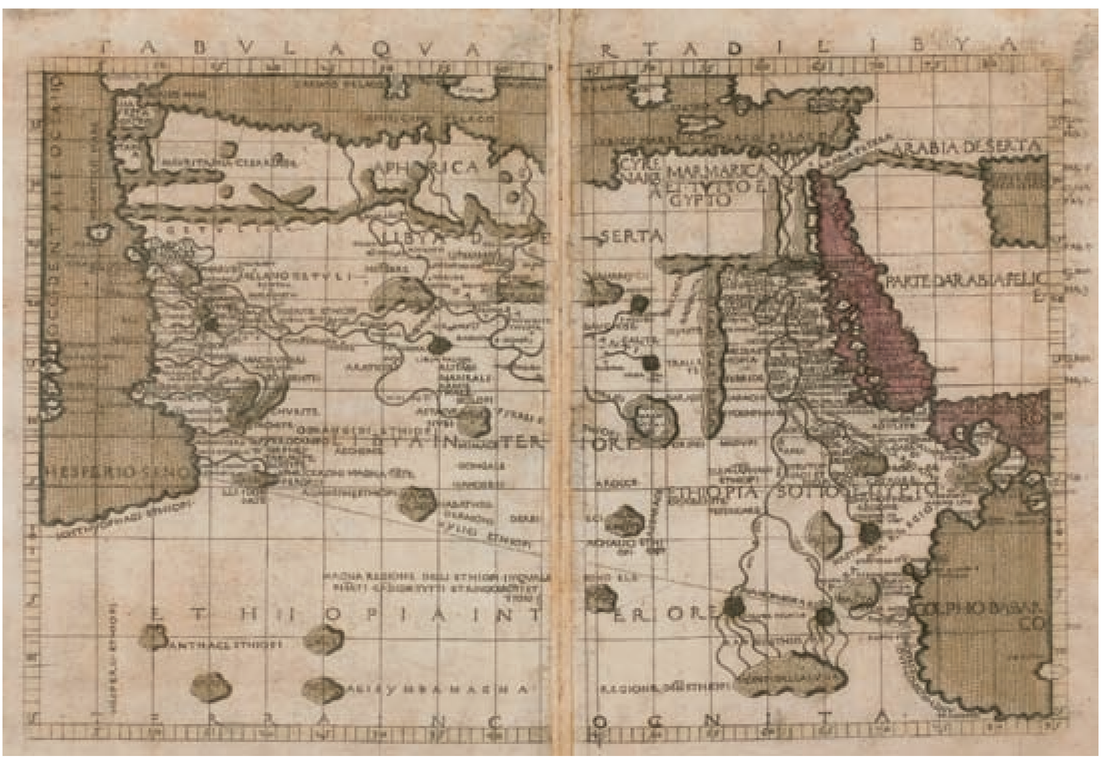


Fig. 1.6 The engraving (a) from Juan de Valverde's book is a copied and inverted image of the corresponding woodcut by Andreas Vesalius (b), with modifications in the positioning of the legs and background. Gaspar Becerra's image for Valverde was engraved by Nicolas Beatrizet, whose monogram appears at the bottom left. From Valverde, *Historia de la composicion del cuerpo human* (1556), tab. V. Plate 22.8 × 14.5 cm. Wellcome Library, London. From Andreas Vesalius, *De fabrica* (1543), 184. Woodcut, 34 × 20.8 cm. Cambridge University Library, K.7.3.

Fig. 1.5 An engraved map of Libya, with Ptolemaic coordinates. Hand-colored. From Francesco Berlinghieri, *Geographia* (1482), 117–18. Engraving 33 × 49.8 cm. Trinity College, Cambridge, Grylls 2.199.

Fig. 1.7 An engraving of the *dens canis*, *dentaria*, and other spring flowers. From Basilius Besler, *Hortus Eystettensis* (1613), [p]v. Plate approx. 47.5 × 39 cm. Cambridge University Library, Tab.b.51.

factor.[18] We do not know how much it cost the Salamanca-Lafrery partnership to print Valverde's work, but when the Antwerp printer Christopher Plantin (1520–1589) issued a Latin edition (see fig. 2.2), also with the text printed on the reverse of the engravings, he paid a total of 606 florins for the copper plates, engraving and printing, which was more than six times the cost of the paper (96 florins), normally the most expensive item in printing books.[19] Integrating engravings in printed books was thus still relatively expensive in the second half of the sixteenth century.

For technical and financial reasons, therefore, it was woodcut rather than engraving that became the predominant medium for replicating images in printed books in the sixteenth century.[20] These same reasons probably explain why Fuchs and Vesalius chose to use woodcuts, and some of the details in their books suggest the advanced state of woodcutting to the point of pushing the limits of the medium (see fig. 4.4). When Christopher Plantin issued *Vivae imagines* (Lively images, 1566), woodcuts were still more the norm for printed images, and hence a respected block cutter could command comparable or higher wages than a less well respected engraver for cutting images of a similar size.[21]

Toward the end of the sixteenth century, engravings became more desirable in books, perhaps reflecting the growing market for prints, and the woodblock cutters' wage started to decrease in real terms against that of engravers.[22] In the seventeenth century, deluxe productions with engravings, such as the *Hortus Eystettensis* (The garden at Eichstätt, fig. 1.7) set the standard for illustrative material in books.[23] Costs, however, could still spiral out of control. An overly ambitious printing project including copper-engraved illustrations for *Plantarum historiæ universalis Oxoniensis secunda pars* (Second part of the general history of plants of Oxford) bankrupted its author, Robert Morison (1620–1683), professor of botany at the University of Oxford, despite the fact that subscriptions had been collected to defray costs (see fig. 2.3).[24]

Nature's Medium

Although woodcuts and metal engravings were the principal means by which figures and images were produced in a printed book, in this period there was also one other form of "printing" known as "nature print."[25] Pressing an inked natural object directly onto a page was a technique used at least since the second half of the fifteenth century. In the 1554 edition of his *De subtilitate* (*On Subtlety*), Girolamo Cardano explained how plants could be depicted "*ad vivum*" just as a bookseller made an embossed binding by a form of panel stamping—by pressing a moistened leather onto a metal frame, filling in the grooves with wax, and coloring in the pattern.[26] By analogy, Cardano explained that a plant could be depicted *ad vivum* by pressing it against paper so that its traces were left on the sheet like a ground plan (*ichnographia*).[27] Some people used a mixture of verdigris and carbon to color the leaves, and a lighter color for the veins and the stalk; others used the juice of the plant or the flower, with water squeezed out and gum water added.[28] This idea of *ad vivum*, as having direct contact with the object, was one that Cardano also used with respect to images of people when he cited the use of plaster to make a death mask, which was then colored and then adorned with the actual hair and beard of the deceased.[29] Cardano said he had seen at the home of François, cardinal of Tournon (1489–1562), such a death mask of Francis I used in the royal funeral rituals.[30] While the idea of *ad vivum* images was certainly based on a direct impression of or contact with natural objects, examples of such printings are rare in the sixteenth century and were certainly not a method used to produce a large number of copies.[31]

Nature print was also sometimes used for private collections, records, and study, as in the manuscript "Icones stirpium impressae" (Pressed images of

Fig. 1.8 Theophilus Kentmann's nature print of *mercurialis*, which shows a tear in the leaf. From Kentmann, "Icones stirpium impressae," Herzogin Anna Amalia Bibliothek, Fol. 323, 281v.

plants) by Theophilus Kentmann (1552–1610).[32] Theophilus was the son of Johannes Kentmann (1518–1574), who had compiled an album of pictures of plants and fishes from his trips to Italy, which in turn were used by Conrad Gessner.[33] Theophilus, who may well have learned the technique from his father, appears to have drenched the leaves in a pigment and then pressed them onto paper, occasionally painting in the veins but leaving imperfections, such as tears in the leaves (fig. 1.8).[34] A copy of Fuchs's *De historia stirpium* in the Wellcome Library, London, contains nature prints of leaves with annotations by one "I. Newton" from the eighteenth century (fig. 1.9). Although it may well be that the blank pages of Fuchs's folio book were convenient for nature prints, it would be intriguing to know whether and how such prints might have assisted in the study and reading of the book. Nature prints could also serve as a model (fig. 1.10) for images in another medium—for example, for Fabio Colonna's etchings of plants in the *Ekphrasis*.[35]

Fig. 1.9 Nature prints of leaves in the blank pages of Leonhart Fuchs's *De historia stirpium* (1542); most probably made by a later eighteenth-century owner, one "I. Newton." Wellcome Library, London.

Fig. 1.10 Nature prints (a) of leaves, supplemented by an ink drawing of the plant's body with additional color applied. From Fabio Colonna, "Icones ipsis plantis ad vivum expressae," vol. 2, 91r, detail. The National Trust, Blickling Hall, Norwich. This picture served as a model for images of two plants (center and left) in an etching (b, rotated sideways for easier comparison) pasted into Colonna's *Ekphrasis* (1616), 221. Cambridge University Library, N*.9.38(D).

Craftsmen

As the first generation of books printed with movable type suggests, Gutenberg's art was conceived as a means of expeditiously reproducing a manuscript book. The typefaces, added rubrics, hand-illuminated initials, and use of vellum in these early printed books also suggest a fundamental continuity with the appearance and texture of a manuscript book.[36] Gutenberg's Bible was aimed at the deluxe end of the manuscript-book buying market—and as it was, after all, a Bible, its sales could be reasonably assured.[37] A richly illuminated copy of the Gutenberg Bible, bound in two volumes, cost 100 gulden, which, as noted by Hoffmann, was still comparable to the 121 gulden paid in Memmingen for a two-volume illuminated manuscript Bible between 1458 and 1460.[38] Images, too, were carried over from manuscripts into incunables—for instance, Apuleius Platonicus's *Herbarium* (1481) copied the schematic images of plants in a ninth-century manuscript from Monte Cassino.[39]

Although early printed books on paper maintained the visual aesthetics of manuscript books, they were regarded as less durable.[40] Discerning collectors in the late fifteenth century, such as Hartmann Schedel (1440–1514), sometimes went to the trouble of having a printed text copied out by a scribe and placing the manuscript copy in their libraries.[41] This practice of copying printed texts by hand continued well into the eighteenth century.[42] Cases of copying printed pictures by hand into manuscripts appear rarer but are not unknown, as in the cases of copies made from Valturio's *De re militari*, Francesco Petrarca's *Trionfi* (*Triumphs*), or Werner Rolewinck's *Fasciculus temporum omnes antiquorum cronicas complectens* (A collection comprising all histories of ancient times).[43] Pictures in printed books were often cut out, colored, and placed in manuscript books.[44] Such practices suggest that there was a large amount of overlap in imagery between the manuscript and the printed book. The woodcuts from Fuchs and Vesalius were also copied in an intriguing Venetian album of medical images (fig. 1.11).

The continuity in appearance between the manuscript and the printed book implied some continuity in the craftsmen involved in producing books or images.[45] Former scribes who became printers, such as Peter Schoeffer and Johann Bämler, continued to decorate their books with initials or rubrication.[46] Other scribes became editors, correctors, or designers of type fonts, but not necessarily because scribal work had become economically less viable.[47] Rubricators and illuminators also continued their work by decorating printed books for printers or private clients.[48]

Craftsmen who manufactured playing cards and images, called *Kartenmacher*, *Kartenmaler*, *Heiligenmaler*, or *Briefmaler*, often moved on to print single-sheet broadsides as well as blockbooks.[49] As a craftsman most associated with

Fig. 1.11 A drawn copy of Leonhart Fuchs's *polygonatum latifolium* (see fig. 3.14) in a Venetian album of medical imagery, about 1560. The English hand at the bottom ("The greater Solomons Seale") must be that of a later owner. Three leaves have been glued on. Ms Sloane 5281, 161r. © The Trustees of the British Museum, London.

coloring prints, the *Briefmaler* extended his work to decorate printed books.[50] Thus, the *Briefmaler* Hans Guldenmund, who printed single-sheet broadsides on various topics, was also paid by Anton Tucher, the Nuremberg patrician, four and-a-half florins in 1518/19 for decorating 118 figures of the *Theuerdank* (1517), and four florins for decorating a prayer book printed by Hans Koberger.[51]

While various craftsmen involved in image making and decoration could thus work with and alongside the production of printed books, printers could still face difficulties. In the early years of the printed book, it seems that some regions experienced a shortage of skilled craftsmen. Peter Schott complained in 1482 that he could not get pictures for his edition of Virgil, because neither an "Apelles" nor a "Lysippus" (Alexander the Great's painter and sculptor respectively) could be found.[52] Petrarca's *Libro degli uomini famosi* (Book of illustrious

Fig. 1.12 A portrait of Marco Valerio Corbo inserted by hand in an empty frame. From Francesco Petrarca, *Libro degli homini famosi* (1476), civ. Woodcut frame 24.5 × 17.5 cm. Cambridge University Library, Inc.3.B.37.1[4571].

men, 1476) had framed spaces for portraits to be added by each owner (fig. 1.12), which might well have been a result of the absence of suitable craftsmen.[53] The printer Erhard Ratdolt emphasized in the preface to the first edition of Euclid's *Elementa* (1482) how producing geometrical figures (*geometrica schemata*) was a difficult task, implying that technical difficulties had hindered previous printers from printing mathematical works.[54] Indeed, Ratdolt appears to have used a form of metal casting to achieve the fine and intricate lines required of Euclidean figures (fig. 1.13).[55] Just what could be achieved by a skillful craftsman using planks made of pear-tree boards sawed parallel with the grain and rubbed or boiled with hot linseed oil to lessen its brittleness, is best seen in the fine lines in the woodcuts for Vesalius's *De fabrica* (1543), which in turn suggest close and intense collaboration between the artist and Vesalius himself (as will be discussed in chapter 10).[56]

Guild regulations could also pose problems. According to Van der Stock, the guild of St. Luke in Antwerp complained in 1494/5 that the printer Adriaan Van

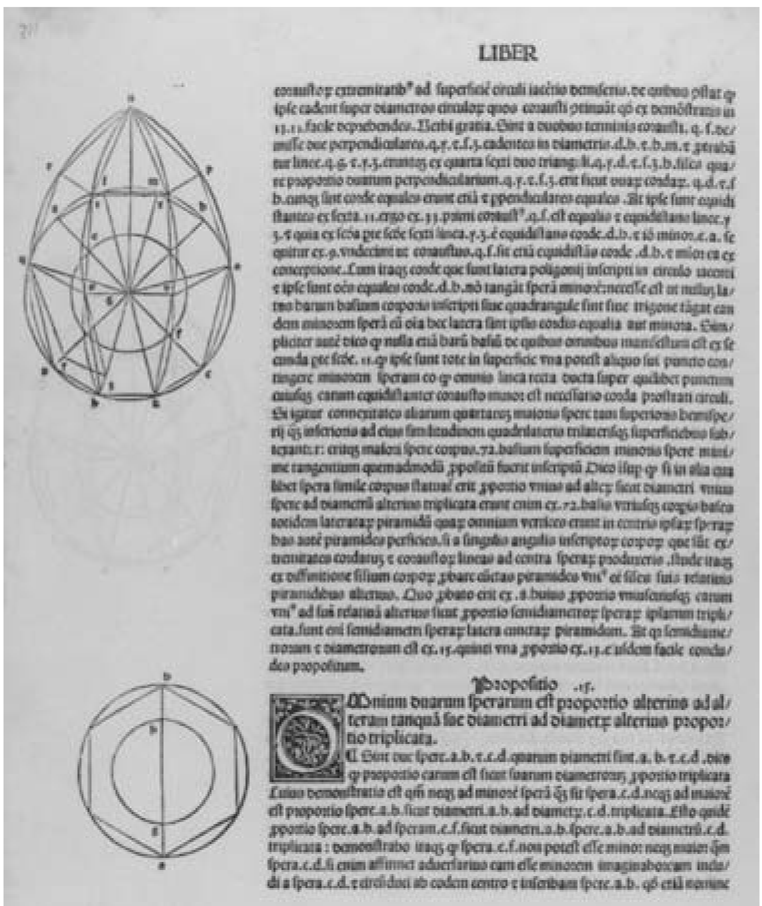

LIBER

Fig. 1.13 Euclidean figures made of metal cast. In the preface to this first printed edition of Euclid's *Elements*, the printer, Ratdolt, expressed his pride in printing these figures (*geometrica schemata*). He cited the difficulty of printing such figures as the reason why other Venetian printers had shied away from printing mathematical books. The figures appeared in the margins. From Euclid, *Elementa* (1482), 114v. Cambridge University Library, Inc.3.B.3.23C[1458].

Liesvelt was making images and figures in books and thus should be made to join the painters' guild, to which Van Liesvelt retorted that he only used paper and ink, not paint or paintbrush.[57] At Strasbourg, the printer Theodosius Rihel was accused in 1572 by the guild Zunft zur Steltz of taking on a block cutter as an apprentice, and the engraver Bernhart Jobin was also ordered to abstain from working for a printer.[58]

In producing pictures in their books, printers found that they had to employ different types of craftsmen. Just as illuminators of manuscript books may not have been inventors of the iconography they illuminated, so the person who cut the woodblock or copper plate for pictures in a printed book had not necessarily designed the original picture.[59] This is not to say that design and cutting were mutually exclusive skills; there were craftsmen who were proficient in both—notably Albrecht Dürer and Peter Paul Rubens (1577–1640)—but they were also happy to let others engrave their designs.[60] In some cases, the designer and the cutter were closely related: Leonardo Parasole cut the wood-blocks after his wife's designs for Castre Durante's *Herbario nuovo* (1585) and Diana Scultori (1547–1612) engraved her husband's designs for almanacs.[61]

The block cutter was usually paid one and-a-half to five times more per piece than the draftsman.[62] For drawing the figures for Rembert Dodoens's *Frumentorum, leguminum, palustrium et aquatilium herbarum . . . historia* (History of grains, leguminous, marsh, and water plants, 1566), Peeter vander Borcht was paid five stuivers per drawing, each of which was cut by others for eight stuivers per wood-block.[63] A more spectacular case is recorded in the failed enterprise by Sebald Schreyer in Nuremberg of printing an illustrated book entitled *Archetypus triumphantis Romae* in the late fifteenth century: the painters who designed the images on paper were paid 9 *fl.* 3 *lb.* 4 *d.*; those who drew those pictures onto the blocks, 37 *fl.* 1 *lb.* 16 *d.*; and Sebolt Gallensdorfer, who cut the blocks, 148 *fl.* 1 *lb.* 28 *d.*[64] That is, the block cutter was paid more than fifteen times more than the draftsman, and the person tracing the images onto the wood about four times more.

This division of labor was captured most famously in the portrait that adorns the last page of Fuchs's *De historia stirpium* (1542; fig. 1.14). Two craftsmen are called painters (*pictores*); Albrecht Meyer is shown drawing the picture of a plant and Heinrich Füllmaurer is seen transferring the drawings onto the woodblocks; Veit Rudolf Specklin, who cut those woodblocks, is shown below as the cutter (*sculptor*).[65] We should not, however, take this portrait too literally, since we know from the surviving drawings for *De historia stirpium* in the Austrian National Library that both Füllmaurer and Meyer drew the original sketches and probably both did the tracing.[66] What neither did was the cutting of the woodblocks. Specklin (d. 1550), the block-cutter, was active in Strasbourg and may have cut woodcuts for other printed books, for instance those for the

Bible (1531) for the Zurich printer Christoph Froschauer.[67] It is unclear, however, when or where Specklin cut the woodblocks for Fuchs.[68]

In the preface to his book, Fuchs wrote: "The block cutter [*sculptor*] Veit Rudolf Specklin, by far the best in Strasbourg, excellently imitated the admirable industry of painters: he has so skilfully expressed the outlines of each picture by carving (*sculpendo*) that he seems to compete with the painter for glory and victory."[69] A comparison between the painter and the sculptor was a favorite topic in the Renaissance genre of *paragone*, a competition between the arts; Leonardo da Vinci, Michelangelo Buonarotti (1475–1564), and Galileo Galilei all composed treatises in which the relative merits of various mimetic

Fig. 1.14 Craftsmen involved in creating woodcuts. At the top, Albrecht Meyer is drawing a plant and Heinrich Füllmaurer transferring a drawing onto a woodblock; both men are labeled as *pictores*. Veit Rudolf Specklin, who cut the woodblocks, is depicted underneath them as the cutter (*sculptor*). From Fuchs, *De historia stirpium* (1542), 897. Cambridge University Library, N*.1.24(A); copy once owned by Julius Echter, bishop of Würzburg.

arts were discussed.[70] Fuchs's comment on Specklin is a little more nuanced, however, than a theoretical competition between the arts over their mimetic skills: Specklin is worthy of praise in producing a *picture*—normally the domain of the painter (*pictor*)—with the cutter's (*sculptor*) specialized skill of carving. This expresses an appreciation of the particular skill involved in producing *printed* pictures. Fuchs here is thinking firmly within the world of printed books. He was, of course, not the first to appreciate the importance of replicable images; Erasmus too had earlier praised Dürer's prowess as a printmaker.[71] When the pictures in Fuchs's *De historia stirpium* were plagiarized in an edition of Dioscorides's *De materia medica* (1543) edited by Walter Hermann Ryff and printed by Christian Egenolff (fig. 4.1), it was also to Specklin that Fuchs publicly acknowledged his indignation. In his *Apologia* (1544), Fuchs claimed that more than two hundred pictures had been stolen in violation of the imperial privilege, that his reputation was in jeopardy, and that the printer Isengrin was losing business, having been undercut by Egenolff's book.[72] Fuchs wrote the *Apologia* in order to prove to Specklin that he had not neglected the latter's repeated warnings, and reassured Specklin that nobody could excel him in his diligence and industry in woodcutting.[73] Thus, although some of the drawings were traced pretty faithfully onto the woodblock, for Fuchs it was Specklin who was the creator of the images of his herbal—not, as modern sensibility would have it, Meyer or Füllmaurer, who had drawn the original sketches.[74] This is consistent with the contemporary view that publishers identified their financial investments with the woodblocks and copper plates that allowed them to replicate pictures not in the original designs.[75] Thus it was the owner of those plates and blocks who could request their investment to be protected by legal means, as will be discussed in more detail in chapter 4.[76]

The printed book, in including decorations and images, drew on preexisting techniques, craftsmen, and division of labor, which suggests continuity between manuscript and printed books in appearance. This should caution us from expecting a dramatic break in book culture after the introduction of the printing press in Europe. For technical and financial reasons, it was the woodblock that became the favored medium for producing images in printed books in the sixteenth century. For all its continuity with the culture of image production before the Gutenberg Bible, the woodcut images at the printing presses were different in one respect from hand-copied ones in manuscript books: while copying an image by hand would have incurred a similar cost each time an image was copied, the more frequently a woodblock could be used to print images, the more the cost of an individual printed woodcut would diminish.[77] It is to the financial aspects of producing images in printed books that I shall now turn.

CHAPTER 2

Publishers' Calculations

Fuchs's *De historia stirpium* was published by Michael Isengrin, and Vesalius's *De humani corporis* by Johannes Oporinus.[1] Neither publisher had been known to speculate in extensively illustrated scholarly books until then, and there were very good reasons why they hadn't done so. In addition to the availability of craftsmen with certain skills, discussed in the previous chapter, a printed book with pictures needed to satisfy certain economic conditions, or at least some financial expectations of a publisher, who may or may not have been the printer. The business of financing and selling printed books gradually grew apart from the trade of printing, though some printers, such as Anton Koberger in Nuremberg and Jean Petit in Paris, emerged as highly successful publishers.[2] Other publishers did not print books themselves but had extensive business networks of distribution, like Johann Schabler (d. c. 1540), who had a shop in Paris named L'Écu de Bâle, and a store in Lyons run by the publisher Michel Parmentier, who in turn had agents in Bordeaux, Toulouse, and Avignon.[3] Publishers, as financiers, could affect the selection of books to be printed. Hence, Johannes Froben refrained from publishing humanist titles until the death of Wolfgang Lachner (d. 1518), his financial backer and father-in-law, who specialized in the importation of Italian books, especially those printed by the Venetian publisher, Aldus Manutius.[4] The example of Manutius himself is a reminder that some publishers appreciated scholarship: his passion for classical scholarship is reflected in his publications, and his policy of keeping the price of his books relatively high even when book prices were generally decreasing suggests an interest in maintaining quality and scholarly standards.[5] But even Aldus had a business to run.[6]

Johannes Regiomontanus (1436–1476), another scholar-printer (see fig. 1.3), issued a list of classical scientific works he regarded as worth printing.[7] He also stressed the importance of accuracy in scholarship as well as printing: "For who does not realize that the admirable art of printing recently devised by our countryman is as harmful to men if it multiplies erroneous works as it is useful when it publishes properly corrected editions?"[8] Scholarly printed books in themselves demanded care and attention. Those with pictures posed even more challenges to publishers. The images I analyze in parts 2 and 3 of this volume would not have been included in books unless a publisher thought it financially viable to do so. In this chapter, I review how book production was affected by the interests of those who financed it.

Material Costs of Printing Illustrated Books

In producing a printed book, paper was normally the single most expensive item; it could occupy about one-half of a publisher's entire outlay.[9] The relative cost between comparable illustrated and non-illustrated printed books is a little difficult to ascertain, though for English books it appears that an illustrated book was priced on average at 75 to 100 percent more than a comparable non-illustrated book.[10] The most instructive examples of the material cost of printing illustrated books are found in the accounts of Christopher Plantin.[11] In 1564, Plantin published Joannes Sambucus's *Emblemata* (Emblems), an octavo edition with 139 woodcuts, and in the following year he produced a Dutch edition of Giambattista della Porta's *Magia naturalis* (Natural magic), also in octavo, but without any illustrations (see table 2.1). If we compare these two octavo books published in two consecutive years, we find that for della Porta's book, paper accounted for more than 50 percent of the total cost, and the cost was about 1 *d*. per sheet of paper.[12] For Sambucus's *Emblemata*, Plantin paid 260 *fl*. 5 *st*. for the images (i.e., for having them drawn and cut), which was almost three times the sum he paid for the paper, which was 88 *fl*. 8 *st*.[13] The cost per sheet of paper was about 4 *d*., four times that of the *Magia naturalis*. Even taking into account the differences in the quality, and hence the basic cost, of paper (which was about twice as much for Sambucus's book) the difference in cost between a non-illustrated and an illustrated book was not trivial.[14] Printing books with woodcut images was thus relatively expensive, though the initial outlay for woodcuts constituted only a small proportion of a publisher's expenditure.[15]

Fig. 2.1 A portrait of Jean Calvin (a) and an "empty" portrait of Louis de Berquin (b), both with the same frame. From Théodore de Bèze, *Icones* (1580), Rijv, Ziijv. Woodcut frame 13 × 10.1 cm. Cambridge University Library, SSS.36.23.

It was always possible, of course, to economize, as in the case of the empty frames in Petrarca's *Libro degli uomini famosi* (see fig. 1.12). Or one could include some but not all of the required pictures, as in Théodore de Bèze's *Icones, id est verae imagines virorum doctrina simul et pietate illustrium* (Icons, that is, true images of men distinguished in doctrine and in piety, 1580), which contained portraits of reformers as well as pictureless frames with the names of those whose true likenesses de Bèze could not find (fig. 2.1).[16] For a reader who may not have had the means of establishing whether the portraits were "true" images, as claimed in the book's title, the presence of the empty frames would have had the effect of adding credibility to the portraits that were present.[17]

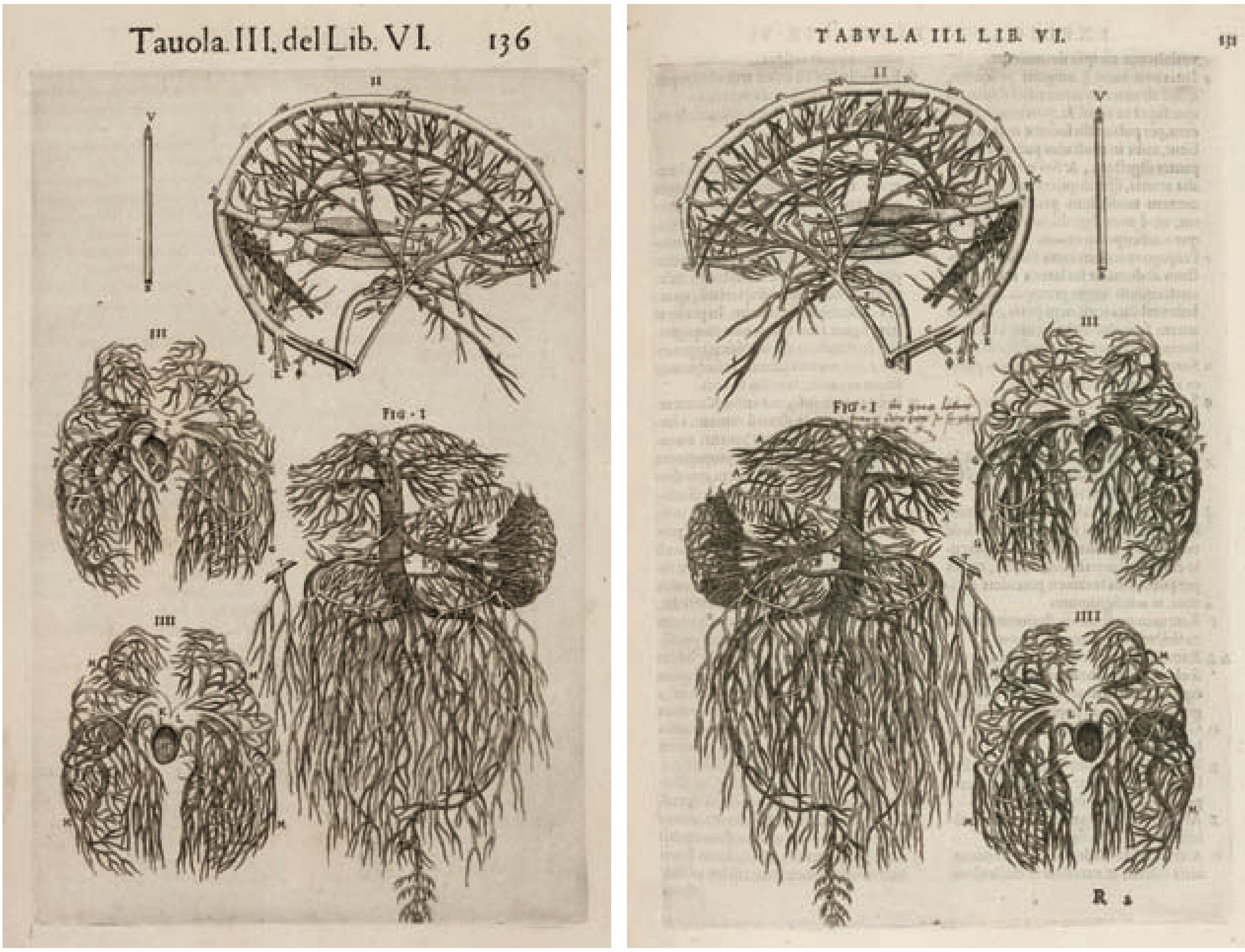


Fig. 2.2 An engraving (a) of cerebral vessels, portal veins, and pulmonary arteries that appeared in the Italian edition of Juan de Valverde, *Anatomia del corpo humano* (1560), 136, was copied and inverted (b) in the Latin edition by Christopher Plantin. Juan de Valverde, *Vivae imagines partium corporis humani* (1566), 131. Cambridge University Library, (a) Keynes T.7.11 and (b) Keynes P.7.6.

As for the costs associated with producing a large, scientific work containing engravings, the Plantin archives again offer an instructive example.[18] In 1566 Plantin published Valverde's *Vivae imagines partium corporis humani aeris formis expressae* (Lively images of parts of the human body expressed in copper plates), based on the Italian edition by Lafrery and Salamanca (*Anatomia del corpo humano*, 1560).[19] Plantin's edition was a folio-sized book with forty-two copper engravings (fig. 2.2).[20] As with several of his other illustrated scientific

Table 2.1 Comparative costs of images in Christopher Plantin's accounts[1]

	Della Porta, *Magia naturalis* (1565)	Sambucus, *Emblemata* (1564)	Valverde, *Vivae imagines* (1566)
Size	Octavo	Octavo	Folio
Paper quality	Medium (1 *fl.* 2 *st.* per ream)	Good (2 *fl.* per ream)	Very good (3 *fl.* per ream)
Total amount of paper used	48 reams 10 quires	44 reams	32 reams
Total cost of paper	53 *fl.* 7 *st.* (52 %)	88 *fl.* 8 *st.* (25 %)	96 *fl.* (12 %)
Number of pictures	None	139 woodcuts	42 copper engravings
Total cost of pictures	None	260 *fl.* 5 *st.* for drawing and cutting (254 *fl.* 16 *st.*) and portage (5 *fl.* 9 *st.*) (70 %)	606 *fl.* for making (474 *fl.*) and printing (132 *fl.*) the plates (76%)
Cost of pressmen and compositors' wages	33 *fl.* 15 *st.* (33 %)	23 *fl.* 14 *st.* (6 %)	45 *fl.* 8 *st.* (6 %)
Cost of authors, translation, etc.	15 *fl.* (15 %)	None	47 *fl.* (6 %)
Total cost	102 *fl.* 2 *st.*	372 *fl.* 7 *st.*	794 *fl.* 8 *st.*
Total number of copies printed	1,250	1,250	600
Cost per copy	Approx. 1.7 *st.*	Approx. 6 *st.*	Approx. 1 *fl.* 6 ½ *st.*
Cost per sheet of paper (i.e. 1/500 of a ream)[2]	Approx. 1 *d.*	Approx. 4 *d.*	Approx. 12 *d.*

1. Figures based on Voet 1969–72, 2:382–84; revised in Voet 1980–83, 4:1934, 5: 2026–30, and 2331–33. Percentages in parentheses are of the total cost.

2. This is calculated by dividing the total cost by the total amount of paper used.

books, Plantin was following a rather conservative strategy of choosing to print a work already known to have sold well in the vernacular, and then republishing it in Latin for the international market.[21]

For *Vivae imagines*, Plantin spent 474 florins for making the copper plates, 132 florins for the separate printing of the copper plates, 12 florins for three copies of the Italian edition, 35 florins on translation from Italian into Latin, and 96 florins for the paper.[22] The engraved images thus cost roughly six times more than the paper, which in turn constituted just 12 percent of the total cost. In the context of annual operational costs—in Plantin's case, more than 10,000 florins—the total cost of producing the Valverde volume was relatively small, at about 7 percent, but it was over seven times more than the cost of producing a non-illustrated octavo book, and twice that of an octavo book with woodcut illustrations.[23]

Plantin's total cost for producing six hundred copies of Valverde's *Vivae imagines* was 794 *fl.* 8 *st.*, which works out at 1 *fl.* 6½ *st.* per copy. The sales price was roughly twice the cost, at 2 *fl.* 10 *st.*, which was equivalent to a little more than an Antwerp carpenter's weekly wage around that time.[24] Although the sales price was set at about twice the printing cost, Plantin made a profit only in the third year of his sales.[25] This was in fact somewhat quicker than the average return for Plantin's books; two-thirds of them did not recover their cost even after three years of sales.[26]

Slow profit returns on individual titles often led publishers to diversify their wares, share stock with other publishers and booksellers, and ensure production of staple titles (such as breviaries) whose sales could be guaranteed. In 1566, two-thirds of the books sold by Plantin were printed by others.[27] Sales did not necessarily mean cash income, either: in the same year, Plantin's book sales amounted to 16,340 florins on paper, but cash receipts amounted only to 5,523 florins, or roughly a third of the sales, including payment from previous years.[28] This was because transactions made at each Frankfurt Book Fair were normally settled at the next fair, and many booksellers and publishers settled accounts in kind.[29] Like many other publishers, Plantin regularly issued a catalog of his books for advertisement.[30] Apart from the important exceptions of the first Aldine catalog and the catalogs of Simon Colines, catalogs rarely printed prices—which is understandable, given that publishers charged variable rates depending on whether the books were for wholesale or retail, additionally decorated or not, bound or not, and whether transport costs were included.[31]

Plantin's printing of Valverde's *Vivae imagines* in 1566 thus highlights some important financial considerations for the publisher of a scholarly work with pictures. Although *Vivae imagines* was by no means an overnight bestseller, within the context of Plantin's business operation, it was not a complete disaster either. While such financial calculations must have been common to other publishers, there were also other problems that publishers of scholarly works had to face.

Costs and Problems of Scholarly Books

Large, scholarly tomes aimed at university professors and advanced scholars could be costly for a publisher even without illustrations. Such books incurred extra costs by way of special fonts (Greek or Hebrew) and greater outlay for correctors, indexers, or authors. For Chrysostom's *Opera*, printed by Episcopius and Froben (1558), the collation of text cost at least sixteen florins and the indexing around twenty-one.[32] They also paid fifty-eight pounds to a corrector for a revised edition of the works of Hippocrates, fifteen florins to Gessner for his preface to the works of Galen and twenty-two florins to three other doctors for the index.[33] Even when such additional outlay was made by the publisher, an author like Erasmus still felt the need to be present at the printing of a revised edition of the New Testament, and cited his own absence as the reason for typographical errors.[34] Vesalius too traveled to Basel in order to supervise the printing of his *De fabrica*.[35]

Given the cash-flow problem encountered by many publishers, authors of scholarly works were frequently paid in installments or in kind—namely, with copies of their own books.[36] Thus Rembert Dodoens was given as payment fifty copies (or 6.25 percent of an eight-hundred-copy print run) of his *Frumentorum leguminum, palustrium et aquatilium herbarum . . . historia* (1566), and Matthias de L'Obel (1538–1616) received eighty copies, or 10 percent of the print run, of his *Kruydtboeck* (Plant book, 1581).[37] This suggests that Plantin's expenditure of forty-seven florins (see table 2.1), comprising the price of purchasing three copies of the Italian edition of Valverde's anatomical work (twelve florins) and the fee for translating it from Italian into Latin (thirty-five florins)—which amounted to about the cost of thirty-five copies, or about 6 percent of the entire print run—was comparable to the standard author's commission. Publishing a translation thus did not necessarily save costs under the heading of author's fees. From a publisher's point of view, some authors appear to have had unduly high expectations: the publisher Johannes Oporinus sent back the manuscript of a revised edition of Lorenzo Valla's commentary on Thucydides when its editor, Thomas Naogeorgius, asked for a fee of 25 gulden.[38] In 1557, Janus Cornarius made an offer to the publisher Johannes Herwagen the Younger of 170 and 50 gulden respectively for his Latin translations of Plato and of Synesius, to be paid in four installments over eighteen months at the Frankfurt fairs, in addition to twenty complimentary copies of each title.[39] That Cornarius's annual salary between 1538 and 1540 as Frankfurt's city physician had been 70 gulden suggests that his demands were perhaps optimistic.[40]

For a successful physician like Felix Platter, the fee received from publisher Ambrosius Froben for his *De corporis humani structura et usu libri III* (1583)—76 *lb*. 18 *s*. in kind and in monies—was just over 5 percent of his average annual income (approximately 1,417 *lb*.), which consisted mainly of remunerations earned as a professor at the University of Basel and as city physician (about 405 *lb*. per annum), as a medical practitioner (about 821 *lb*. per annum), and in interest income (191 *lb*. per annum).[41] For Erasmus, who did not have other gainful employment, honoraria probably mattered more; he famously complained that his work as author was not sufficiently recognized by publishers: "When Froben sees the printer's copy all ready, he does not give enough thought to the work that went into it; he only looks to see how many printed pages there are."[42] Scholarly publications rarely generated a substantial profit for the author, let alone the publisher.

Some authors had more luck dedicating their printed work to potential patrons. Peter Apian was handsomely rewarded with three thousand gold pieces when he dedicated to the Emperor Charles V his *Astronomicum Caesareum* (Caesar's astronomy), which contained sumptuously colored volvelles and pearled strings.[43] In 1559 Cornarius's heirs received one hundred gulden from John Frederick, the Elector of Saxony, for the dedication of Cornarius's edition of Dioscorides's *De materia medica*.[44] But some degree of tact was involved in this form of gift exchange: while Gessner was granted an annual supply of rye and wine by the city council of Zurich for dedicating to them the first volume of *Historia animalium* (1551), he had to apologize for dedicating his *Icones* to Elizabeth I without permission.[45] Publishers similarly dedicated books to actual and potential patrons in the hope of financial, and sometimes spiritual, return.[46] A dedication did not always guarantee financial return, however.

The main problem of scholarly editions was that their market was not nearly as large or as guaranteed as that of breviaries, missals, books of hours, or calendars. The Greek edition of Galen's *Methodus medendi* (The method of healing) bankrupted the publishers Zacharias Callierges and Nicolas Vlastos, reflecting the limited market for Greek books around 1500.[47] Even with as effective a network of distribution as that of the Giunti firm, Cardinal Marcello Cervini had to remainder 771 copies (out of a print run of 1,275) of Eustathius's commentary on Homer in Greek at half price six years after its publication (1551).[48] Even if he could find the funds, Oporinus was reluctant to publish Greek books, especially theological ones, as their sales were slow.[49] This was in contrast to the market for calendars or liturgical books.

For liturgical books, Plantin regularly exceeded his normal upper limit for print runs, producing editions of three to five thousand copies, and Georg Willer (better known for his catalogs of the Frankfurt Book Fair) ordered twenty-two thousand copies of calendars for a single year.[50] In stark contrast, stocks of

Fig. 2.3 An engraved plate of plants subscribed by Robert Boyle, whose coat of arms is at bottom right. From Robert Morison, *Plantarum historiae universalis Oxoniensis pars secunda* (1680), tab. 7–2, detail. Plate 36.7 × 24.6 cm. Trinity College, Cambridge, Q.18.17.

some scholarly works could last for years. The first edition of Nicolaus Copernicus's *De revolutionibus* (*On the Revolutions*, 1543) was in print for ten years, and Aldus Manutius's edition of Galen's *Opera*, published in 1525, was still in stock in 1586.[51] Hence, certain publishers tried to obtain some financial security before printing a book—for instance, by a subscription system. Martin Luther's *Second Lectures on the Psalms* was published in fascicules, with the purchase of the first fascicule implying the purchase of the rest.[52] In the seventeenth century, this system of subscription was frequently used to subsidize the cost of images in scientific books (fig. 2.3).[53]

Fig. 2.4 A watercolor (a) of Gessner's *psittacus erythrocianus*, now in the collection of Felix Platter, Basel, Universitätsbibliothek, MScr. K. I. 1, 50r, detail. The coloring in a printed copy (b) appears to be relatively close to the original. From Conrad Gessner, *Historia animalium* (1551–58), 3:690, detail, donated by Archbishop Matthew Parker (1504–75). Cambridge University Library, N*.1.20(A).

It is not surprising, then, that when publishers did commit themselves to producing heavily illustrated, scholarly tomes in Latin, they sought to recoup their investments in various ways. One strategy was to bring out a vernacular and/or pictorial edition with minimal text, thus making good use of the woodcuts and optimizing their market appeal. Fuchs's *De historia stirpium* was followed by a German edition the next year; Vesalius's *De humani corporis fabrica* was published simultaneously with a pictorial version, the *Epitome*; Charles Estienne's *De dissectione partium corporis humani libri tres* (Three books on the dissection of the parts of the human body, 1545) was translated into French (*La dissection des parties du corps humain divisee en trois livres*, 1546); Gessner's *Historia animalium* (History of animals, 1551–1558) was followed by a pictorial edition, *Icones* (1553, 1560); Guillaume Rondelet's *De piscibus marinis* (On marine fish, 1554) was redacted to *De natura aquatilium carmen* (Poem on the nature of aquatic animals, 1558) by François Boussuet;[54] Valverde's *Anatomia* (1566) was followed by a Dutch version (1568).[55] Such vernacular or pictorial editions did not, however, necessarily preserve the functions or arguments of the original Latin versions, as I shall discuss in chapter 6.

Another strategy was to invest a little more into decoration or coloring to make the printed book more appealing. Oporinus, for instance, printed one or two copies of a title on fine paper and had them colored as advertisement copies in order to attract students and other booksellers.[56] For the pricing of colored copies we have an unusually detailed account in a letter by Zacharias Ursinus (1534–1583), who in 1561 relayed to the imperial physician and book collector Johannes Crato von Krafftheim (1519–1585) the prices the publisher Christoph Froschauer had quoted him for the colored copies of Gessner's *Historia animalium* (fig. 2.4).[57] What is very helpful here is that Ursinus also gave the prices quoted for "white"(i.e., uncolored) copies (see table 2.2).[58]

While it appears that the price of the uncolored copies is proportionate to the amount of paper used in the volumes, namely around one-half pfennig per page, the same cannot be said for the colored copies. Although the few cases we have of the breakdown of costs for coloring elsewhere suggest that they were normally calculated by the number of figures to be colored, the additional cost incurred here for coloring the figures in the *Historia animalium* is not a straightforward calculation by that unit. This is not so surprising, since the pictures in the *Historia animalium* vary in size from approximately 25 × 19 cm to approximately 1.5 × 1.5 cm.[59] It would have been unreasonable to charge the same amount for coloring of the largest and smallest woodcuts in the *Historia animalium*. Indeed, there are many more small figures in the fourth volume than in the first three, and Froschauer must have had a way of adjusting the cost of coloring smaller figures, perhaps by ignoring the smallest ones, or by calculating instead by the amount of time taken by the painter. We can safely assume, however, that a colored copy was priced at about two to four times the price of an uncolored copy.

In January 1564, Achilles Priminus Gasser (1505–1577), one of Gessner's friends, asked for a colored copy of *Icones*.[60] Froschauer's response, via Gessner, was that his painter was too busy with coloring other large volumes and that all the other colored copies had been stored in Frankfurt, so it would be more convenient to send a copy at the next fair, in spring.[61] In March, Gessner reported that Froschauer was now at Frankfurt and hoped to get the colored copies of *Icones* to Gasser.[62] The following month, however, Gessner had to relay the disappointing news that there were no colored copies left.[63] It appears that by then, Froschauer was not willing to have another colored copy made on demand.[64] In August, Gessner was further told by Froschauer that despite an earlier promise, a colored copy could not be arranged because his painter was occupied with other projects.[65] Finally, on 6 November 1564, a relieved Gessner wrote that he hoped that Gasser had received the colored copies of *Icones animalium* (Im-

Table 2.2 Prices of colored and uncolored copies of Conrad Gessner's *Historia animalium*

	Price of "white" copy	Price per folio page of "white" copy	Price of colored copy	Price per folio page of colored copy	Additional cost per copy for coloring	Additional cost per figure for coloring
Volume 1: 1,153 folio pages and 82 figures	2 *fl.*	0.42 *d.*	4 *fl.*	0.83 *d.*	2 *fl.*	5.85 *d.*
Volume 2: 143 folio pages and 43 figures	7 *s.*	0.59 *d.*	1 *fl.* 10 *s.*	2.51 *d.*	1 *fl.* 3 *s.*	6.42 *d.*
Volume 3: 813 folio pages and 217 figures	1 *fl.* 10 *s.*	0.44 *d.*	6 *fl.*	1.77 *d.*	4 *fl.* 10 *s.*	4.98 *d.*
Volume 4: 1,337 folio pages and 737 figures	3 *fl.*	0.54 *d.*	7 *fl.* 10 *s.*	1.35 *d.*	4 *fl.* 10 *s.*	1.47 *d.*

1. Prices per page and per figure were calculated using bibliographic data in Wellisch 1975, 194–97. See chapter 3 for further cases of coloring.

ages of animals) and *Icones avium* (Images of birds).[66] Gasser's copies of these titles have survived in the Vatican Library.[67] In his copy of the *Icones animalium,* Gasser noted that in January 1565, the price was six and-a-half gold coins; this probably included the cost for *Icones avium*, which bears Gasser's signature but not a separate price.[68] Gasser's case usefully highlights the following points: that Froschauer seems to have employed an artist whose working patterns he controlled, that he somewhat underestimated the number of colored copies of *Icones* he could sell, and that he was unwilling to produce colored copies on demand. We do not know the precise print runs of Gessner's *Historia animalium* or of *Icones*, nor do we know the number of speculatively colored copies Froschauer made, or the original cost (as opposed to the price) of coloring. It is therefore impossible to determine the additional profit Froschauer made by coloring the books, but it appears to have been something he felt worthwhile doing in small batches to extend his market. The practice of coloring and its implications will be discussed further in the next chapter. What is important to note here is that the appearance of a printed book could be affected by a publisher's calculations even after publication.

Decisions regarding whether there should be pictures in a printed book, how many, and what kind, were subject to various calculations and expectations of a publisher who had a business to run. It is, in fact, hard to fathom how a sumptuously illustrated scholarly book about nature such as *De fabrica* or *De historia stirpium* became a viable prospect for its publisher at all. The key to the successful printing of these works was that both Fuchs and Vesalius made financial contributions toward production. We know that Fuchs received supplementary pay from the University of Tübingen for his publications.[69] Vesalius had also paid for the paper and woodblocks of *De fabrica*.[70] But that was not all. Fuchs and Vesalius also had to grapple with the implications of such practices as copying and coloring, as I will discuss in the next chapter, and they also had to find ways to protect and stay in control of their books, as described in chapter 4.

CHAPTER 3

Copying and Coloring

In the previous chapter, I discussed how the maker of printed images was rarely the publisher or the author, and how publishers' calculations affected the presence and quality of images in their printed books. These calculations in turn led to practices, such as copying and coloring, that resulted in seemingly contradictory trends; copying led to convergence in the imagery used across printed books, and coloring created variation in their visual appearance. Copying meant that woodcuts encountered in a printed book might be connected only loosely with the accompanying text; coloring practices suggest that woodcuts in printed books were not always expected to look black and white. Fuchs objected violently to the generic function of images made through repeated use of woodcuts. His and Vesalius's images were always specifically relevant to the text they accompanied. For Fuchs (and to some extent Gessner), furthermore, coloring was important in differentiating species, which in turn led them to write their texts with colored images in mind. This chapter assesses the positions of Vesalius and Fuchs against the general practice of copying and coloring.

Copying

Given the processes and costs involved in producing printable images, it made sense to save money if at all possible. One obvious way to do this was to copy pictures from other books. A picture could be cut out of a book, pasted onto a woodblock, and then cut by a block cutter. This naturally saved the cost of an original drawing and of tracing the drawing onto a woodblock. This method, which could also be applied to copper plates, resulted in a reversed print of the original picture (see fig. 2.2), which did not matter, except on a few occasions when placement of left and right made a difference.[1] It is thus not surprising to find that images in Fuchs's *De historia stirpium* were copied in seventeen other works through to the seventeenth century, and that the Vesalian images from *De humani corporis fabrica* (1543) and the *Epitome* (1543) suffered a similar fate, all the way to eighteenth-century Japan.[2]

Once a woodblock was cut, it could be used in different places within the same book, it could be combined with other woodcuts or have parts of it replaced in order to create variation, or it could be used in different publications. All of these strategies were deployed from the fifteenth century.[3] The life of a copper plate for a print could also be extended by altering parts of the image to fit a new context—for instance, by replacing the head in a figure of Oliver Cromwell with that of Charles I.[4] Woodblocks or copper plates could also be loaned or sold to other printers; Lafrery and Salamanca built up a large stock by purchasing plates that had already been used commercially.[5] Such purchases could also be motivated by a desire to take out one's competition rather than to augment one's stock cheaply, as was the case when Plantin bought up the woodcuts of Willem Silvius's edition of Francesco Guicciardini's *Descrittione di tutti i Paesi Bassi* (A description of the whole of the Low Countries) because he was planning his own edition).[6] Woodblocks and woodcuts originally made in the fifteenth or sixteenth century could thus survive well into the seventeenth.[7] Indeed, blocks from Fuchs's *De historia stirpium* and Vesalius's *De fabrica* were reused in the eighteenth century, respectively, in Salomon Schinz's *Anleitung zu der Pflanzenkenntniss* and in a manual for artists entitled *Des ersten, besten, Anatomici*. Both sets of woodblocks survived into the twentieth century before being lost.[8]

The reuse of woodblocks by the same publisher for different titles, their loan or sale to other publishers, as well as authorized or unauthorized copying of pictures from other books were hence widespread practices. This meant that imagery was shared across a high proportion of illustrated printed books in the sixteenth century. Of the 559 Italian sixteenth-century illustrated titles listed in Ruth Mortimer's catalog, almost 40 percent share images with other books, while about one-third of the 556 French titles also catalogued by Mortimer do so too.[9] Generally speaking, therefore, a picture encountered in a printed book in this period had not necessarily been designed and created afresh for that particular book.

It would be rash to conclude that these copying practices were new or unique to the printed book. Line drawings had been used in the late Middle Ages as models and motifs that could be copied and reused in different contexts.[10] Copying a drawing of an earlier masterpiece was also regarded as an essential form of training for a painter.[11] Some authors, such as Tito Giovanni (1518–1582), defended this practice by invoking Vitruvius, who mentioned that craftsmen copied earlier models of architectural ornaments (*De architectura*, 4.2.2).[12] These copying practices resulted in a convergence of pictorial forms, which in turn implies that most of the time, pictures in printed books were generically rather than specifically relevant to the text next to which they were placed (fig. 3.1).[13] Although such repeated images could be made to look quite different through coloring, the repeated use of woodcuts was a practice that Fuchs vigorously objected to, as will be discussed in chapter 5.

Fuchs, however, was not the first author to insist on a specific relationship between picture and text in a printed book. The German translator of Terence's *Eunuchus* (*The Eunuch*), Hans Neidhart, appears to have been able to persuade the printer, Conrad Dinckmut, who otherwise had a tendency to recycle his woodcuts, to provide theater scenes at the start of each act in which all the dramatis personae (those with speaking parts placed at the front) were represented, and in which each role could be identified throughout the book by specific features and clothes.[14] In a later example, it was a publisher who appreciated the need for a more specific relation between image and text. Johannes Oporinus, after printing Vesalius's *De fabrica*, said that he would rather delay publication and incur more costs than repeat figures for the Greek cities in Nicolaus Gerbelius's edition of Sophianos's *In descriptionem Graecae*; Opornius believed that students were more likely to trust unrepeated figures as "true [*veras*]" and would thus be more willing to buy the book.[15] Unlike in the repeated and generic use of woodcuts of cities in Schedel's *Liber cronicarum* (fig. 3.1), here, fifty years on, for a historical description of Greek cities, Oporinus suggested that illustrations must appear to be specific to the object discussed. While the repeated use of woodcuts was commonly motivated by cost saving, in the case of Vesalius he deliberately reused the same woodcut in order to point out different parts of the structure shown—not to show different objects, as in the generic repeats of city woodcuts.[16]

Against the general trend of copying, some publishers became aware that for illustrated books to have any appeal for purchasers, the quality of pictures had to be assured, or at least the care and expense expended for them had to be declared. Jean de Moulins, the French translator of Mattioli's commentary

Fig. 3.1 The cities of Troy and Ravenna, rendered using the same woodcut. From Hartmann Schedel, *Liber Cronicarum* (1493), fols. XXVIr and CXLIIr, detail. Trinity College, Cambridge, VI.17.6.

on *De materia medica*, impressed upon the reader that the publisher Guillaume Rouillé had not rushed production for the sake of profit, and had spared no expense, effort, or time to produce pretty and natural (*naifz*) pictures representing natural things.[17] Whether publishers actually did expend much care or expense is a moot point; it is important to note that these were claims that publishers felt they needed to make in order to appeal to customers.[18]

It would be misguided to regard the practice of copying images in this period as somewhat disappointing and lacking in originality. Just as medieval manuscript illumination could draw on panel-paintings drawings, or other illuminations, so too could pictures for printed books be inspired by locally available imagery such as pattern books, sketches, wooden carvings in the local cathedral, or indeed from other printed books.[19] In turn, pictures in printed books served as models for other artwork: Mary Queen of Scots (1542–1587) is known to have embroidered several animal patterns based on Gessner's woodcuts (fig. 3.2).[20] Bess of Hardwick, countess of Shrewsbury (1527–1608) made embroidery

Fig. 3.2 A cat embroidered by Mary, Queen of Scots, c. 1569–84, 29.5 × 29.5 cm, with her cipher (MA). The cat is based on the woodcut from Gessner, *Historia animalium* or *Icones animalium*, though the tail is somewhat elongated and a mouse has been added. RCIN 28224, all rights reserved. The Royal Collection © 2011, Her Majesty Queen Elizabeth II. From Conrad Gessner, *Icones animalium* (1560), 28, detail. Cambridge University Library, M.13.31; once owned by one Francis Wythens, perhaps the judge and politician (d. 1704).

Fig. 3.3 Although inverted and somewhat modified with thicker stems, the details—such as the relative position of the flowers, buds, and leaves, the intertwining of the stems and the short stem at the bottom left in Fuchs's woodcut—suggest that the *Nymphea candida* in Fuchs's *De historia stirpium* (a) must have been modeled on Hans Weiditz's image for Brunfels's *Vivae eicones* (b). From Leonhart Fuchs, *De historia stirpium* (1542), 535, woodcut 30.1 × 19.5 cm; and from Otto Brunfels, *Vivae eicones*, 1 (1530): d3r, woodcut 25.8 × 16.5 cm. Cambridge University Library (a) N*.1.24(A); (b) CCA.47.26.

work of plants modeled on figures from Mattioli's commentary on the *De materia medica*.[21] Embroidery of natural objects continued to be a favorite pastime well into the seventeenth century, when engraved prints served as patterns.[22] Several painted glassworks, tapestries, metalworks, and paintings were modeled on images from printed books.[23] Engravings were also used for disseminating models and designs of well-known paintings.[24] Printed images were thus part of a more general visual culture. Even in Fuchs's *De historia stirpium*, in which most of the woodcuts of plants appear to have been created afresh, we can note a remarkable resemblance between one of its figures and a woodcut from Brunfels's *Vivae eicones* (fig. 3.3).[25] What we should acknowledge is that in this period, pictures in printed books did not have to be created anew each time from direct observation of an actual object.[26] Though their own woodcut images quickly became part of a wider visual culture, Vesalius and Fuchs sought, against the trend of generic images, to develop uses of images specific to their study of nature, which in turn necessitated additional expenditure on their part.

Coloring

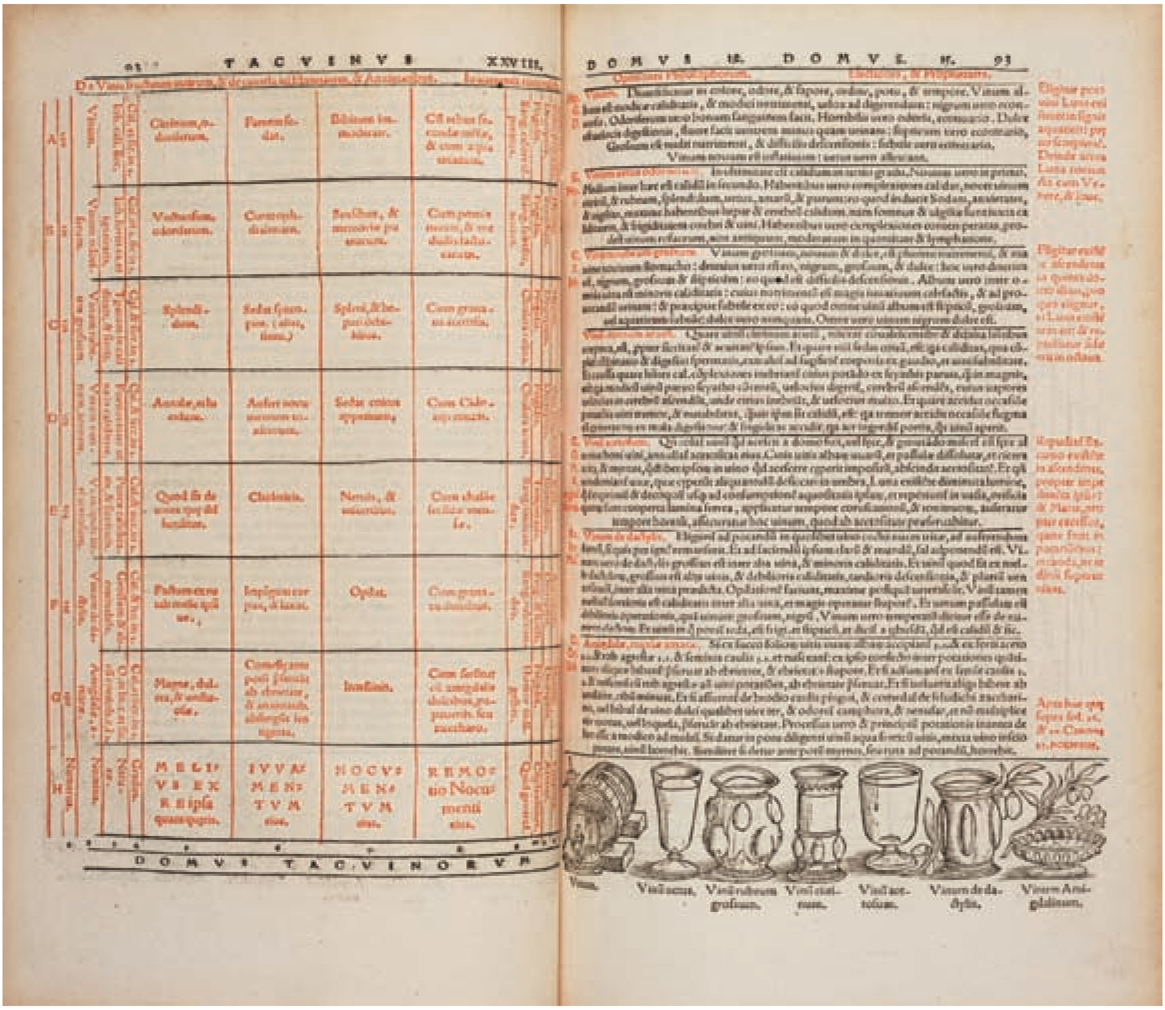
The significance of printed pictures, according to Ivins, was that for the first time it allowed "exactly repeatable pictorial statements."[27] This assessment has to be treated with caution, because not all copies of the same edition or title looked exactly alike. Some publishers, as well as some purchasers of illustrated books, wanted variation, which commonly was achieved by means of colored paper, colored printing ink, or hand-coloring.[28] Some copies of a 1572 commentary by Federico Commandino (1509–1575) on Euclid's *Elements* were printed on blue paper (fig. 3.4), as were those of Mattioli's commentary on Dioscorides' *De materia medica*.[29] Printing on blue paper seems to have been a predominantly Italian phenomenon, and more usually found in Hebrew books.[30] Red ink was used often in printing the text or symbols in law books, almanacs, liturgical works, and other titles (fig. 3.5).[31] More unusual was the use of gold ink for the text of the dedication (at least seven copies are known) by Erhard Ratdolt in his edition of Euclid's *Elementa* (fig. 3.6).[32] Stenciling, a technique used also by Ratdolt and others (fig. 3.7), may well have expedited the application of simple colors, but it may also have reflected a desire by printers to standardize coloring.[33] Colored blocks were occasionally used (fig. 3.8), but they appear to have had limited competitive advantage over coloring by hand.[34] Chiaroscuro printing, the technique of superimposing toned and outline blocks, was developed in the early sixteenth century, but was rarely used for pictures in books, with the exception of Hubertus Goltzius's *Vivae imperatorum imagines* (Lively images of emperors, fig. 3.9).[35] Color printing, in fact, did not become widespread until the nineteenth century.[36] The most common way for printers to apply color to their

Fig. 3.4 Blue geometry: Commandino's commentary on Euclid's *Elements* (1572), 27v, printed on blue paper. Cambridge University Library, F.157.a.2.1.

Fig. 3.5 Printing using red and black ink in a book on regimen: here the virtues of wine are explained. From Ibn Butlan, *Tacuini sanitatis* (1531), 92–93, printed by Johannes Schott. Cambridge University Library, N*.7.26(C).

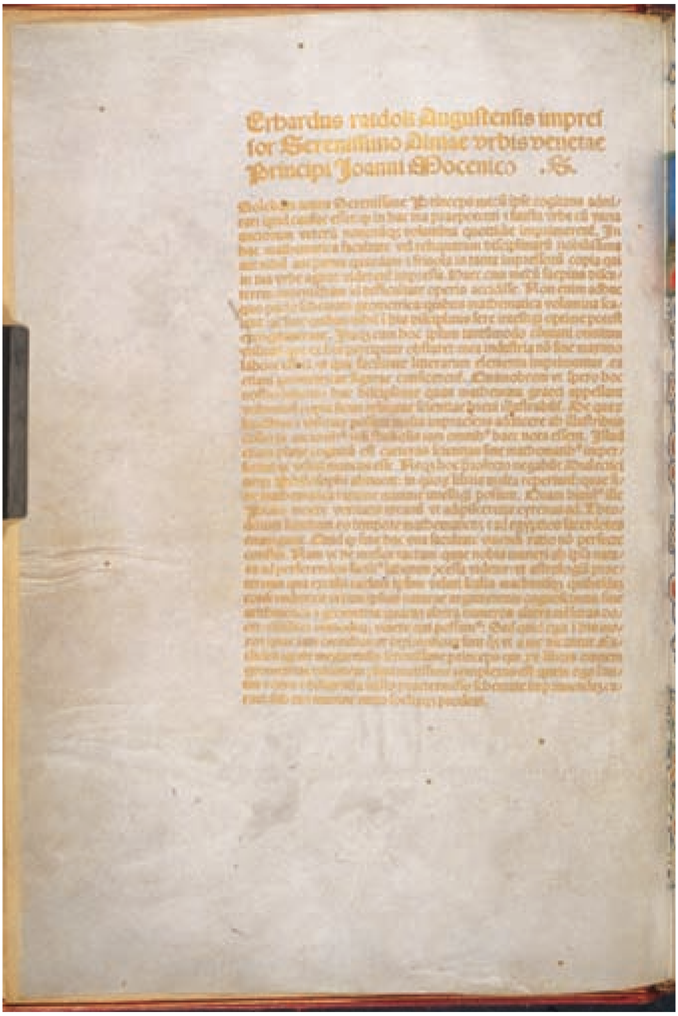
wares in the early modern period was by hand. The fifteenth-century publisher and illuminator Antoine Vérard produced sumptuously illuminated copies of his books printed on vellum.[37] Such copies were meant to look and feel like illuminated manuscripts and they confirm the enduring aesthetic value of a manuscript book.[38] Vesalius's gift copy of *De fabrica* for Charles V was sumptuously illuminated, and a colored copy of the *Epitome* (fig. 3.10), now at Cambridge University Library, may well have been a dedication copy also.[39]

The market for handsomely colored scholarly books must have been limited in the fifteenth century, however, as the printer Lienhart Holle found when he printed Ptolemy's *Cosmographia* (1482) with all copies beautifully colored (fig. 3.11); he quickly ran into debt and ceased printing the next year.[40] A fully colored



production of an entire print run never became the norm in the early modern period, but several publishers were aware that some portion of the book-buying market would be attracted to colored copies. The Venetian publisher, Vincenzo Valgrisi, printed twenty-five copies of Mattioli's 1585 commentary on Dioscorides on special paper in order to take color, but we do not know what proportion of the whole print run this constituted.[41] It was probably a difficult market to judge, as suggested by the example, discussed in the previous chapter, of Froschauer, who somewhat underestimated the number of colored copies of the *Historia animalium* he could sell.

Coloring of books was arranged either by the publisher or by the purchaser in this period. Publishers produced bespoke colored copies for particular indi-



Erhardus ratdolt Augustensis impres
sor Serenissimo Almae urbis venetae
Principi Joanni Mocenico .S.

Fig. 3.6 Preface to Euclid, *Elementa* (1482), printed by Erhard Ratdolt in gold ink. © The British Library Board, C.2.c.1.

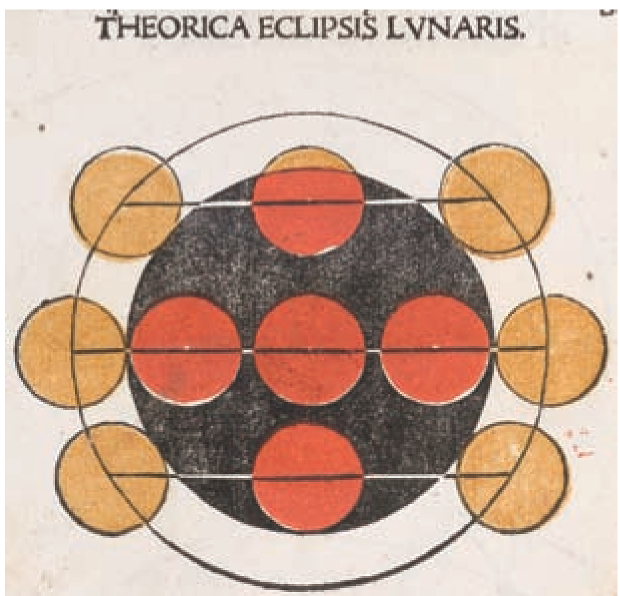


Fig. 3.7 Ratdolt's edition of Johannes de Sacrobosco's *Sphaera Mundi* (1485), S3r, detail, colored by stencil-ing. Wellcome Library, London.

Fig. 3.8 Map of the Lorraine region, colored with woodblocks. From Ptolemy, *Geographia* (1513), printed by Johannes Schott. In this particular copy, the red block did not register precisely with the black outlines. Bayerische Staatsbibliothek, München, Rar. 881.

Fig. 3.9 Chiaroscuro portrait of Charles V: etching with some detailed coloring added by hand. From Hubertus Goltzius, *Vivae omnium fere imperatorum imagines* (1557), Cc2r, detail. Woodcut, diameter 17.8 cm. Cambridge University Library, Q.8.29.

Fig. 3.10 Colored title page of Andreas Vesalius's *Epitome* (1543), on paper. Cambridge University Library, CCF.46.36.

Fig. 3.11 A sumptuously coloured map of Italy from Ptolemy, *Cosmographia* (1482), which led to the financial demise of its printer, Lienhart Holle. Map 36.6 × 56.2, narrowing to 52 cm. Trinity College Library, Grylls 2.195.

viduals, as well as "speculative" copies for unspecified buyers.[42] In the case of Vérard, the original woodcuts mattered little in bespoke illumination, as they were painted over with scenes appropriate for particular patrons.[43] Such productions tended to be expensive, though some speculative copies aimed at the upper end of the market could be equally costly. For example, Severinus Gobelius, physician to the Elector of Brandenburg, requested a colored copy of L'Obel's *Plantarum seu stirpium icones* (Images of plants and shrubs) from Plantin.[44] Plantin replied that he had no colored copies of *Icones* available, and that it would take at least three months to produce one. Instead, he offered one of the three already colored copies of L'Obel's *Kruydtboeck*, the Dutch herbal that contained the same pictures as *Icones*. Plantin charged one stuiver each for the coloring of 2,100 figures, costing an extra 105 florins, or well over ten times the book's original cost of eight florins (unbound).[45] Colored copies aimed speculatively at less wealthy book buyers were somewhat cheaper; Froschauer priced colored copies of Gessner's *Historia animalium* at twice to four times the price of uncolored ones (a colored four-volume set was priced at nineteen florins and an uncolored set at 6 *fl.* 17 *s.*).[46] Decorations and coloring could also be varied to cater for different purses: Sigmund Feyerabend offered colored copies of the Bible ranging in price between eight and ten florins (uncolored copies were sold for three florins).[47]

In sixteenth-century cases where coloring was arranged by the publisher, a master copy was used to guide and possibly control the coloring process. Gessner mentioned in the preface to the first volume of his *Historia animalium* that for those willing to pay more, the printer, Froschauer, had had several copies colored by a painter (*pictor*) following a master copy (*ad archetypum*).[48] Gessner described this in-house painter (whose name we do not know) as having colored a dozen or more copies at a time rather carelessly, which suggests perhaps that the use of the master copy was also meant to expedite the labor of coloring.[49] Felix Platter owned some of the original drawings of birds for Gessner's *Historia animalium* (see fig. 2.4), which may well have been part of Froschauer's master copy from which other colored copies were made.[50] Despite the fact that color was an important part of the description of species, Gessner was pessimistic as he felt that little importance could be attributed to the colored copies, since the colours were applied carelessly (*negligenter*) and perfunctorily (*defunctorie*) as a result of the printer's avarice.[51] Except in the cases of well-known illuminators, it is difficult to establish who did the coloring of printed books for publishers.[52] Peter Draeckx colored maps for Plantin, as did Mijncken Liefrinck (daughter of the Antwerp bookseller Hans Liefrinck I).[53] Two other women are known to have been paid by Plantin for coloring herbals.[54]

Coloring of books could also be arranged by purchasers (fig. 3.12). Many Venetian patrician purchasers of Aldine books had their own copies decorated in a style similar to how they had their legal documents illuminated.[55] The production of such hand-illuminated printed books was undoubtedly affected by the strength and character of the local tradition in manuscript illumination.[56] Indeed, variations in decoration have helped historians understand the distribution of early printed books such as the Gutenberg Bible, whose copies tended to be decorated at their destinations.[57] In Nuremberg, the patrician-scholar Willibald Pirckheimer (1470–1530) could draw on no less a local artist than Dürer to have his books decorated,[58] while another patrician, Anton Tucher, had Hans Springinklee (c. 1495– c.1540), who with Erhard Schön had designed the original woodcuts for the *Hortulus animae* printed by Koberger, color the sixty-one figures in the book for five florins (the book itself cost two florins).[59] With coloring by potential readers in mind, some authors also tried to provide guidance:

Fig. 3.12 This copy of Jerome's *Epistolae*, printed in Mainz by Peter Schoeffer in 1470, was decorated five years later, as indicated at 49v: "Laszarus de Andlou, Illuminator 1475." Trinity College, Cambridge, Grylls 2.183.

Stephan Fridolin's *Schatzbehalter* (1491) included an instruction to the reader for applying colors,[60] and Ulrich Rülein von Kalbe's *Bergbüchlein* had initials printed in the picture to guide coloring—"b" for blue (*blau*), for example.[61] Judging from the surviving copies of these titles, however, the instructions were not always followed consistently by the purchasers.

In certain cases, coloring was not just something that could be added if desired, but was integral to the original composition. Some early devotional prints, for example, required streams of blood to be colored in for the image to be complete.[62] In early printed books, initials and paragraph marks were expected to be added in by hand.[63] The simple outlines of woodcuts in early printed books are also believed to have been meant to allow coloring.[64] The woodcuts of plants in Fuchs's *De historia stirpium* also show much less shading compared to a woodcut, say, from Dodoens's *Stirpium historiae pemptades sex sive libri XXX* (Five times six, namely thirty books on the history of plants; fig. 3.13), which suggests that they were indeed meant to be colored—a point also noted later

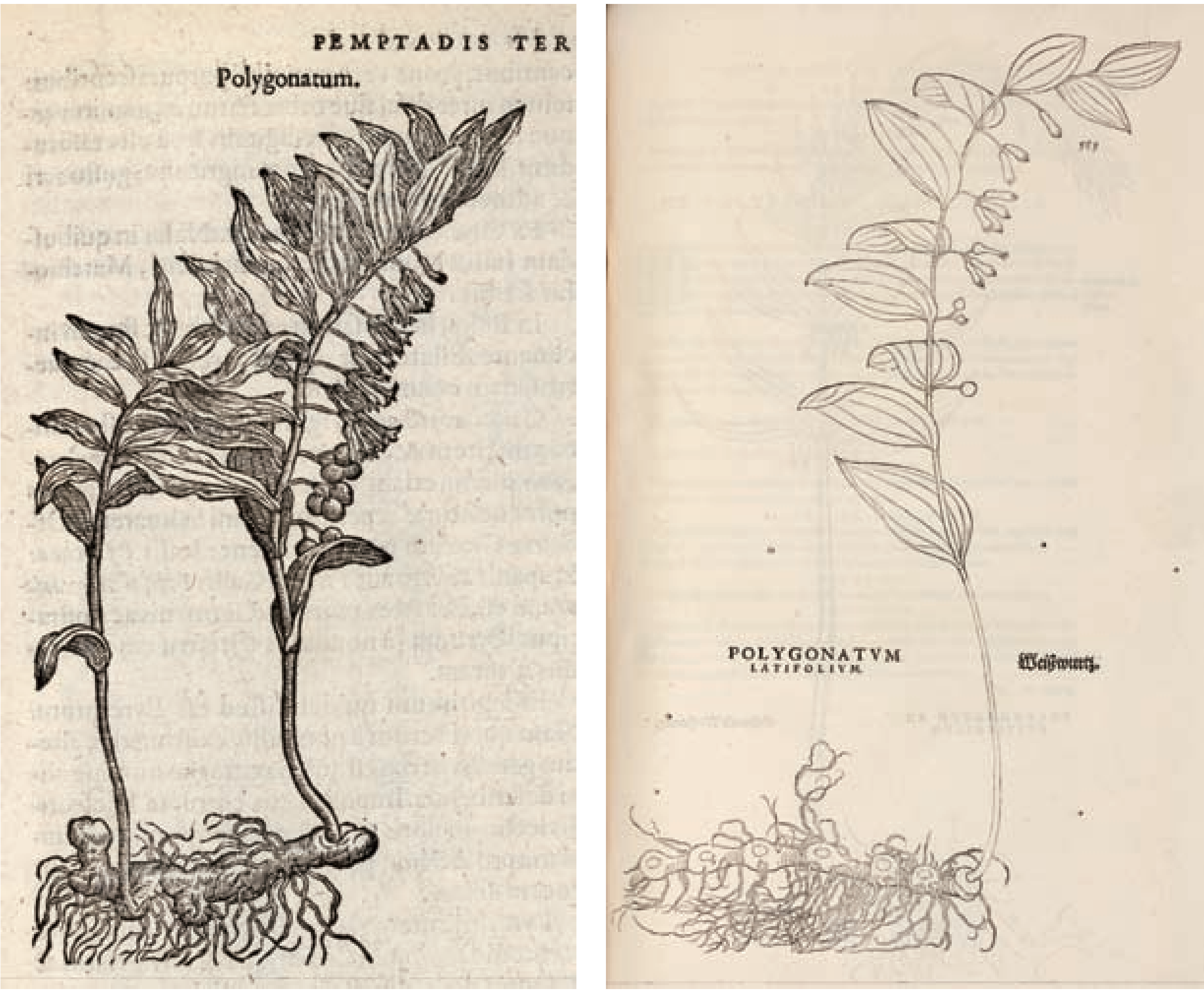


Fig. 3.13 Rembert Dodoens's heavily shaded woodcut (a) of the *polygonatum*, compared to Fuchs's shadow-free image (b) of the *polygonatum latifolium*. From Rembert Dodoens, *Pemptades* (1583), 343, detail, woodcut 13 × 7 cm; also from Leonhart Fuchs, *De historia stirpium* (1542), 585, woodcut approx. 33 cm × 21 cm. Cambridge University Library, (a) Adams.3.58 and (b) N*.1.24(A).

by Charles Plumier (who incidentally named a South American plant "fuchsia" after Fuchs).[65]

In the field of medicine, color had been integral to diagnosis since antiquity; the Hippocratic writers, Galen, and others distinguished different colors for various conditions of the human body.[66] Color also became integral to classification. Fuchs often referred to colored variations of plants, and coloring was certainly required for his woodcut of "three kinds of *lamium*" (see fig. 6.2) to make sense. In the case of the *Historia animalium*, coloring had the effect of turning generic images into specific ones, as colors disambiguated between species (see fig. 5.8).

As art historians have noted, however, the history of color perception is beset with difficulties.[67] There is first the difficulty of gauging color from surviving artifacts, given the instability of pigments and materials.[68] Of the 162 surviving copies of Fuchs's *De historia stirpium* (1542), 54 are colored, but only a few so far have been identified as having been colored following the scheme of the original drawings now in Vienna.[69] Books may have been colored at any time after publication by later owners—for example, by Joseph Banks (1743–1820), an avid collector of botanical books—and this further complicates the dating of the coloring.[70] It is also difficult to establish whether partially colored copies were contemporary and, if so, whether they might represent incomplete attempts at coloring by owners, for example.[71] The practice of variable coloring adds further difficulty in dating or grouping colored copies. This means that at present, there is little scope in gauging contemporary readers' grasp of color from surviving colored copies.

Secondly and more crucially, color terminology was far from standardized, because of the subjective element of color perception, the difficulty in defining color, and the bewildering array of color terms in classical literature.[72] While Fuchs felt the need to explain the "difficult" terms he used to describe parts of a plant, such as the *acus* (chaff of grain), *corymbus* (cluster of ivy stems), and *scapus* (upward-creeping stem) at the beginning of his *De historia stirpium*, he appears not to have felt the need to define his colors.[73] Just as he expected his readers to be able to read Latin and Greek and to be university-educated, it may well be that he also expected his readers to know the difference between *flavus* and *rubeus*.[74] This may not have been too unreasonable an expectation, especially of medical students, who may already have learned ancient medical color terms, many of which were related to everyday objects, such as "lentil-coloured."[75] They may well have been further helped by textbooks like *Urinarum probationes* (Inspection of urines) by Jodocus Willich (1501–1552), in which different colors of urine formed an important part of diagnosing different ailments.[76] Willich expected his student readers to be able to color in the urine flasks with the correct colors in his textbook, but he also made an effort to anchor the various color terms. For the color of urine that indicated a generally healthy state of the body, he cited several Latin terms—golden (*aurea*), tawny (*rufa*), dull yellow (*fulva*)—and added in German: "the prettiest gold color; the yellow of the Hungarian ducat."[77] Though much depended on the age and complexion of the patient as well as on the kinds of sediments in the urine, a darker yellow urine could also be a good sign, described as dark tawny (*subrufa*), dark yellow (*subfulva*), or dull golden (*subaurea*)—and the "yellow of Rhenish gold."[78] For distinguishing shades of yellow, Willich thus made reference to objects that were circulating widely, if not available to every student, such as the Hungarian ducat or the Rhenish gulden. Though perhaps somewhat arbitrary and ad hoc to modern sensibilities, such references must have helped medical students master the color terminology necessary for their profession, and authors like Fuchs probably expected his readers to have been so trained.

Hand-colored printed books, when offered by the publisher, were costly and lacked precision, and coloring supplied or imagined by the reader also ran the risk of being unreliable. Yet, few authors in the sixteenth century for whom color mattered in their work thought of abandoning coloring altogether. The

Fig. 3.14 Denis Dodart's engraving (a) of the *Polygonatum vulgare* (right) shows heavy shading. A colored woodcut (b) of Fuchs's *polygonatum latifolium* must have been a different visual experience. From Denis Dodart, *Mémoires pour servir à l'histoire des plantes* (1676), 114, plate 40.5 x 30.5 cm; and from Fuchs's *De historia stirpium* (1542), 585, woodcut approx. 33 × 21 cm. Cambridge University Library, (a) Rel.Aa.67.4 and (b) Sel.2.81.

expectation of these authors, it seems, was that color terms could be grasped by their readers just as well as terms in Latin and Greek.

Alternative ways to designate color in printed books did not emerge until the beginning of the seventeenth century, when conventions to designate heraldic colour in black-and-white emerged, though these were not deployed systematically even in heraldic literature.[79] Denis Dodart (1634–1707) of the Académie Royale des Sciences claimed that gradations achieved with copper engraving in his *Mémoires pour servir à l'histoire des plantes* (1676) could be a substitute for color printing.[80] His image of the *polygonatum vulgare* contrasts starkly with Fuchs's *polygonatum latifolium* (fig. 3.14), but whether this amounted to the same experience in the reader remains an open question. The lateness of this move to make black-and-white replace color may be all the more surprising, given that Albrecht Dürer had developed the idea of prints without coloring as self-sufficient works of art rather than cheaper copies of well-known paintings.[81] Despite Dürer's aspirations, it is also known that his prints were often colored, probably by their owners, in the sixteenth century.[82] This suggests that his audience was not yet ready to replace vivid colors with black-and-white print conventions. Indeed, Froschauer's use of the phrase "white" to designate uncolored copies of the *Historia animalium* (as discussed in the previous chapter) might suggest that printers, authors, and readers could expect a black-and-white image in a printed book, to look more colorful.

Hand-coloring appears to have been a viable option for coloring images in printed books in the sixteenth century, though invariably it involved additional cost and effort. This is perhaps why, apart from dedication copies, Vesalius was in the end rather sanguine about the coloring of his own work: "It would have been desirable to mark the tables in all the copies with colors individually so that the membranous part could readily be distinguished from the fleshy part, but some people would find the cost too great."[83]

Fuchs and Vesalius, as I shall be discussing in parts 2 and 3, deployed images to make specific points in their study of nature, and in this sense the use of their images ran counter to the trend of copying pictures from elsewhere at the time. It is why they had to pay for the making of new woodcuts. Coloring was also necessary—probably more so for Fuchs and Gessner than for Vesalius—in maintaining the specific functions of the images in relation to descriptions of species. They hoped for, and wrote for, the reader who would have a copy of their book for which coloring could be supplied either by hand or by education. As authors, Fuchs and Vesalius thus saw it as more important to expend their effort and money in creating specific functions of images, which in turn were crucial for their visual arguments about nature. Given their investment, the resulting book, as I shall discuss in the next chapter, was something that they felt should be protected from the relentless copying practices of the printing press.

CHAPTER 4

Control

The title page of Fuchs's *De historia stirpium* sported the following declaration at the bottom of the page:

> Furthermore, by the decree of Charles, invincible Emperor, warning is given that no other person goes without punishment who anywhere else prints these commentaries on the history of plants, just as was said in the privilege previously made known to us.[1]

At a similar location of the title page of Vesalius's *De fabrica* was written:

> With the grace and privilege of his Imperial Majesty, of the King of the Franks and of the Senate of Venice, as contained in the documents from them.[2]

These were indications that the books were covered by a privilege, a legal instrument. As discussed earlier, printed books with pictures demanded significant financial investment; their marketing and distribution arrangements were complex and unreliable; their profit returns could be slow; and the widespread practice of copying threatened to undercut the investment made in them by publishers, editors, authors, painters and engravers.

These people therefore sought to protect their product and interests through a privilege, which could be the basis of a lawsuit. Though not much is known about such lawsuits and their details with regard to illustrated scientific books in this period, the publisher Egenolff's disputes with Schott and Fuchs bring out the different attitudes that existed toward images of nature and copying. This chapter discusses these privileges and lawsuits, as well as another means of controlling the printing of books—namely, censorship. These were ways in which various interested parties sought some control over their printed books. No one group was more successful than another in exercising satisfactory control, mainly because of the limited means of enforcement available at the time. In the end, authors had to resort to personal negotiation, financial investment, and supervision in order to maintain a modicum of control over the content of their books.

Privileges

A privilege was a well-established legal instrument.[3] A legislating authority could grant by special favor a privilege to an individual, giving the grantee an advantage over the non-privileged. Such advantages typically came in the form of exemptions from duties or monopoly of certain activities or products, and fines against those who infringed the privilege. Such a privilege was effective, however, only within the jurisdiction of the legislating authority.

Emperor Maximilian granted printing privileges to literary figures in his court, and Pope Leo X used them as a form of patronage to scholars.[4] Royal and imperial chanceries accepted applications for privileges, since the fees provided extra revenue, and the clerks and notaries received gratuities for successful applications.[5] Although one could simply apply to the imperial or royal chancery for a privilege, because the granting of the privilege was solely in the power of the emperor or the king, many publishers and authors entreated clients and favorites of rulers to intercede on their behalf. Johannes Crato von Krafftheim, the court physician to three successive emperors (Ferdinand I, Maximilian II, and Rudolf II), is well known for having played such a role.[6] Plantin procured his papal privileges through Cardinal Antoine Perrenot de Granvelle (1517–1586).[7] Gessner presented a colored copy of *Icones animalium* to the imperial vice-chancellor, Georg Sigismund Seld (1516–1565), who had arranged for a privilege.[8] Several printed books were dedicated to those who helped procure privileges, and the intermediaries were often explicitly mentioned and thanked in the prefaces.[9] Though not every printed book needed to be protected by a privilege, publishers and others clearly thought that it could have some effect in protecting their present or future products. Some even resorted to forgery: in 1544 the printer Balthasaar Beck and the author Walther Hermann Ryff were prosecuted by the city of Strasbourg for forging an imperial privilege using a sheet of vellum sealed with a Joachimsthaler, "as if it were the Imperial insignia."[10]

Privileges usually spelled out in formulaic format to whom they were granted, for which title(s), for how long, and the details of penalties against those who trespassed on such rights of the privilege's grantee. These penalties usually specified the amount of fines and confiscation of infringing copies, though a papal privilege could also impose a penalty of excommunication, as it did for Paul of Middelburg's slender book, *Compendium correctionis calendarii* (A compendium of the correction of the calendar).[11]

The privilege covered texts that were to be published for the first time, including translations or substantial revisions.[12] This may well have encouraged the practice of claiming newness on title pages—"never before seen," "newly revised," and so on—when in some cases the changes were relatively minor. Both Fuchs and his nemesis, Janus Cornarius, accused each other of this practice of claiming novelty out of minor changes.[13] Privileges were sometimes sought by publishers as a preemptive measure to stop others from printing a particular title.[14] They could also be extended to cover elements of the appearance of the page, such as typefaces, music fonts, maps, and pictures.[15] In the case of printed images and maps, it was normally the financial investment and effort that went into the production of woodblocks and plates (not the original design) that was being protected, so the penalties for infringement additionally included confiscation of the block or the plate.[16] Dürer was perhaps unusual in claiming that his imperial privilege for his *Little Virgin* protected his labor as well as his talent (*ingenium*).[17] Fuchs seemed to think that a formulaic privilege did not necessarily cover images in printed books. He had obtained a standard privilege from King Ferdinand (dated 27 May 1544) for the smaller woodcuts of his *Läbliche* [sic] *Abbildung und Contrafaytung aller Kräuter* (Laudable images and portraits of all plants, 1545), which forbade copying and selling copied books, but on discovering that his 1542 edition had been copied by Egenolff, he obtained a renewal of his privilege (dated 28 March 1545) that added special mention of the smaller pictures (fig. 4.1).[18]

There was also regional variation: privileges issued in Rome tended more to cover the printing and selling of copies rather than their design, while Venetian privileges seem to have included form and composition as part of "new" printing.[19] The length of time covered by a privilege could vary between three and ten years, or up to a particular number of copies sold.[20] Given that stocks could last for some time, such conditions were perhaps reasonable. Paul IV's privilege for Juan de Valverde's *Historia de la composicion del cuerpo humano* (1556) protected the work, without limit of time, from reprinting or sales elsewhere without an engraved license from the author or from the publisher, Antonio Salamanca.[21]

Privileges could be protected only within the jurisdiction of the granter, so publishers aiming at markets in different jurisdictions sought multiple privileges. Given their proximity to both German and French markets, publishers in Basel often sought privileges from the Holy Roman emperor as well as from the French king, despite the fact that papal privileges claimed effectiveness over the whole of Catholic Christendom.[22] Mattioli's commentary on Dioscorides's *De materia medica* (1565) included privileges granted by Pope Pius IV for ten years (with an approbation from the inquisitor general of Venice); by Emperor Ferdinand for twenty years; by the emperor's son, Archduke Ferdinand, for twenty years (Mattioli was his personal physician); by Charles IX, the king of France, for ten years; and by Cosimo I, grand duke of Florence—all of which covered the new illustrations.[23] Given how often privileges failed to deter, it is likely that Mattioli's parading of so many privileges must have had an element of display.[24] Not every book reproduced the full text and paraph of each original privilege.[25] It was common for a title page instead to contain a summary of the privilege, or simple acknowledgment of the fact that a privilege covered the book, as was the case with the books by Fuchs and Vesalius noted at the beginning of this chapter.

The publisher's practice of copying from other books was not necessarily curtailed by privileges, as this could be done legitimately outside the specified period or jurisdiction of the privilege. The Lyonnais publisher Balthazar Arnoullet contracted the engraver Clément Boussy to start copying the illustrations for Fuchs's *De historia stirpium* in 1547, in preparation for printing them in 1549 when the original privilege ran out.[26]

There were also those who flagrantly violated the terms of the privilege, a few of whom were taken to court by the wronged publishers.[27] It is difficult to assess how successful such lawsuits were, and it certainly seems that privileges rarely worked as deterrents, as Vesalius lamented to Oporinus:

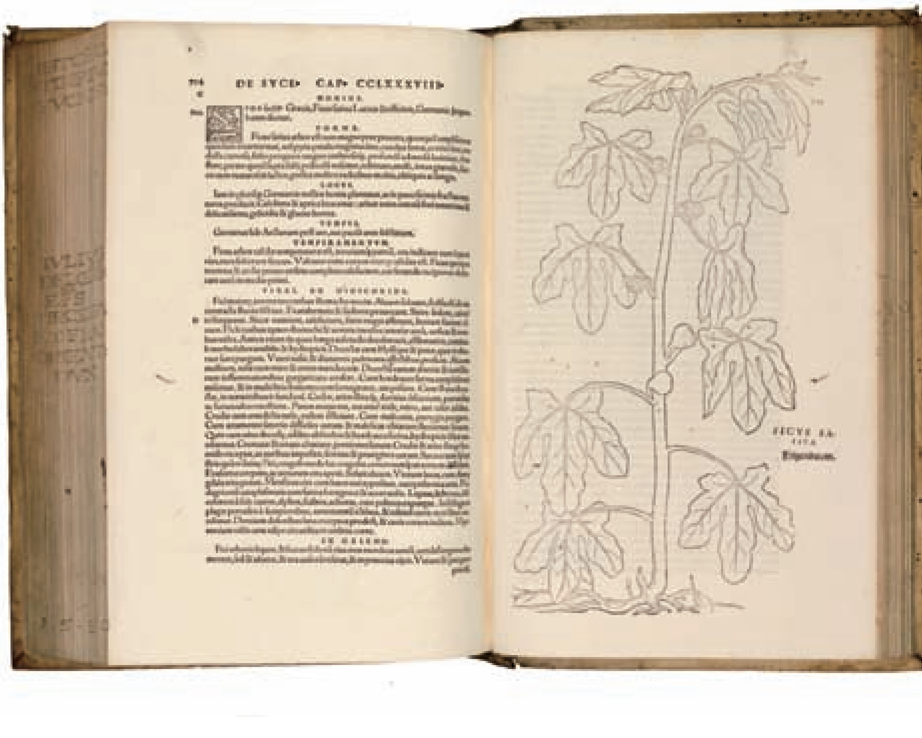
> I . . . shall bring with me the written decree of the Venetian Senate forbidding anyone to print any of the illustrations without my consent. Although you have a general license for all the books that you are the first to publish, my mother will send you an imperial one from Brussels. It was granted to me some years ago; but I have not so far made written application to have it brought up to date and its validity extended over a number of years. The Bishop of Montpellier, Orator at Venice, has undertaken to get me one from the King of France. I am not too worried about this, and I decided not to fill a page with official documents. For the fact is that booksellers and publishers, whose premises are now springing up in every corner of the land, take little notice of imperial decrees.[28]

Vesalius himself appears to have applied for the privileges, which further confirms his financial investment in his own book.[29] What is important to note here is Vesalius's sense that privileges had only a limited effect.

Nature's Court Case

Records of lawsuits specifically covering pictures relating to scientific subjects are relatively rare, except for the well-known case between the Strasbourg publisher Johannes Schott and the Frankfurt publisher Christian Egenolff.[30] In 1533, Egenolff issued the *Kreuterbuch* (Plant book) edited by Eucharius Rösslin (c. 1470–1526), which copied in a smaller format the pictures in Brunfels's *Vivae eicones herbarum*, printed by Schott.[31] Schott took Egenolff to the Reichskammergericht for infringing the imperial privilege which protected the book from being copied for six years.[32] Egenolff defended himself by making the following points.[33] First, the *Kreuterbuch* was based on an old book compiled by Dr. Johannes von Cube, a former city physician to Frankfurt, and copying from a book which was thirty to forty years old was not forbidden.[34] Second, Egenolff's book contained fifty pictures not in Schott's book, and fifty pictures in Schott's book were not in Egenolff's book. One hundred pictures thus did not match, and therefore Egenolff's book could not be regarded as a copy of Schott's. Third, pictures of plants are likely to resemble each other because one cannot draw or copy a picture of a rosemary, a daffodil, or a borage in any other form than what it is.[35] It would have been absurd to take the imperial privilege to mean that simply because Schott had published a herbal, one now had to depict a plant with longer and broader leaves when it really had slender and shorter leaves. Fourth, Egenolff argued that privileges granted to Dürer or Jacopo de' Barbari did not imply that no other painter might paint the same subjects, such as Adam and Eve.[36] The last two points illuminate particularly well a publisher's position on copying pictures of natural objects. For Egenolff, privileges over pictorial matter did not cover the subject matter of the pictures, but only their forms. But even copying these forms could not be avoided in the case of pictures of plants, because plants have to be depicted the way they are. One daffodil is going to look similar to another daffodil; thus, depictions of plants will necessarily look alike. Egenolff seems to have been arguing implicitly that prohibiting the similarity between pictures of plants was tantamount to prohibiting the depiction of the subject matter itself. It suggests that Egenolff thought that there was less of what we could call "artistic license" in depicting objects of nature. The outcome of Schott's lawsuit is not known.

If Egenhoff was somewhat disingenuous, he was at least consistent in his views when in 1543 he brought out Dioscorides's *De materia medica* edited by Walter Hermann Ryff in Latin, with pictures copied from Fuchs's *De*



historia stirpium, which had appeared a year earlier (fig. 4.1). Against Fuchs's charge of theft, Egenolff argued the following: Fuchs should not get so angry over Egenolff's pictures (which, eight years before Fuchs's book was even published, already numbered more than six hundred) resembling those of Fuchs, because painters compete by emulating each other; moreover, if there is any charm in the parts that cannot or should not be depicted other than the way nature brings them about, glory must first be given to God the creator, then to the artist, and not to the author, as Fuchs was trying to do by including his own large portrait in his book.[37] Here we see the echo of Egenolff's earlier argument: nature, and indeed God, created plants in a certain way, which compels the forms of the pictures to look alike, and hence resemblance between pictures of the same plant is inevitable. Egenolff added further that the artist should get the credit for the picture, and not the author, whom he charges with vainglory for having included a picture of himself. Fuchs replied in *Adversus Mendaces et Christiano homine indignas, Christiani Egenolphi typographi Francoforti* (A reply against the mendacious calumnies, unworthy of a Christian, of Christian Egenolff the publisher in Frankfurt) that Egenolff's position was absurd, since no two wormwood plants have exactly the same form; so if two people painted a wormwood in two different places, they would not have the same contours (*lineamenta*) or composition (*schema*).[38]

So here are two contrasting assumptions underpinning attitudes toward plagiarizing pictures of natural objects. One position derives from the assumption that instances of the same species in nature have essentially the same form. It thus makes it possible to argue that by the force of nature, depictions of objects in nature will converge in form; it further implies that resemblances between pictures of the same natural species drawn by various craftsmen are inevitable, and that they should not be regarded as the result of intentional copying or "theft." The other position is that no single example of a given species has exactly the same form as another example of the same species, and that therefore pictures of the same plant species must diverge in form if they were drawn from different samples. If line contours and compositional arrangements match exactly between two pictures of the same species, it implies intentional copying. These positions may of course seem rather obvious, given that one was held by a publisher making a profit from producing cheap, plagiarized picture books and the other by a learned physician feeling protective of Veit Rudolf Specklin's woodcutting labor and his own financial investment. Fuchs's position may appear ironic, since he was interested in making his pictures as "complete"

Fig. 4.1 Comparative sizes of books. At bottom is the image of a fig tree in Fuchs's *De historia stirpium* (1542), 754–55, in folio. In the middle is the woodcut copied by Egenolff in a quarto edition of Dioscorides's *De medicinali materia* (1543), 90–91. In response, Fuchs had smaller woodcuts made for an octavo edition, the *Primi de historia stirpium* (1545), 440–41 (top). Cambridge University Library, N*.1.24(A) (bottom); K.3.29 (middle); Rel.d.54.36 (top).

as possible, in support of universal arguments, as opposed to focusing on the particularities of individual specimens. Such universalized images must have looked similar, though Fuchs's focus on contours and composition implies that he believed artists had some freedom in how to represent generalized images. This tallies with the high regard he had for his artists, such that he included an image of them in his book (see fig. 1.14). At the very least, this dispute between Fuchs and Egenolff shows that neither the publisher nor the author thought that privileges covered the subject matter or objects of nature that had been depicted. At issue was whether depictions of natural objects could be legally protected, and the answer boiled down to the relative freedom artists were perceived to have in picturing objects whose forms were determined by nature.

The publisher Egenolff was not put off by lawsuits or controversies. Indeed, he was quick to spot opportunities for profit to be had by copying pictures from books printed by others and reproducing them alongside similar or different texts in books of smaller formats. He annoyed Schott, Fuchs, Specklin, and doubtless many others by doing so, but there was money to be made. When Egenolff died, he left his widow an estate worth sixteen thousand florins, which made her the highest taxpayer in Frankfurt am Main at the time.[39]

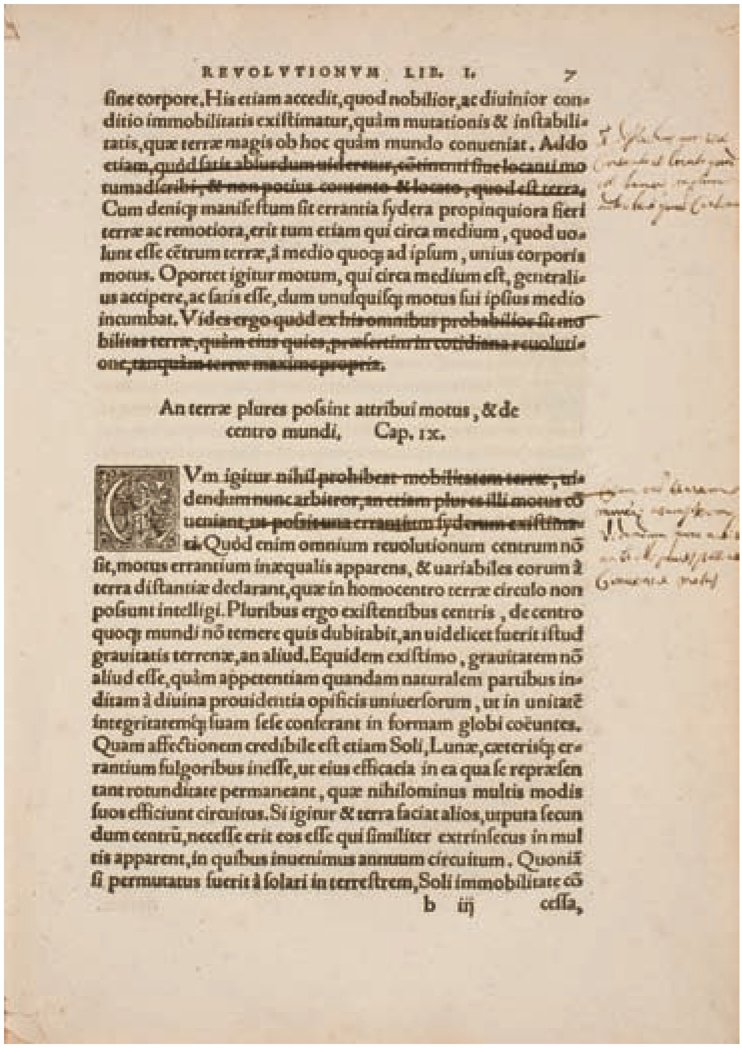
Censorship

While publishers and authors sought to protect their products from the relentless replicating power of the printing press, some groups began to see the need for controlling what could be printed in the first place.[40] Popes and councils had been proscribing books deemed heretical long before the invention of movable-type printing, and they continued to do so in the early years of the printed book, as was the case with Giovanni Pico della Mirandola's *Conclusiones nonagentae* (Nine hundred theses) in 1487 and *Epistolae obscurorum virorum* (*Letters of Obscure Men*) in 1517.[41] More rarely, individuals such as Niccolò Perotti (1429/30–1480) asked Pope Paul II to protect classical authors from the sort of incompetent editing that had been perpetrated by Giovanni Andrea Bussi (1417–1475) in the 1470 edition of Pliny's *Historia naturalis*.[42] Interest in censorship intensified with the onset of the Reformation. Upon outlawing Luther at the Diet of Worms, Charles V issued the Edict of Worms in 1521, which included a section on printing. This was intended to outlaw Lutheran publication and, significantly, it included pictures as being possible conveyers of heretical ideas, which were thus subject to strict penalties.[43] The Edict of Chateaubriant in 1551, which included a clause specifically aimed at Lyonnais publishers who had enjoyed relative immunity, forbade the production of irreverent pictures of saints and ecclesiastic dignitaries, though it is unclear to what extent this edict was enforced.[44] Martin Luther, in turn, asked the elector of Saxony to prohibit the printing of books by Andreas Karlstadt, and he was responsible for closing down the press of the Brethren of the Common Life in Rostock in 1530, though he is known to have supported the publication of the Koran.[45] No systematic attempt to control pictorial material appears to have been made by Luther or Philip Melanchthon. They are instead known for their extensive use of broadsides for anti-papal popular propaganda.[46]

During the Council of Trent, Paul IV set the Congregation of the Inquisition the task of compiling a comprehensive list of prohibited books, *Index librorum prohibitorum*. A list was compiled in 1554/55, and was expanded in 1559 and revised in 1564 to include rules governing the details of the prohibition. The 1564 rules allowed for a distinction between a blanket ban of all the works of a heretic and a partial ban of the works of heretical authors whose nonreligious works might be permitted. Most Protestant authors, however, were placed in the first category.[47] Both Gessner and Fuchs were placed on the *Index* in the category of authors all of whose works, past, present and future, were banned.[48] In a copy of Fuchs's *De historia stirpium* (1555) at Stanford University Library, for example, Fuchs's name on the title page is crossed out and "*damnato*" written next to it.[49] Contemporary Venetian booksellers complained of the wholesale ban of the works of Protestant authors such as Gessner, who had also written on bibliographical and medical topics as well as authoring the *Historia animalium*.[50]

The Congregation of Index, established in 1588, was charged to seek out and list books pernicious to faith and morals. The *instructio* added to the *Index* of 1596 explained in detail how to expurgate texts. Once it had been expurgated according to these instructions, the possession and reading of Gessner's *Bibliotheca universalis*, for instance, was permitted.[51] Copernicus's *De revolutionibus* was placed on the *Index* of 1616, and requisite corrections were spelled out in 1620 (fig. 4.2).[52] Sixty percent of the copies in Italy appear to have been censored following the *Index*'s guidelines, but hardly any were censored in Spain or Portugal.[53] This suggests the limitation in enforcement of such bans. Moreover, the bookstore of Juan de Junta (son of the Florentine publisher Filippo di Giunta) in Burgos held eighty-two titles that were prohibited in the Spanish version of the 1559 *Index*.[54] Cardinal Michele Ghislieri (later Pius V) allowed the bishop of Spalato, Marco Corner, to keep Fuchs's *De historia stirpium* for six months, and Pope Sixtus V (1585–90), who established the Congregation of the Index, owned a dozen prohibited books, including Gessner's *Bibliotheca universalis*.[55] These cases suggest that Fuchs, as a Lutheran author, may not have found a ready market for his book in Catholic territories, but also that copies of the book were not completely unavailable.

Despite the efforts by Johannes Molanus (1533–1585) and Gabriele Paleotti (1522–1597) to establish an "Index of Prohibited Images," a separate index for pictures, this did not materialize.[56] In fact, images, regarded as "books" of the



REVOLVTIONVM LIB. I. 7

sine corpore. His etiam accedit, quod nobilior, ac diuinior conditio immobilitatis existimatur, quàm mutationis & instabilitatis, quæ terræ magis ob hoc quàm mundo conueniat. Addo etiam, ~~quòd satis absurdum uideretur, cõtinenti siue locanti motum adscribi, & non potius contento & locato, quod est terra.~~ Cum deniq; manifestum sit errantia sydera propinquiora fieri terræ ac remotiora, erit tum etiam qui circa medium, quod uolunt esse cẽtrum terræ, à medio quoq; ad ipsum, unius corporis motus. Oportet igitur motum, qui circa medium est, generalius accipere, ac satis esse, dum unusquisq; motus sui ipsius medio incumbat. V~~ides ergo quòd ex his omnibus probabilior sit mobilitas terræ, quàm eius quies, præsertim in cotidiana reuolutione, tanquàm terræ maxime propria.~~

An terræ plures poßint attribui motus, & de centro mundi, Cap. IX.

C~~Vm igitur nihil prohibeat mobilitatem terræ, uidendum nunc arbitror, an etiam plures illi motus cõueniant, ut posit una errantium syderum existimari.~~ Quòd enim omnium reuolutionum centrum nõ sit, motus errantium inæqualis apparens, & uariabiles eorum à terra distantiæ declarant, quæ in homocentro terræ circulo non posunt intelligi. Pluribus ergo existentibus centris, de centro quoq; mundi nõ temere quis dubitabit, an uidelicet fuerit istud grauitatis terrenæ, an aliud. Equidem existimo, grauitatem nõ aliud esse, quàm appetentiam quandam naturalem partibus inditam à diuina prouidentia opificis uniuersorum, ut in unitatẽ integritatemq; suam sese conferant in formam globi coëuntes. Quam affectionem credibile est etiam Soli, Lunæ, cæterisq; errantium fulgoribus inesse, ut eius efficacia in ea qua se repræsentant rotunditate permaneant, quæ nihilominus multis modis suos efficiunt circuitus. Si igitur & terra faciat alios, utputa secundum centrũ, necesse erit eos esse qui similiter extrinsecus in multis apparent, in quibus inuenimus annuum circuitum. Quoniã si permutatus fuerit à solari in terrestrem, Soli immobilitate cõ

b iij cessa,

Fig. 4.2 Three passages on this page have been struck out and corrected (in the margins) as decreed in the *Index of Prohibited Books* (1620), so that that the passages now treat the earth's motion as a hypothesis, not a reality. From Nicolaus Copernicus, *De revolutionibus* (1543), 7r. Trinity College, Cambridge, T.3.75.

unlearned, were treated in the same ways as printed books.[57] The *Instructio* of 1596, which prohibited "obscene" woodcuts, was in fact a much toned-down version of the rule devised in 1590 (but never promulgated) that prohibited "obscene" pictures and images as "mute books" that corrupted mores.[58] In 1590 the Inquisition arrested and imprisoned the engraver Philippe Thomassin for engraving the portrait of the French Protestant king, Henry IV, accompanied by a text praising his piety, that was being shown in Rome.[59] Even pictures that did not explicitly represent Protestant figures could become suspect by association with Protestant texts, as was the case with a set of woodcuts designed by

Hans Holbein the Younger (c. 1497–1543) which originally had been set in a book printed by Catholic printers Melchior and Gaspard Treschsel, accompanied by texts of the moderate Catholic authors Jean Vauzelles and Gilles Corrozet.[60] When the woodblocks passed on to the Protestant brothers Jean and François Frellon, they printed them alongside more explicitly Protestant readings.[61] This latter edition was censured by the faculty of theology at the University of Paris and placed on the *Index* in 1559.[62] This suggests that the meaning of certain images were determined by the text they accompanied.

Neither Fuchs nor Vesalius could have resorted to censorship either to protect their own scholarship or to silence their opponents, though they could be subject to it. As Protestant authors, Fuchs and Gessner came under Catholic censorship and certainly had no means of getting the bans lifted. Nevertheless, evidence suggests that being placed on the *Index* did not stop circulation of their works in Catholic territories. Moreover, nature, as subject matter for depiction, did not of itself attract censure. This is not to say that the study of nature had nothing to do with religion. Indeed, Gessner had deep religious reasons (as I discuss in chapter 8) for feeling the need to study nature pictorially. It would, however, be an overstatement to suggest that Catholic censorship was detrimental to the study of nature in general.

Both privileges and censorship were rather ineffective instruments for exercising control over printed books. Satisfactory control by the author of the final printed product—both text and image—was seldom achieved by such means. Given that authors depended on skilled artists for their images, and publishers had the upper hand in the process of book production (as seen in chapters 1 and 2), did authors, in fact, ever achieve a satisfactory result with their books?

Authorial Control?

When Luther lamented, “I know my wish doesn’t count, since what will be done is what the press wants and not what I want,” he was neither the first author nor the last to complain that publishers’ calculations compromised scholarly standards and accuracy in the printed product.[63] The Zurich publisher Christoph Froschauer preferred to print theological works rather than scholarly medical books, which disappointed Gessner.[64] Gessner was also irritated with Froben when the publisher tried to cut corners by including only one index, which to Gessner smacked of pandering to the unlearned.[65]

Copernicus’s *De revolutionibus* is a typical example of the author lacking control over both his text and his images, with serious consequences: the diagrams were wrongly cut, the title was altered, and a new preface was added by the editor, Andreas Osiander (1498–1552)—which meant, as is well known, that Copernicus’s heliostatic claims were read as a hypothesis rather than a real description of the universe.[66] Charles L'Ecluse (1526–1609) carefully supervised Peeter vander Borcht in drawing pictures of plants from dried specimens, only to see the woodcuts being first used for Dodoens' *Purgantium . . . herbarum historiae libri I* (1574) by Plantin.[67] Gessner complained how, at the order of the publisher Froschauer, the painter would only release one proof of an image at a time, to be inserted in the correct place in the publishers' copy, and how Froschauer's misguided fastidiousness resulted in the pictures being placed out of order.[68] When Ippolito Salviani (1514–1572) took matters into his own hands and tried to print at home his own study of fishes (*Aquatilium animalium historiae liber*) with fine copper engravings, the project floundered as he ran out of patronage and funds.[69] Hence it was very rare for an author to be in full control of the production of both images and text.[70]

Although the publishers were inclined to save costs, at least some authors managed to persuade them that mismatches warranted emendation. This could be done by inserting a list of errata later in the publication process.[71] Names accompanying an image could readily be corrected in this way, as when Fuchs included corrections such as, "Page 148. next to the picture, read 'Bellis Maior' [instead of Bellis Minor]," and when Vesalius corrected an image caption to indicate the "fifth" table of muscles rather than the "first" table.[72] Correcting a picture was more awkward, as the amended picture had to be pasted by hand into each copy.[73]

Well known is the case of Charles Estienne (c. 1505–1564), who had his stepfather, Simon Colines, and a publisher on his side, yet struggled to have control over the woodcuts for an anatomical work.[74] As a medical student at Paris in the 1530s, Estienne had embarked on writing a book on human anatomy with the help of a student in surgery, Etienne de la Rivière, who drew the figures.[75] The latter then accused the former of plagiarism. The case appeared to center on whether de la Rivière should also be credited with the authorship of the book. Colines took the case to the medical faculty of Paris, who, though unhappy with the idea that a work in Latin should be published under the name of a mere surgeon, nevertheless handed the case over to Parlement.[76] In 1541 a committee of two surgeons and two doctors was appointed to decide the question, but it was not until March 1545 that Parlement confirmed Estienne as sole author and ordered de la Rivière to hand over the remainder of the figures.[77] This clash should perhaps be seen more as a struggle of a surgeon trying to obtain intellectual recognition on a par with that of a physician; de la Rivière went on to agitate for surgeons' rights and was restrained by the medical faculty in 1552.[78] The resulting book is somewhat puzzling in that each woodcut has "very little anatomy" for its size (fig. 4.3), and several have insets which were obviously replaced, perhaps for the purpose of correction rather than for recombination and reuse.[79] It is not clear whether the inserts were made by Estienne or by Rivière,

Fig. 4.3 This woodcut shows parts of the brain, such as the dura mater (A, B) and the meninx (C), as specified in the tableau. The break in shading on the arm and shoulder indicates that a separate, rectangular piece of woodcut (approx. 4.5 × 3.2 cm) showing the brain was inserted. A similar insertion was made for the top half of the skull shown next to the knee, where the gap in the shading is more visible. The whole woodcut measures 28 × 18 cm. The anatomical detail of the brain therefore comprises less than 3 percent of the surface area of the entire image. From Charles Estienne, *De dissectione partium corporis humani libri tres* (1545), 239. Cambridge University Library, N*.3.12(B).

Fig. 4.4 Vesalius supplied a figure (a) to show where to add the keys that were left out in the original (b). Note that in the original figure, it is extremely difficult to locate e or n. From Andreas Vesalius, *De fabrica*, [435], detail, and [432], detail. Cambridge University Library, K.7.3.

but the book is a striking example of an unhappy collaboration between author and image maker.

Many more cases of authors' lack of control over their printed books can be cited. Fuchs and Vesalius were unusually successful in publishing their pictorial projects and maintaining the specific connections between image and text that mattered to their studies of nature (as I shall discuss in parts 2 and 3). They were successful because they were prepared to pay for the preparation of images, and because they found skilled artists who could translate what they wanted onto the printed page. We should be cautious, however, not to overstate their degree of success, as their books were not completely free of errors, as is indicated by their errata. In Vesalius's case, although he traveled to Basel to supervise personally the printing of his book, there were still some mistakes.[80] For example, he supplied a figure (fig. 4.4a) to show where to add the keys that had been left out of a larger image of nerves of the vertebra (fig. 4.4b), with the instruction:

> I have inadvertently left out *l* and *m* in the first figure; I may have done so in assigning the symbols because I thought I had put them on the left side,

> or perhaps I did in fact use them but the block cutter did not notice them. However that may be, you can of your own accord add *l* to the left of *e* so that it marks the anterior branch of the sixth pair and traveling toward *n* (the nerve of the septum). The figure inserted here will enable you to do this much more easily than I could; if I tried to add *l* and *m* to the other symbols when the block has already been cut and is about to be sent to the press I would risk spoiling the illustration to no advantage.[81]

In this part of the book, I have set out the background necessary to understand the world of printed books that Fuchs, Vesalius, Gessner, and others inhabited as authors. Fuchs and Vesalius opted for woodcuts, the favored medium for printing images of the time. They paid for the production of images, which enabled them to have close and successful collaborations with artists; this in turn allowed them to go against the trend of generic images by developing specific connections between text and image. They expected their readers to be able to understand Latin, including color terms, and they sought to protect their images from copying by others.

Although including good-quality pictures in their printed books was hardly ever a priority of printers or publishers in this period, some, such as Ratdolt or Schott, were not afraid to experiment and invest resources in pictorial matter, albeit on their own terms. In turn, authors such as Fuchs, Gessner, and Vesalius saw the potential of pictures for their arguments, and ultimately for their scholarly enterprise. Such authors needed to grapple with the material, financial, and legal conditions governing the production of the printed book in order to have their pictures printed and their arguments maintained. These were necessary, but not always sufficient, conditions for the use of pictures in printed books about nature. As I shall now discuss in parts 2 and 3, there were intellectual reasons why certain learned authors did—or did not—believe in the usefulness of pictures for their study.

PICTURING MEDICINAL PLANTS

PART II

In this part, I focus on the works of Leonhart Fuchs and Conrad Gessner. I discuss how Fuchs's *De historia stirpium* should be understood as a Renaissance enterprise to recover a pristine knowledge of plants, and how pictures became integral to that project (chapter 5). Fuchs's use of pictures in *De historia stirpium* cannot be regarded as a characteristic common to humanist medicine, because another humanist physician, Janus Cornarius, objected to his form of pictorial argument; nor was the way in which Fuchs used pictures in *De historia stirpium* the only way he envisaged doing so, as other editions of his work suggest (chapter 6). Although the projected second and third volumes never saw the light of day, Fuchs was successful in publishing his herbal. Gessner, in contrast, failed to have his "historia plantarum" published, but its pictorial remains offer insight into his working methods (chapter 7). Gessner too had his critics, such as Pietro Andrea Mattioli, but he strongly believed in the usefulness of images, a belief inspired by Wenzel Jamnitzer's "nature cast" (chapter 8). Both Fuchs and Gessner regarded pictures as central to the study of their medicinal plants, as they both emphasized the plants' morphology—understood as "accidents" by Fuchs (chapter 5) and as "forms" by Gessner (chapter 8). These cases underscore the intellectual issues regarding the choice of whether and how to use pictures in forming knowledge about nature.

CHAPTER 5

Accidents and Arguments:

Fuchs's *De Historia Stirpium*

Most university-educated physicians active in the sixteenth century were interested in reviving classical medicine, though exactly how best to do that was much debated.[1] Leonhart Fuchs was no different from his colleagues in this regard, though he found a particularly powerful way to use "accidents"—a rather unpromising category in traditional schemes of knowledge, but one that increasingly came to be seen in positive terms by certain humanists. This chapter deals with how this focus on "accidents," criticized as pictorial by an opponent, led Fuchs to create a book with images he touted as *absolutissima*, which in turn enabled him to develop his interpretation of the efficacy of ancient plants.

Errors of Physicians

In 1530, the same year in which Schott published Brunfels's *Vivae eicones*, an ambitious university-trained physician was trying to make his own mark by criticizing the current state of medical knowledge. The book was entitled *Errata recentiorum medicorum. LX numero, adjectis eorundem confutationibus in studiosorum gratiam, iam primum aedita* (Errors by recent physicians, sixty in number, now published for the first time, with their refutations added for the sake of students); the author was Leonhart Fuchs. Born in 1501, Fuchs had studied at the Universities of

Erfurt (BA 1517) and Ingolstadt (MA 1521, MD 1524).[2] After practicing in Munich and teaching medicine at Ingolstadt, he moved to Ansbach as the physician to the Lutheran Margrave Georg of Brandenburg-Ansbach, who had plans to establish a university there. Under the Margrave's patronage, Fuchs began publishing works with a marked emphasis on Greek medicine and disdain for the Arabic commentators.[3] *Errata* was the first of such works, and its title echoed that of the work of the famous medical Hellenist Niccolo Leoniceno, *De Plinii et aliorum medicorum erroribus* (On the errors of Pliny and others in medicine), first published in 1492. The planned university at Ansbach did not materialize, and on the return of the Lutheran Duke Ulrich to Württemberg in 1534, Fuchs took up the position of professor of medicine at the University of Tübingen. There he stayed until the end of his life, playing an active role in reforming the medical curriculum.

In *Errata*, Fuchs sought to show how and where the Arabs and more recent physicians had erred, and how to restore a proper understanding of Greek medicine to the methods of healing, medicinal plants, and anatomy—areas in which Fuchs was later to publish further works.[4] In the area of medicinal plants, Fuchs pointed out that the plant his contemporaries took to be the *buglossum* did not correspond to its ancient namesake and therefore could not be used in medical recipes from ancient authors. Fuchs cited the description of *buglossum* by Dioscorides (*De materia medica*, 4.127) as a plant with rough, black deciduous leaves, each similar in shape to the tongue of an ox, that when dropped in wine would "bring pleasure and lightness to the mind." This, Fuchs argued, matched the contemporary *borago* better than the contemporary *buglossum*, which had leaves that became white. The contemporary *buglossum*, Fuchs claimed, actually corresponded to the ancient *crission* (*De materia medica*, 4.118).[5] Fuchs's identification of ancient plants was thus based on a morphological match.

Niccolo Leoniceno (1428–1524) had earlier made the same point, that Dioscorides's *buglossum* was the contemporary *borago* and that the contemporary *buglossum* should be identified with the ancient *crission* (spelt *cirsion* in Latin).[6] He cited Dioscorides's description of the leaves of the *crission* as being larger than those of the *buglossum*, and located the source of confusion in Pliny the Elder's *Historia naturalis* (27.39.61), where it was claimed that the *cirsion* had leaves that were *smaller* than those of the *buglossum*.[7] This error had occurred, Leoniceno explained, because of a faulty manuscript Pliny had used and the similarity of the Greek words *macrotera* (larger) and *microtera* (smaller), which differ only by a letter. Leoniceno then appealed to the senses: it was clear to the senses that the leaves of the contemporary *buglossum* (Dioscorides's *crission*) were longer than those of the contemporary *borago* (Dioscorides's *buglossum*). Also, Dioscorides's *crission* had purple heads, as did the contemporary *buglossum*, but not the contemporary *borago*, whose heads were blue.[8] Leoniceno then went on to point out confusion about the plant among other, later medical writers such as Pandectarius, Avicenna, and Serapion.

Leoniceno originally wrote *De erroribus* as a response to Angelo Poliziano (1454–1494), who had claimed that the philology of the *grammaticus* was the cornerstone of all learning and knowledge, including philosophy and medicine, and that Cicero, the "prince of eloquence," was also the foremost interpreter of Greek scholarship.[9] Leoniceno also believed in the usefulness of philology, but only as a tool to understand Greek medicine better. Furthermore, he doubted the competence of a mere *grammaticus* on matters of medical knowledge. *De erroribus* was thus presented as a work by a qualified professor of medicine who sought to establish the pristine medical knowledge of the Greeks while at the same time lambasting those who mangled that Greek tradition with errors—namely, Arabic interpreters (whom both Leoniceno and Poliziano similarly criticized) and Latin authors, especially Pliny the Elder (of whom Poliziano approved). The errors at stake involved proper interpretation of the ancients, but it also mattered which ancient authority counted, who had the authority to correct such errors, and how. The emphasis on Greek medicine over Arabic and Roman commentators was an attitude inherited by Leoniceno's students, such as Giovanni Manardi (1462–1536) and Antonio Musa Brasavola (1500–1555).[10]

In his *Errata*, Fuchs aligned himself with Leoniceno's project to revive Greek medicine, yet he did not bother much with Leoniceno's careful philological examination or with consulting Greek manuscripts, let alone with minute attention to the difference of a single letter. Instead, the matching up of morphological features, which formed one part of Leoniceno's identification process, provided sufficient grounds for Fuchs's own identifications. It would be a little unfair to judge Fuchs as having followed Leoniceno only superficially, for it appears that he had good reasons for emphasizing a morphological match, a point he later came to clarify in a controversy with another physician with humanist leanings like himself.

Uses of Accidents: Fuchs versus Monteux

Fuchs's method of identifying ancient plants was challenged by the French physician Sébastien de Monteux, and a pamphlet skirmish followed. Monteux first published his criticism in 1533 in *Annotatiunculae . . . errata recentiorum medicorum* (Small remarks on the errors of recent physicians), to which Fuchs responded in 1535 with his *Paradoxorum medicinae libri tres* (Three books of paradoxes in medicine). Monteux countered this in 1537 with the *Dialexeon medicinalium libri duo* (Two books on medical discourses), which contained points from Fuchs's *Errata*, his own criticisms of them in *Annotatiunculae*, Fuchs's response in the *Paradoxorum*, and a fresh response from Monteux. Fuchs replied in 1538 with *Apologiae tres* (Three apologies), which was revised in 1540 as *Libri IIII . . . difficilium aliquot quaestionum* (Four books on some difficult questions).[11]

For Monteux, knowledge of medicinal simples consisted of two parts: knowledge of their medicinal powers and of their names. The former was evidently more necessary for a doctor, but Fuchs tried to derive the latter (and less important) knowledge of names from "accidents" rather than from essential differences. Accidents were features that could come or go irrespective of the state of the subject.[12] Fuchs pointed out that like the hardness of a stone or the heat of fire, the shapes and colors of roots, stems, leaves, and flowers were "inseparable" accidents that always inhered in the substance of a plant; thus they were "native" accidents, which could in turn serve to define unknown substances, just as one could distinguish a swan from a raven.[13] Monteux retorted that inseparable accidents such as the blackness of ravens or of Ethiopians were still separable in one's mind, and that furthermore, Aristotle had recorded the case of ravens that turned white (*History of Animals*, 3.12).[14] Monteux's point was that even if one would expect a raven to be black, the color black was not a quality essential to ravens, because white ones occasionally turned up. So blackness could not be an essential definition of the raven, since such a feature had to be valid for all individual instances of the species. Moreover, accidents could be shared across different plants: as Dioscorides had said, the *iberis* had the leaf of the *nasturtium*, but it did not follow that the *iberis* was therefore the *nasturtium*. Indeed, plants such as the *apium* changed their appearance over time, but not their medical efficacy.[15]

This exchange was based on the standard classification of subject-predicate relationship that all university-educated men learned at the start of their arts course from Porphyry's *Isagoge*, an introduction to Aristotle's *Categories*.[16] Porphyry discussed five types of "predicables" (words being predicated of things): namely, "genus" (e.g., animal), species (e.g., human), "difference" (e.g., rational), "property" (e.g., capable of laughter), and "accident" (e.g., white). These Porphyrian distinctions defined the type of relationship a predicable had with the subject it predicated. Thus, while the term "rational animal" (genus and difference) is convertible with the species "human," as is the term "animal capable of laughter" (genus and property), the term "white animal" (genus and accident) is not. These were important considerations within the Aristotelian scheme of scientific knowledge as explained in the *Posterior Analytics*, because necessary premises in *scientia* had to be constructed from predicables using "genus" and "difference" or "property," but not from accidents. Indeed, Aristotle had declared that there could not be a *scientia* of accidents.[17]

Porphyry had identified two types of accidents: "Accident is what comes and goes without the destruction of the substrate. It is divided into two kinds. One kind of accident is separable and the other is inseparable. Thus sleeping is a separable accident, whereas being black is an inseparable accident of the crow and the Ethiopian."[18] This is the "inseparable accident" cited by both Fuchs and Monteux. But even these "inseparable" accidents, Porphyry taught, did not predicate their subjects reciprocally, because they were shared by other substances.[19] Monteux's point to Fuchs that even inseparable accidents were still separable "in the mind" was, furthermore, a well-known point made by Boethius in his commentary on Porphyry.[20] In terms of establishing something about the essence of the subject in the Aristotelian tradition, therefore, accidents were the weakest link because they were neither causal nor demonstrative.[21] While they could not establish essential definitions in this traditional scheme of knowledge, they could be used in definition "by division," which was formed by listing a collection of attributes or accidents of the subject, each of which may be shared by other species, but which collectively could become coextensive with the subject.[22] This definition was traditionally called "description" in rhetoric.[23] Indeed, when Monteux dubbed the use of outward features of plants as "definition from 'genus' and 'accidents'" (*definitio ex genere et accidentibus*) that did not yield essential characteristics, his point was that this was more suitable for rhetorical than for logical, necessary arguments.[24] Monteux had thus deployed standard and well-worn arguments about accidents to argue that there was no fixed relationship between the exterior appearances and essences of plants that guaranteed a secure inference from the former to the latter.

In defending the inseparability of accidents in plants, Fuchs invoked Rudolf Agricola (1443–1485), whose manuals on dialectics were becoming ever more popular across Europe.[25] Agricola discussed the idea of "native accidents" (*nativa adiacentia*).[26] These were characteristics that inhered in a thing, but not according to its substance: hence Cato is "wise," but "wise" does not name his substance, "man." Similarly, heat in fire, wetness in water, and dryness in earth are examples of "accidents" (because those qualities can be found in other substances—e.g., hot water, moist earth), but they are the qualities that persist when the same substance is conserved.[27] "Native accidents" are those which originate from the thing itself, "as if" they were innate to it.[28] Fuchs added that left unhindered, natural things would follow the common or ordinary course of nature and fulfill its goal. Under this common course of nature, these "native" accidents can de facto be treated as innate qualities. Fuchs thus argued that these "native" accidents of a plant were not separable from its substance under the "laws of nature [*leges naturae*]."[29] These "laws of nature" provided Fuchs with a strong reason why certain accidents could be treated as "innate" and, furthermore, why "description" could be used for identification. The cases of white crows or black swans, traditionally invoked to show that the blackness of crows or whiteness of swans were not substantial qualities, fell outside this ordinary course of nature.

Agricola had also pointed out that, given how difficult it was to find "property" or "difference," it was possible to describe a subject by adding on accidents until all other species of the genus had been excluded.[30] The usefulness of a definition using accidents was also recognized by the Lutheran educational reformer Philip Melanchthon (1497–1560), with whom Fuchs had corresponded.[31] Melanchthon sympathized with Fuchs over his dispute with Monteux, whom Melanchthon described as inept and arrogant.[32] In his textbook on dialectics, Melanchthon gave the descriptions of plants as examples of "definition from accidents" (*definitio ex accidentibus*), which could also be used to describe a person, such as Thersites (*Iliad*, 2, the insolent soldier who incurred the wrath of Achilles and Odysseus), as "squint-eyed, hump-backed and scurrilous," or to tell a swan apart from a raven.[33] Such definitions were useful, according to Melanchthon, because definitions involving "differences" were difficult to obtain.[34] Melanchthon further added that description was effective in grasping unknown substances. In fact, he wrote that as a condition of man having fallen, humans could understand substances only through such accidents.[35] Citing Homer's description of Thersites, Fuchs too pointed out that it was the way of human knowledge to gather some image of the substance from many accidents. He asked rhetorically, "Is an argument derived from definition by accidents inefficacious, when almost everywhere we get round any reference to "differences" of things by referring to accidents?"[36]

It was as evidence of the inadmissibility of accidental definitions that Monteux cited Galen and Pliny the Elder as having disapproved of the use of pictures.[37] Fuchs's reply was that in *De simplicium medicamentorum naturalibus* Galen had meant that there was no need to depict plants after Dioscorides, who had so excelled in describing herbs that nobody could find fault with him,[38] and also that the Elder Pliny had meant that pictures with abundant colours did not emulate nature well.[39] What Monteux or Fuchs understood as the proper sense of these classical statements about pictures probably reflected, rather than informed, their own attitudes towards pictures.

Fuchs's critique of contemporary and Arabic understanding of medicinal herbs in his *Errata* was reproduced in 1531 in the second volume of Brunfels's herbal, *Vivae eicones herbarum*, alongside the tracts on the Pliny controversy by Leoniceno and Pandolfo Collenuccio.[40] The third volume of Brunfels' *Vivae eicones* contained repeats of images for different plants.[41] Repeating images would have meant playing into Monteux's hands, since the latter's objection was based on the argument that external features could be shared by several plants, and that therefore they were not sufficient to distinguish different species; even if some plants did share some features, the picture of one plant, if a full depiction, should look different from a picture of any other plant. It is worth noting that it was Monteux who from the start connected Fuchs's use of accidents and descriptions with pictures.[42] It may well be that Fuchs's controversy with Monteux inspired Fuchs to think of his own method, centered on accidents, in terms of a match between a picture and a plant.

De Historia Stirpium Commentarii Insignes

In 1536 the names of the painters Heinrich Füllmaurer and Albrecht Meyer appeared in the accounts of Duke Ulrich of Württemberg, probably in connection with artwork for his castles near Tübingen and Stuttgart.[43] The two painters must have started working for Fuchs soon after this ducal commission, since by October 1538 Fuchs reported that his herbal contained pictures of more than 350 plants, though it was not yet ready for the printer.[44] Though we do not know when or where Specklin cut the blocks for Fuchs, the book was ready in 1542.

The book, published by Michael Isengrin in Basel, was entitled *De historia stirpium commentarii insignes* (Notable commentaries on the history of plants). It was a large book with almost nine hundred folio (37.8 × 24.5 cm) pages, including more than five hundred full-size pictures of plants. A presentation copy for Joachim II, Margrave of Brandenburg (1505–1571), presumably colored, was worth fifteen florins without the binding.[45] This was comparable to Fuchs's monthly salary from the University (just over sixteen florins a month), though, like Platter, Fuchs must have had additional income from his practice.[46]

The book opens with a full-length portrait of the author at the age of forty-one (fig. 5.1). In this period there was a range of ways in which an author could be represented in a printed book: as a saint-scholar, as a scholar in his study, as a master teaching students in a classroom, as a donor of a book to dignitaries, or as a classical figure set in a medallion or surrounded by other classicizing motifs.[47] These portraits tended to be small images, focusing on the head and emphasizing authorship by attributes of books or pens. Fuchs's portrait was unusual in comparison: it was a full-length figure with no background, setting, decorative motif, or cue to link him to a traditional format. Instead of a book, he held a sprig of germander speedwell.[48] This ties in neatly with his emphasis on the idea of *autopsia*, as expressed in his preface:

> In acquiring this knowledge, it is not enough to have examined the individual characteristics of these herbs once or twice or thrice, but many times over, as Galen also reminds us. Further, since not only the philosophers of old but the physicians, too, considered seeing for oneself [*autopsia*] and thorough examination to be necessary for the attainment of precise knowledge of plants,

Fig. 5.1 Author portrait from Leonhart Fuchs, *De historia stirpium* (1542), α1v. Woodcut 24 × 11.5 cm on paper measuring 37 × 23 cm, which suggests that the original paper size was demy, rather than royal, paper. Cambridge University Library, Sel.2.81.

> the duty of making these investigations was assigned neither to crude and unskilled drug peddlers, nor to their assistants, equally ignorant or much cruder, nor to the foolish and inept common crowd.[49]

The choice of the word *autopsia* was most probably deliberate, echoing the preface of Dioscorides's *De materia medica*. Although the portrait does accentuate the importance of seeing and handling plants oneself, it would be rash to conclude that Fuchs disregarded books altogether in favor of observation alone. After all, this was a woodcut in a *book*—his own book.

We have already encountered the portrait of the craftsmen, with which *De historia stirpium* ends (fig. 1.14). Their inclusion was all the more significant since Fuchs mentioned few others who had contributed to his work. Although in his preface he listed contemporary authors (Ermolao Barbaro, Otto Brunfels, Hieronymus Bock, Euricius and Valerius Cordus, Jean Ruel, and Marcello Vergilio) who had contributed to the study of plants in general, he thanked few for help with his own book, except for Georg, Margrave of Brandenburg, who had given him the larch (*larix*), and Hieronymus Schaller, a physician in Nuremberg who supplied him with foreign plants (Fuchs did not specify which ones).[50] Neither these people nor the dedicatee, Joachim II (Margrave Georg's first cousin once removed), were portrayed in the book.[51] This underlines the importance Fuchs attached to the craftsmen involved in producing the pictures.

He was clearly happy with their work: "With industry and attention, we have taken care lest with shadows and other less necessary things with which painters often bring about the glory of their art, the "natural form [*nativa forma*] of herbs be blotted out, and lest we suffer these masters to follow their whims so that the picture would then correspond less to truth [*veritati*]."[52] The "natural form" may well be an allusion to the "native accidents," the all-important external features defended against Monteux. If we compare the woodcuts with, say, those in Dodoens's *Pemptades*, we see that they indeed exhibit minimal shading (see fig. 3.13), which makes it impossible to determine the direction of the light source, point of view, or details of texture or of patterns. The overall effect of Fuchs's woodcut image is, according to Brian Ogilvie, "panoptical."[53] The surviving sketches in the *Vienna Codex* suggest that the painters understood well the instruction of minimal shading, since Fuchs's own intervention, indicated on the drawings with a pointing index finger, appears to have been confined to morphological details (fig. 5.2).[54]

The preface to *De historia stirpium* had a typical Renaissance flavor, expressing the decline and hoped-for recovery of ancient knowledge. Ancient rulers such as Gentius, Mithridates, and Solomon were cited as men who understood the importance of the knowledge of plants and took an active interest in it. Ancient philosophers and doctors also agreed that close firsthand inspection was necessary for acquiring this knowledge, and considered it their own duty to travel widely so that they could examine all kinds of plants carefully with their own eyes, take them into their own hands and taste them, and thus learn the powers of plants in addition to their images. But when physicians came to regard this knowledge as being beneath their dignity, it had fallen into the hands of peasants, old wives, and unlettered men.[55] Physicians now had to reclaim the pristine knowledge of plants from druggists and unlettered folk.[56]

For Fuchs, this pristine study of plants was an important part of the study of medicine for physicians. Establishing the names and medicinal properties

Fig. 5.2 A picture of the large and small *phu* by Jorg Ziegler (monogram at bottom right). Fuchs inscribed instructions with a pointing index finger: above the plant at right, he wrote that the flowers and leaves needed to be larger. Next to the line-drawing of the flower, he wrote that the blossom should be of that size. *Codex* 11 125, 3(3):271, ÖNB/Wien/E26.109C.

of plants formed the core of this enterprise. When appropriate Greek names could be established, Fuchs used them.[57] For plants unknown to the ancients and used extensively by contemporary surgeons in wound treatment, he retained the common and "barbarous" names. Such plants were not mentioned, however, unless they had some clear medicinal use—as in the case of the *pilosella*'s power to close wounds.[58] For the plants we can identify as being from the New World, Fuchs was able to establish medicinal uses by identifying them as species of, or analogous to, known plants. Hence the chili pepper was identified with the *siliquastrum* of Pliny the Elder (*Historia naturalis*, 20.66) and given the same properties as true pepper, with strong heating and drying qualities that were effective for stimulating digestion and clearing coughs.[59] The (Mexican) pumpkin was grouped with the *cucumis* known to Dioscorides, Galen, and Pliny the Elder, which had a cooling temperament of the second order, was beneficial for bladder functions, and restored a failing sense of smell.[60] Despite this marked interest in medicinal uses, Fuchs appears to have been unable to resist including the *mala insana*—aubergine or eggplant to us—which was alien to the German lands and appeared to have only a culinary use, being boiled or pickled in brine or fried in oil with salt and pepper, cut into circles and sticks, and put into salads. They were hard to digest, however. "*Malum insanum* is a food for pleasure seekers and those willing to taste everything. Therefore, those who have some interest in health, terrified by the outset by its very name, will avoid using these fruits."[61] This suspicion of the *malum insanum* continued into the late sixteenth century.[62]

Rather than heaping up every known name associated with each plant, Fuchs claimed to use fewer but "true" and "legitimate" names, lest confusion of names led to confusion of things.[63] Special care was needed in attributing medicinal virtues to plants, since false ones could endanger life.[64] In determining the medicinal power of plants, Fuchs reasoned that if Dioscorides, Galen, and Pliny the Elder all agreed, one could well be assured of that power, but that if there was disagreement among the three, then Galen should be trusted rather than Dioscorides, and Dioscorides rather than the elder Pliny.[65] For plants unknown to antiquity, Fuchs chose to follow Galen, who alone recognized that powers of plants should be investigated by "reason and experience."[66] Galen was also the authority Fuchs cited for the ordering of plants in his book by the Greek alphabet. Though it was well known that Dioscorides sought to group related plants, it was more practical for Fuchs to proceed alphabetically, since it had taken him several years to gather the plants and prepare their pictures.[67] Fuchs thus set himself up as a responsible learned physician, pursuing a practice of ancient medicine in the footsteps of Galen, but in a world that contained plants unknown to the ancients.

For such a project, pictures were important:

> To the description of each plant we have added pictures [*imagines*]. These are lifelike [*vivas*] and modeled after nature [*ad naturae aemulationem*] and rendered more skillfully, if I may say so, than ever before. This we have done for no other reason than that a picture expresses things more surely and fixes them more deeply in the mind than the bare words of the text.[68]

Fuchs's pictures were certainly "livelier" than, say, a picture of a jar containing aloe.[69] His justification for using pictures was based on the well-known topos that pictures were more effective for memory than words alone.[70] Indeed, as Fuchs further emphasized:

> Who, I ask, of a healthy mind would condemn a picture which is agreed to express a thing much more clearly than they can be delineated with any words, even of the most eloquent men? It has indeed been ordained by nature in such a way that we are all captivated by a picture. Those things which are presented and depicted to the eyes on paper and panels adhere to the mind more deeply

than those described by bare words. Hence it is obvious that there are many plants which in order to be recognized cannot be described by any words, but being placed before the eyes in a picture, can be recognized immediately at first sight.[71]

In making a case for including pictures in what was essentially a humanist project of emulating ancient practice, Fuchs preempted the possible countercharge that the ancients had condemned pictures as useless. He repeated his earlier point that Galen, in the well-known passage from *De simplicium medicamentum facultatibus*, did not regard pictures as useless, but was making the point that they had become superfluous, especially after Dioscorides.[72] Fuchs pointed out that drawing had been counted among the liberal arts that freeborn boys in ancient Greece had to learn with their letters, as it expressed the nature of things and preserved their memory.[73] Yet for Fuchs, pictures had functions far more powerful than simple enhancement of one's memory.

One-to-One Correspondence

Fuchs emphasized how his pictures were used differently from those in contemporary herbals, especially the ones printed by the Frankfurt publisher Christian Egenolff, the shrewd businessman who printed books with texts and pictures from other people's publications copied in smaller and cheaper formats.[74] According to Fuchs, Egenolff would use the same picture as well as the same name for different plants—a charge borne out in Egenolff's edition of Theodore Dorsten's *Botanicon* (1540), in which the same woodcut is used for the *mercurialis* and the *atriplex* (fig. 5.3), and the name *gladiolus* is used for three different plants.[75] This is also a fault Fuchs finds with Brunfels's book, of which he otherwise approves for introducing into the German lands a "correct way [*recta ratio*]"—that is, a naturalistic rather than a mnemonic way—of depicting plants.[76] A printer's repeated use of the same pictures was a sign that he had every interest in money and none in scholarship.[77]

Offering such criticism of earlier and contemporary works had the effect of raising the stakes by which one's own work might be judged. And indeed, Fuchs ensured that in his book each picture was used for one and only one plant. The *atriplex* and the *mercurialis* look very different (fig. 5.4). But Fuchs's insistence on a one-to-one correspondence between plant and picture was not simply about distancing himself from a greedy publisher. It was the visualization of his *method* of identification, of a morphological match between an ancient plant and a contemporary one—a method that his enemy

Fig. 5.3 Repeated use of the same woodcut for the *atriplex* and *mercurialis* in Christian Egenolff's edition of Theodore Dorsten, *Botanicon* (1540), 35r, 189v, detail. Cambridge University Library, L.3.3; once owned by Archbishop Thomas Cranmer.

had dubbed pictorial. If the same picture was repeated for different plants, it would prove the contention of Monteux, who had argued that accidents could be shared across species and therefore did not provide sufficient definition or differentiation.

Pictura Absolutissima

Fuchs also explained that each of his pictures was taken from outlines (*lineamenta*) and shapes (*effigies*) of a "living" plant, so that it was made "as complete as possible" (*absolutissima*) by including its roots, stems, leaves, flowers, seeds, and fruits (fig. 5.5).[78] *Absolutus* is an adjective that denotes completeness, reliance on nothing else, and perfection.[79] "Absolute" as conveying a sense of perfection was certainly one of its most frequent usages in English during this

Fig. 5.4 *Atriplex* (a) and *mercurialis* (b) in Leonhart Fuchs, *De historia stirpium* (1542), 118, 475. Cambridge University Library, Sel.2.81.

Fig. 5.5 *Dracunculus* with its root, leaves, flower, and fruit depicted. Note how the leaves are turned or curled over, which gives the plant a fuller (rather than flat) look and allows both sides of the leaves to be shown. From Leonhart Fuchs, *De historia stirpium* (1542), 235. Cambridge University Library, Sel.2.81.

period, and it was so deployed by Vesalius, as we will see later.[80] The adjective had also been applied since the later medieval period to the unfettered power of God (*potentia absoluta*) as contrasted with his "ordained" power (*potentia ordinata*), which empowered his activities according to the order he had (freely) established. [81] Fuchs's use of *absolutus* in his preface suggests a sense of "completeness"—namely, that no part of the plant is missing. Such a "completeness" was expressed in two ways.[82] First, the different stages of a particular plant—typically buds, flowers, and fruits—were incorporated into a single bush (fig. 5.6). This diachronical strategy answered well Pliny the Elder's reservation that a picture could not capture a plant across the vicissitudes of the seasons. The second type of a "complete" picture integrated variations as if they grew in a single plant (fig. 5.7).[83] In the case of the *lamium*, Fuchs pointed out that since there were no differences among the variations other than the color of the flow-

Fig. 5.6 Diachronic woodcut of *prunus*. From Leonhart Fuchs, *De historia stirpium* (1542), 404. Cambridge University Library, Sel.2.81.

Fig. 5.7 Variations of the *lamium* incorporated into one bush. From Leonhart Fuchs, *De historia stirpium* (1542), 469. Cambridge University Library, Sel.2.81.

Fig. 5.8 Two types of martens depicted using the same woodcut: one in a gray coat, and another in brown. From Conrad Gessner, *Historia animalium* 1: 865 and 866. Cambridge University Library, N*.1.19(A).

ers, he had put all the variations together into one picture.[84] This kind of composite image allowed him to discuss the morphology of variations efficiently, and it certainly had cost-saving implications.[85]

This strategy of amalgamating variations into one specimen works well for plants, but less well for animals. Gessner, for instance, had the woodcut of a marten repeated in his *Historia animalium* in order to show the grey and the brown kinds (fig. 5.8).[86] A woodcut of a marten colored half brown and half grey might have confused the reader as to whether it represented one kind with a two-colored coat or two kinds in different colors. In fact, this is the type of confusion that Fuchs had in mind when he discussed the colored image of the "Turkish grain" (maize to us; fig. 5.9): "This shows you four colors of grain in one sheath, although actually each one has all its grains of only one color,

Fig. 5.9 *Turcicum frumentum*. From Leonhart Fuchs, *De historia stirpium* (1542), 825, detail. Wellcome Library, London.

either yellow or purple, reddish or whitish. We thought there should be a warning, lest anyone be deceived by the picture."[87] Fuchs was clearly aware that his readers might assume that his picture represented a single specimen or kind, especially in the case of rare or exotic plants which they might not have come across. Fuchs sought to prevent readers from making the wrong inference from an "*absolutissima*" image. This point would, of course, be lost to a reader with an uncolored copy.

Fuchs thus tried to ensure that the plants in his pictures were as "complete" as possible, with no individual blemishes. The pictures have rightly been called "ideal,"[88] and they tally well the nature of his work: he was not discussing this or that particular specimen, but was instead arguing about medicinal virtues of entire species that would be valid for all instances of a given kind.

Argument and Adjudication

Let us now see how a picture functioned in Fuchs's work. The *historia* of the *petasites* (butter-bur) began with its name: it was called *petasithes* in Greek, and *petasites* in Latin, but was totally unknown to contemporary apothecaries. It was called *Pestilenzwurz* in German because its root was an immediate relief for pestilential fevers. The name *petasites* came from the Greek word *petasos*, meaning a cap, because its large leaf was placed over the pedicel, like the cap of a mushroom.[89] Then followed the section on the form (*forma*) of the plant, which started with a quotation from Dioscorides (*De materia medica*, 4.107) on the plant: "The footstalk is larger than a cubit, as thick as a thumb, over which a large leaf, in the shape of a cap, hangs, like a mushroom."[90] Then the pictured plant was introduced (fig. 5.10) and matched up with Dioscorides's description: "From this description it becomes sufficiently clear that the herb whose picture we give is the petasites."[91] Fuchs then smoothly moved on to introduce more features of the pictured plant: "This [plant] always brings forth at the beginning of March purple flowers clumped together in the shape of grapes, near the leaves." This feature, according to Fuchs, Dioscorides has left out.[92] Next, new features not even depicted in the picture were brought in: "Its root is thick and long and white inside, has an overpowering smell, and is bitter. From which it follows that the powers of this herb are no different from the powers of the petasites."[93] The description of the root, as will become clear in a moment, was crucial for Fuchs.

What Fuchs did here was the following: he identified a classical plant with a plant of his own time by matching up features described in the text of Dioscorides with those depicted in the picture of a plant. The assumption here was that the pictured plant represented a known contemporary plant. Then, in the text, Fuchs drew out additional features from the pictured plant that he claimed had been left out by the ancients, and he attributed them back to the ancient plant. These additional features included invisible and undepictable traits such as taste and smell. A picture therefore signified not only the plant's visible external features, but also characteristics, including taste and smell, that were neither visible nor depictable. Fuchs never explained how such knowledge of an object was acquired or justified in the first place—he seems to have assumed that once a plant was recognized via a picture, one could also recall its taste, smell, and appropriate flowering season. Fuchs's strategy presupposed some prior knowledge on the part of the reader, as well as the reader's ability to recall the invisible traits of a depicted plant. It must certainly have been for this potential to signify more than they appeared to depict that Fuchs considered pictures more expressive than words, but such expressiveness assumed prior knowledge on the part of readers.

Fig. 5.10 *Petasites*. From Leonhart Fuchs, *De historia stirpium* (1542), 644. Woodcut 32 × 20.5 cm. Cambridge University Library, Sel.2.81.

Fuchs's explanation of the plant continued: as for its location (*locus*), he reported that the *petasites* was found abundantly in humid meadows or near streams.[94] Regarding its season (*tempus*), he explained that it flowered at the beginning of March, and close to April the flowers dropped off, leaving the fruits, and then the leaves came out with their pedicels.[95]

Then followed a section on the temperament (*temperamentum*). In classical medicine, every drug had a temperament—a property defined as dry or wet, cool or warm. Dryness and wetness formed a pair of contrary properties, as did cold and hot. Each property had an intensity determinable by four degrees, the first degree being almost imperceptible and the fourth degree being most intense.[96] The temperament of the *petasites* was, Fuchs reported, of the third order of dryness, which could easily be shown from its bitter taste.[97] Then Fuchs listed the medicinal powers (*vires*) attributed to the plant by ancient authorities: the *petasites*, according to Dioscorides, was useful for malign ulcers when ground and applied as a paste. According to Galen it was also useful for malign and phagedaenic ulcers, and Paul of Aegina agreed.[98]

Fuchs then listed other medicinal uses in an appendix, and here we see the importance of the root of the *petasites*, introduced earlier. "By experience," Fuchs said that the root helped pestilential fevers wonderfully, because it strongly induced perspiration when reduced to powder and taken with wine.[99] Fuchs pointed out that this agreed with what Galen had taught in a general way in *De simplicium medicamentum facultatibus* (4.17): that certain acute temperaments could induce perspiration. The bitter-tasting root, introduced and attributed to the classical plant *petasites* through a picture, was now evidence of Fuchs's practice as the Galenic good doctor, as he showed by his own experience that it conformed to a general principle proposed by Galen himself. Pictures thus helped Fuchs supplement and improve on the work of the ancients while he also aligned himself as following in the footsteps of Galen, who advocated "reason and experience."

The headings of name, appearance, species, location, season, temperament, and medicinal powers were found in medieval and contemporary herbals.[100] Brunfels, for instance, included descriptions of the forms of plants in a section on the "opinions" of each ancient author, but with hardly any reference to the pictured plants, unless their classical names could not be established. In contrast, for Fuchs the section on a plant's *forma* became a crucial heading where pictures were key to the process of identifying the plant and discovering its medicinal virtues.

Fuchs's confidence in the picture as a representation of the whole object led him to use it in settling differences of opinion. Thus, in the case of the *hortense serpyllum* and the *sylvestre serpyllum*: "Pliny asserted differently from Dioscorides that the *sylvestre serpyllum*, and never the *hortense serpyllum*, crept along the ground, and thus it was likely that Dioscorides was in the wrong. But the thing itself [*res ipsa*] and the lively images [*vivae imagines*] of herbs testify sufficiently that Dioscorides's opinion is truer."[101] Erroneous identification of plants by others was also dismissed by appealing to a picture; after matching up the features of Dioscorides's *agrostis* and a pictured *gramen*, Fuchs wrote: "There should be no one who does not see that every feature of *gramen* corresponds [to one of the *agrostis*]. Therefore, those who think that [*agrostis*] is *euphrasia* deserve censure."[102] Pictures could thus represent the object (*res*), ultimately adjudicating between competing opinions among ancient and contemporary authorities.

Fuchs's *De historia stirpium* was the culmination of an effort to revive the classical study of plants by matching up external features of plants, or "accidents." By taking on board the criticism that his arguments were pictorial, and by producing precisely such pictorial arguments that disambiguated identities of plants, Fuchs visibly defied his critics. The one-to-one correspondence between picture and plant ensured the validity of his method: the *absolutissima* pictures allowed him to discuss a generalized object of investigation, and functioned to adjudicate between competing opinions. Hence, Fuchs's pictures formed an integral part of his effort to revive the pristine knowledge of medicinal plants as presented in a printed book. He was not alone in using accidents to study nature: Guillaume Rondelet (1507–1566), another classically trained physician, argued in his pictorial study of marine fishes that the use of accidents in distinguishing species of fish was warranted by the examples of Aristotle and Theophrastus, because there were so few true "differences" or "properties," which were also very difficult to find.[103] Yet it would be rash to assume an inherent link between humanism and the use of images, or to presume that Fuchs's use of images was limited to the ones we have seen in *De historia stirpium*.

CHAPTER 6

Arguments over Pictures:

Reactions to Fuchs's *De Historia Stirpium*

Fuchs made pictures integral to his Renaissance enterprise of reviving classical knowledge of plants in his *De historia stirpium*. The fact that somebody who valued description positively in terms of humanist dialectics found a positive use of pictures makes it tempting to attribute to humanism a generally favorable attitude towards pictures. But that was far from the case, as Fuchs's differences with Cornarius, to be discussed in this chapter, will suggest. While it is important to appreciate the variety of attitudes towards the use of images that existed among university-educated physicians like Fuchs, Monteux, and Cornarius, it is also worth noting that Fuchs did not confine himself to one way of using pictures for disseminating his knowledge of medicinal plants. The functions and uses of pictures were transformed in the various translations and editions of *De historia stirpium*.

Fuchs versus Cornarius

True to style, Egenolff copied the pictures from Fuchs's *De historia stirpium* soon after it was published. In 1543, in Dioscorides's *De materia medica*, edited by Walter Hermann Ryff in Latin, they appeared in a smaller form (fig. 4.1). A rapid exchange of pamphlets followed. Fuchs accused Egenolff and Ryff of theft and greed in his *Apologia . . . qua refellit malitiosas Gualtheri Ryffi* *veteratoris pessimi reprehensiones* (Apologia, by which he refutes the malicious criticism of the sly fox, Walther Ryff; 1544), to which Egenolff responded with *Adversum illiberales Leonhardi Fuchsij. . . calumnias, responsio* (A response against the ignoble calumnies of Leonhart Fuchs; 1544). Fuchs countered this with *Adversus mendaces et Christiano homine indignas, Christiani Egenolphi typographi Francoforti suique architecti calumnias responsio* (A reply to the mendacious calumnies, unworthy of a Christian, of Christian Egenolff, the Frankfurt publisher, and his architect), which was probably first printed in March 1545 by Ulrich Morhard of Tübingen in time for the Frankfurt Book Fair, though none of that first edition survives, as Morhard apparently sold all his copies to Egenolff's agents at the fair. The second edition was printed in August 1545.[1] Fuchs thought that Egenolff was incapable of writing in Latin and assumed that somebody else, an *architectus* (master designer) was behind his diatribes. Egenolff's snide remark on Fuchs's edition of Hippocrates's *Epidemics VI* led him to believe that another humanist physician, Janus Cornarius, was this scheming "architect," especially since he had earlier accused Fuchs of lifting a passage from his oration and using it in the preface to the edition of *Epidemics VI*.[2]

Cornarius joined the fray with the *Vulpecula excoriata* (The flayed vixen), published in March 1545, which was intended as an exposé of a "vixen" (a pun on Fuchs's name) whose *De historia stirpium* was a patchwork of previous herbals, and a debt not properly acknowledged. Punning on his own name, Cornarius described himself as a lion with a heart (*cor*) for avenging himself against the vixen, and a nose (*nares*) for tracking down his enemy.[3] In August of the same year, Fuchs responded with the *Cornarrius furens*, which was an allusion, according to Meyer, to Seneca's *Hercules furens* (Mad Hercules), rendering Cornarius's name into a combination of "heart" (*cor* in Latin) and "fool" (*Narr* in German).[4] Two further refutations were written by Cornarius in 1546: *Nitra ac brabyla, pro vulpecula excoriata asservanda* (Saltpeter and brabyla, for use in preserving the flayed vixen), and *Vulpecula catastrophe* (A vixen, a catastrophe). Fuchs had questioned the moral probity of a printer greedy for a quick profit; Cornarius ridiculed the vanity of an author who had himself portrayed on large royal paper (fig. 5.1).[5]

When in 1557 Cornarius eventually published his own commentary on Dioscorides's *De materia medica*, he reiterated his objection to pictures: they could not be useful in obtaining new knowledge of plants for people who had not seen live specimens of those plants in nature before seeing their pictures. From live plants, he argued, one could often recognize their pictures, but from pictures of plants, one could never obtain knowledge of live plants.[6] In a way, Cornarius was right in pointing out that a reader's prior knowledge of plants was required for pictures of those plants to be effective; that was precisely what was required for Fuchs's argument on the *petasites* to work.

Dioscorides had said that it was necessary to pay attention to the vicissitudes of the size, color, and forms of plants that changed according to region and season. But, Cornarius contended, pictures of plants did not depict the characteristics of region or season unless they were added in writing.[7] Even then, a picture would represent a plant at a certain time at a certain place, while one might not necessarily come across it in that exact form. This suggests that Cornarius understood pictures as a form of "counterfeit," representing an individual plant at a particular time and place. He declared that what he wanted to do was to nourish the mind, rather than please the eyes.[8]

Cornarius's own desire was first to read and hear Dioscorides in Greek, and then to enable medical students to hear and read him in Latin. Cornarius added to the text some *emblemata* like inlaid ornaments, to describe the "true images" of great minds—namely, the opinions of ancient authorities who did or did not agree with Dioscorides. [9] Cornarius's use of the word *emblema* is very similar to that of Andrea Alciati (1492–1550), who defined it as an epigram that signified "something pleasant taken from history or from nature, after which painters, goldsmiths and founders can fashion objects which we call badges."[10] Like Alciati, the most famous promoter of the term, Cornarius understood *emblemata* to be verbal.[11] Hence Cornarius's "images" were verbal statements of other ancients, and it is quite telling that in his index he used the word *pictura* to refer to verbal descriptions of the forms of plants.[12] Needless to say, his commentary contains not a single woodcut or engraving of a plant.

Cornarius dealt with plants quite differently from Fuchs. For the *petasites*, for instance, he began by reproducing Dioscorides's description in Latin, which differed slightly from Fuchs's quotation: "Its pedicel is larger than a cubit, with a thickness of a thumb, over which a large leaf in the way of a cap or a bonnet hangs, like a mushroom. Applied by rubbing, it is good for malign and phagedenic ulcers."[13] Then followed an *emblema* in a smaller font, in which Cornarius reported and examined the opinions of other ancients: Pliny the Elder had not mentioned the plant; according to Galen, it was of the third degree of dryness, whence it might be used for malign and spreading ulcers.[14] In these *emblemata*, Cornarius was often content with comparing the opinions of other ancient authors such as Galen, Paul of Aegina, and Pliny the Elder. For the *petasites*, however, he made a further oblique reference. Almost all experts on plants "of our time," he wrote, wanted it to be the *Pestilenzwurz*. But it was astonishing, Cornarius continued, that Dioscorides had not considered the use of its root—in fact, he had not mentioned the root at all. Since Dioscorides had given the same use of its leaf as that of the *arcion* (*De materia medica*, 4.106), it seemed to Cornarius that the *petasites* was a kind of *arcion* unknown to anybody. He ended by explaining the etymology of the plant's name: it was taken from *petasos*, a kind of broad cap, which the leaf resembled.[15]

To render Dioscorides readable and audible was precisely the kind of work Cornarius found most congenial. As he himself related later, he had a near-conversion experience in 1528: he had known he had immense talent for philological studies (he had taught Latin and Greek grammar at the University of Wittenberg) and he was also interested in medicine. But, unsure of what he wanted to do, he left Wittenberg and roamed Europe for four years. When he reached Basel he received the hospitality of the printer Hieronymus Froben, in whose famous library he found the Greek texts of the ancient physicians.[16] Years later, Cornarius recounted the moment when he found his métier:

> From that time, having condemned and rejected those barbaric physicians whom I had been following for nine years, I brought myself wholly to Greek medicine and attached myself totally to the Greek physicians whom I am following and whose medicine I am also striving to emulate. And now for twenty-six years I have persevered to persuade our Germany that these are the true physicians and the correct authors of the art of medicine who should be read and followed, especially in their own tongue. And lest it be the case that somebody would complain, either from ignorance of the Greek language or from the difficulty of these authors, I wanted to render those Greek physicians into Latin, not obscurely or confusedly, but through a lucid and clear translation into Latin for their use.[17]

Throughout his life, Cornarius was engaged in a revival of classical medicine through editing Greek texts and translating them into Latin so that the voice of the ancients might be heard and read.[18] In his textual revival of the ancients, he saw no place for pictures.[19]

The works of both Fuchs and Cornarius can be characterized as quintessentially Renaissance enterprises, and their differences may seem slight to the modern eye—after all, they were both deeply interested in reviving medical knowledge of the ancients. To ignore their differences, however, would be to ignore their own sense of distinctiveness and passion for their own work, and most significantly, to ignore their diametrically opposed positions on the use of pictures. Fuchs and Cornarius employed essentially the same sources on the *petasites*—Galen, Dioscorides, Pliny the Elder, and classical etymology—but what they did with them was starkly different. Fuchs was happy to supplement where, as he saw it, Dioscorides fell short, and then to show how his own identification of the plant and of further medicinal virtues (via a picture) fitted in with the Galenic practice of establishing medicinal virtues of plants through reason and experience.[20] It was not the words of the ancients that he was committed to, but the practice of medicine according to Galen, which gave him license to correct and supplement Dioscorides or the elder Pliny. In contrast, Cornarius refused to accept Fuchs's identification of the *petasites* with the *Pestilenzwurz*, on the grounds that Dioscorides had never mentioned the root of the plant. Furthermore, because of a use similar to that of another plant, Cornarius conjectured that the *petasites* might actually be another kind of plant mentioned by Dioscorides in the preceding chapter. The words of Dioscorides were the only basis from which Cornarius was prepared to accept inferences and arguments; there was little attempt to expand or supplement the medicinal use of a plant for contemporary use. For Cornarius, it was Dioscorides's words that were sacrosanct, and there was no use for a picture of a plant in the sense of a "counterfeit."

Fuchs and Cornarius were then pursuing different types of commitment to the classical world. Fuchs was interested in the revival of a Galenic medical practice, of looking at plants and finding out their properties through reason and experiment. And he found a powerful use for pictures in that revival. Cornarius's revival of Greek medicine, on the other hand, was through the voice and words of the ancient author. His enterprise was strictly verbal and textual; even "pictures" of plants were expressed in words. Fuchs and Cornarius were thus arguing at cross-purposes and irresolubly so, since they were committed to different ideas about how to revive the pristine knowledge of the ancients, and this in turn committed them to different positions on the usefulness of pictures in their projects.

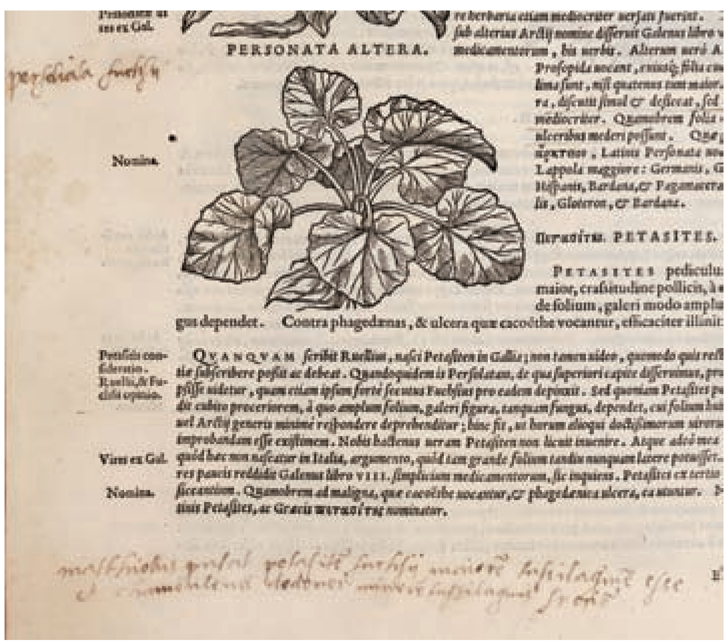


Fig. 6.1 *Petasites* from Pietro Andrea Mattioli, *Commentarii* (1558), 564, detail. Compare fig. 5.10. This copy once belonged to Thomas Lorkyn, who noted at the bottom of the page that Mattioli believed Fuchs's *petasites* to be the *tussilago major*. Cambridge University Library, N*.7.5(B).

The controversy between Cornarius and Fuchs over the use of pictures was well known in their time, and Pietro Andrea Mattioli decided to adjudicate in his commentary on *De materia medica* (fig. 6.1).[21] Even if Galen had said that pictures of plants were not useful for acquiring knowledge of plants, this did not mean that those who included pictures of plants or animals in their books should therefore be criticized. In fact, Mattioli could find no place where Galen criticized such use of pictures, but instead found that he condemned those who assumed that they could pass themselves off as experts on plants simply by inspecting pictures of them and reading about them in books written by the weightiest authors.[22] Here again, the precise meaning of what the ancients said was an important point to be established.

Mattioli went on to speculate about why Cornarius had got Galen wrong: Cornarius saw himself as the ultimate and best interpreter of Dioscorides, so for him there was no room for anything new to be brought out of pictures of plants. Thus he detested those authors who had pictures in their books, wanted all the praise for himself, and wished to cover up his inexperience (*imperitia*) in the matter of plants.[23] For what other reason could there be for him to detest another's industry, as if there was no room for posterity to find something that was not noticed by the ancients?[24] If there was no room for discovery, why did he condemn pictures but not books? What was the point of attaching those *emblemata* if nothing more could be learned? What else was there to do or say?[25] It was deplorable that Cornarius, who was envious of the labor of others and knew no better than to carp at them, had made no effort to produce anything good or new for the "good of the republic."[26]

Mattioli's criticism of Cornarius did not mean that Fuchs received unqualified praise. The 1558 edition of Mattioli's commentary on *De materia medica* listed more than seventy errors or lapses by Fuchs.[27] In fact, very few authors passed muster with Mattioli. This is not surprising, since Mattioli expressed his judgement on the acceptability of contemporary authors and scholars by either including or excluding them in the successive editions of his commentary. As Paula Findlen has shown, those such as Amatus Lusitanus (1511–1568) and Luigi Anguillara (c. 1512–1570) who presumed to contest Mattioli's scholarly judgment, identification, or authority were swiftly censured or excluded from his "botanical republic" in print.[28]

In his own work, Mattioli's position on pictures was perhaps somewhere between the two extreme positions of Fuchs and Cornarius. He explained how he abhorred the overconfidence that would lead to claims that true and precise mastery of medicinal simples could be gained from pictures, simply because a single picture could comprise all its varieties. Perhaps echoing Dioscorides's own point expressed in the preface to *De materia medica*, Mattioli pointed out that if all the changes of a plant had to be represented in a single picture, it would require so much labor and expense as to be impossible.[29] Yet Mattioli regarded images important enough to have woodcuts added, recut, and even enlarged in his editions of the *Commentarii*, though some of his own images were contested by Gessner, as will be discussed in chapter 8.

Fuchs, Cornarius, and Mattioli were all university-educated physicians with an intense interest in reviving the ancient knowledge of medicinal plants, especially of Dioscorides. Yet they disagreed bitterly not just on the status or use of pictures, but also on how to revive Dioscorides, and on who had the ultimate authority on such matters. Getting such precious knowledge wrong implied some serious failing of character. Fuchs accused Egenolff of greed, Cornarius charged Fuchs with vanity, and Mattioli lambasted Cornarius for vainglory. It would be impossible to impute any consistent attitude toward pictures to humanist physicians or university-educated doctors as a group. Indeed, having pictures in one's scholarly book on medicinal prints was not simply about having the financial and other means to do so; it was also an intellectual choice about the shape and form of knowledge, and even about moral character.

Transmission, Translation, and Transformation

Egenolff's criticism of self-aggrandizing pictures seems to have rankled with Fuchs. Fuchs's *De historia stirpium* was indeed of a large format, and his full-length portrait was somewhat unusual in its time for taking up a whole folio page (see fig. 5.1). Egenolff's edition of *De materia medica* was brought out in a quarto size in 1543. In 1545 Fuchs went one better and issued an octavo edition of his herbal with Isengrin, without a portrait of him or of the artists, but with the 1542 pictures recut to a smaller size (see fig. 4.1).[30] This edition was essentially a picture book, with Greek, Latin, and German names at the top of the page above each woodcut of a plant, and without any text or argument establishing its identity or medicinal uses (fig. 6.2). He also intended for the images to be colored, as the heading "three kinds of *lamium*" indicates. The point of this smaller publication, Fuchs explained, was first to publish a book that could be taken outdoors, because the Latin edition (of nearly nine hundred folio pages) was too bulky and could only be used at home.[31] Second and perhaps more important, Fuchs declared that the octavo edition was produced so that readers could compare directly how the pictures by Fuchs's detractors and plagiarizers (namely Ryff and Egenolff) were inferior to those by Specklin.[32]

Yet a major transformation of the project had also occurred. In this octavo edition, with only pictures of plants and their names, the identification of an ancient plant with a contemporary one was now simply taken for granted. There was no room for supporting arguments. Fuchs had removed the process of identification altogether. One could say that he was still trying to prove a

Fig. 6.2 A picture of the *lamium* with the heading, “Three kinds of lamium,” which does not make sense unless the picture is colored. From Leonhart Fuchs, *Primi de stirpium historia commentariorum tomi* (1545), 266. Woodcut 12.2 × 6.2 cm. Compare fig. 5.7. Cambridge University Library, Rel.d.54.20.

point with his pictures, but that point had now changed. Instead of establishing a universal, classical knowledge of plants, in this octavo publication he wanted to prove to his critics that Specklin’s pictures were superior and unostentatious, and that they could be used outdoors. The identification was now a scholarly fact in pictorial form—a visual fait accompli.

This was not the first time Fuchs’s project, and thus the function of pictures within it, had been transformed. In 1543 the large woodcuts of the 1542 edition were reset by Isengrin to a German edition entitled the *Neu Kreüterbůch*.[33] This book was dedicated to Anna of Bohemia and Hungary, wife of Ferdinand I.[34] It began, again, with a portrait of Fuchs—the same woodcut, but described as showing the author one year older—and ended with a portrait of the artists. In the preface, Fuchs explained how he had revised his Latin edition in order for the "common man" (*der gemeine Mann*) to obtain knowledge of plants such that he could himself apply medicines and heal diseases when in trouble.[35] Fuchs did not particularly draw on the indigenous-exotic rhetoric that was beginning to be deployed in other vernacular herbals, nor did he advocate a patriotic medicine based on local resources, as some later pamphlets did.[36] Instead, Fuchs's intended audience, the "common man," was reminiscent of the one Luther hoped to address in his translation of the Bible.[37] For the Reformers, the "common man" could be a heterogeneous group with limited access to political power, such as "the peasant, the burgher of the country town, the townsman barred from imperial city offices, the miner." [38] This was also the group of people to whom an increasing number of vernacular health manuals were directed in the sixteenth century.[39] These people could read and buy such manuals, and could even occasionally afford the services of a physician of a high status, but they would rely more often on alternative types of healers or wound doctors.[40] Fuchs emphasized that nobody should neglect the study of God's noble creation, and that plants should be planted and grown in gardens not just by physicians, but also by the laity and the "common man," and that this in turn would prevent knowledge of plants from being forgotten.[41]

Fuchs claimed that he had spared no expense or labor in transforming his Latin work for the "common man" by cutting out the more formal and unnecessary parts and expanding the descriptions of the forms of plants.[42] Indeed, there were several changes made in the German edition. Like the Latin edition, it included indexes for words in Greek, Latin, and German; but to these Fuchs added a new index of disease names in German, to facilitate finding remedies. The main German text was an abridgement of the original Latin, and the descriptions of the forms of plants, which indeed were more extensive, had been copied out of Bock's *New Kreütter Bůch*. [43] There was a stronger focus on the medicinal effects of plants: arguments in the Latin text appealing to pictures for the identification of the *Petasites*, for instance, disappeared, but the medicinal virtues of the *Pestilenzwurz* were extolled. The exotic plants were described as having become common in the German lands—Turkish corn was now found in many gardens, as was chili pepper, though it had to be overwintered indoors.[44] Fuchs thus transformed *De historia stirpium* to address the medical needs of the German-reading "common man." It was no longer a universal history of plants for the Galenic good doctor, and accordingly, pictures no longer played the argumentative role of restoring the pristine knowledge of the ancients. With a different text accompanying the same woodcuts, the book's nature and the function of pictures within it were transformed. The reprinting of pictures in different contexts, even by the same author or publisher, could thus result in their fulfilling different functions.

Fuchs's *De historia stirpium* was subjected to further transformations, as it was copied and recopied by other printers. Some chose to print the text only. In 1542 the Parisian printers Jacques Bogard, Vivant Gaultherot, and Jacques Gazeau obtained a four-year privilege from Parlement and were certified by the medical faculty of Paris to print and sell *De historia stirpium* for four years.[45] Each printer appears to have brought out an edition in 1543.[46] The edition by Gazeau reproduced from the original Latin edition the dedicatory letter, indexes, and main text, but not the pictures. The dedicatory letter, however, had undergone editing, trimming, and paraphrasing, as what was originally a fourteen-sided folio letter was shrunk to five octavo sides. Many of Fuchs's points were glossed over or ignored altogether: his critique of Egenolff and others for not matching pictures with descriptions, his praise for Specklin, his exaltation of the power of pictures over words, and his preference for Galen as authority were now all gone. In general, his debt to his predecessors was emphasized and the importance of pictures played down. Fuchs was still made to say that he wanted to avoid shadows lest the true form of a plant be obscured, but now there was a subtle addition: the text stated that such perfect plants were to be presented "to the mind" from nature.[47] In the absence of pictures, the point about shadows in pictures became moot, and the description of plants was rendered a matter of mental representation. The main text of this edition, however, was a faithful copy of Fuchs's Latin original, even preserving the references to pictures. The anonymous editor, most probably someone associated with the faculty of medicine in the University of Paris, offered another way of obtaining images of the plants under discussion. Under most headings he gave the French names of the plants and pointed out places in Paris where they might be found: nightshade and balsam, for instance, could be found in the garden of St. Germain des Prés, the tamarisk in the royal Garden and in the garden of Cardinal Jean du Bellay, and the *polygonon* in the Cemetery of the Innocents.[48] The unnamed editor thus had made an effort to compensate for the absence of pictures for French, or rather Parisian, readers. At the hands of an enterprising publisher, what Fuchs had claimed universally was now translated into the local surroundings of Paris.

Fuchs's *De historia stirpium* helped his reputation soar. He boasted to Cornarius that he had been invited by Cosimo I de' Medici (1519–1574) to teach medicine for six hundred crowns per annum at Pisa.[49] Cosimo had founded a medical garden for the University of Pisa in 1543/4.[50] This was, Fuchs later declared, a rare honor for a German, since Italy abounded in "learned men in every type of discipline and study."[51] As Fuchs publicly acknowledged, this invitation was mediated by Andreas Vesalius, whom Fuchs called the "best and

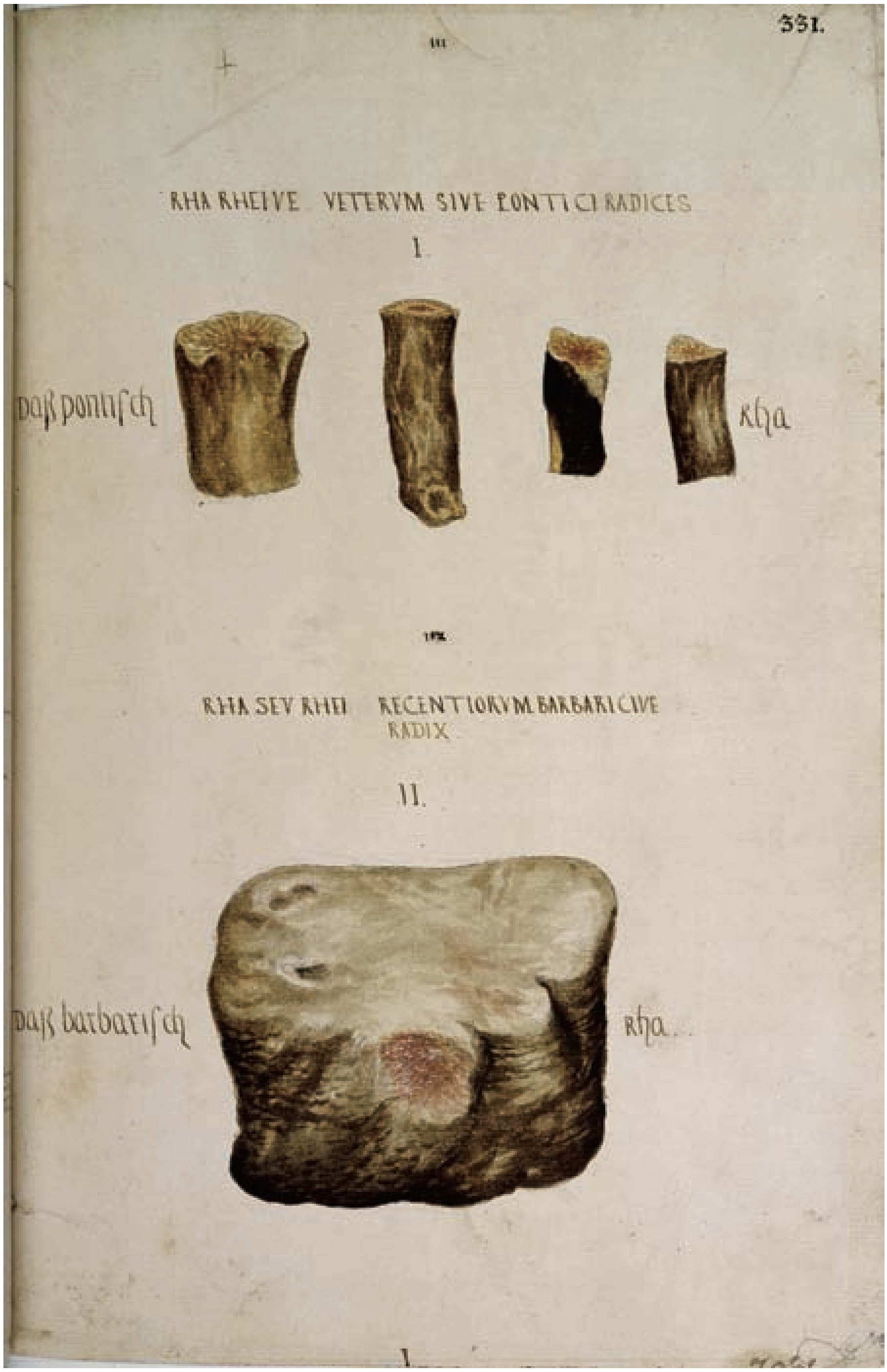


Fig. 6.3 Fuchs believed that the ancient *rha ponticum* and the *rheum barbarum* observed in his own time were the same species with certain distinguishing features, such as the shape of the root: the *rha ponticum* had smaller roots, whereas the *rheum barbarum* grew a larger, almost cube-shaped root. The four small pieces of the *rha ponticum* depicted at the top of this page by Albrecht Meyer, whose signature appears at bottom right, had been sent to Fuchs by Vesalius. Leonhart Fuchs, *Codex* 11 123, 3(1): 331, ÖNB/Wien/E30.134C.

dearest friend, well versed in disciplines, in both the Greek and Latin languages, medicine, and especially of the parts we call anatomy (in which, to state frankly how the matter stands, he surpassed Galen)."[52] Fuchs declined the offer for the "weightiest reasons," but he appears to have remained on cordial terms with Vesalius. Indeed, at some point Vesalius sent him roots of the *rha ponticum*, whose identity in relation to the rhubarb (*De materia medica*, 3.2) was much debated in this period (fig. 6.3).[53]

The publication of *De historia stirpium* in 1542 was also a defining moment for Fuchs in that he made public his scholarship on classical medicinal plants using pictorial arguments. The book was an "end product" in the sense that it was the material unit in which he aimed to proffer his knowledge (and successfully so), but it certainly did not settle definitively the state of knowledge on medicinal plants, nor was it the only way in which he chose to present his findings. In a German folio edition, Fuchs translated his universal knowledge of medicinal plants with pictorial arguments into a medical reference book for the "common man"; in an octavo format with minimal text, to be used outdoors, Fuchs made his arguments into a "fait accompli." At the hands of printers with a local market in mind, his claims were translated, transformed, and localized, for example, into Parisian surroundings.

Fuchs's pictures were integral to the classical and universalizing knowledge of plants presented in *De historia stirpium*. However, not all authors on medicinal plants saw the need for pictures in their books, and others who did include pictures did not necessarily share Fuchs's confidence, or use their pictures in the same way. Not even Fuchs himself was wedded to just one way of using pictures. His universal knowledge could be translated into different uses, audiences, and markets through various arrangements of text and images.

The authors discussed so far have one thing in common: their books on plants were printed successfully. But could pictures be important in the process of study and investigation *before* publication? I turn to this question in the next chapter, using the example of Conrad Gessner.

CHAPTER 7

Gessner and the Making of the *Historia Plantarum*

Conrad Gessner is today best known as "the father of bibliography" for his attempt to list all books ever written in his *Bibliotheca universalis* (Universal library); for the gigantic collection of animal etymology, character, and lore in his *Historia animalium* (History of animals); and for the first illustrated study that included *fossilia* (literally, "things dug up from earth") in his *De rerum fossilium lapidum et gemmarum maxime, figuris et similitudinis* (On the shapes and similarities of fossil objects, stones and especially gems).[1] He also left behind many drawings of plants with extensive annotations, now at the University of Erlangen-Nuremberg (fig. 7.1).[2] The drawings were intended to be the basis of a comprehensive *Historia plantarum* (History of plants), a project that remained incomplete and unpublished at his death. Although some of the drawings were reproduced selectively (fig. 7.2) in the eighteenth century by Casimir Christopher Schmiedel, they were not published in full until the twentieth century, in a facsimile edition with transcription and translation of the annotations, supported by historical, botanical, and artistic commentaries by Heinrich Zoller, Martin Steinmann, and Karl Schmid.[3] While we do not know the precise format Gessner envisaged for his book on the universal history of plants, we can be confident that it was going to contain pictures. Pictures were important for Gessner, not just for knowledge presented in a printed book, but also as a means of studying plants. The *Historia plantarum* drawings provide a rare opportunity to examine how pictures became integral to the process of developing knowledge about plants prior to scholarly publication in this period. They are traces of knowledge in the making, rather than part of a printed product like Fuchs's *De historia stirpium*.

Fig. 7.1 *Cotonago*, Erlangen, Universitätsbibliothek, Ms 2386, 256v. The textual inscriptions are by Gessner, except for the five lines at bottom right , written by Thomas Penny, and the inscription "N.52" at the top and the letters (e.g., A at the top and B at bottom left), which were added for the eighteenth-century edition.

Fig. 7.2 From Conrad Gessner, *Opera botanica* (1771), tab. XVI. The image labeled "Num. 52" is a reproduction of the Erlangen drawing of the *cotonago* (see fig. 7.1). It also shows a plant from another drawing (see fig. 7.12) at the foot of the page, on either side of the *cotonago*. Cambridge University Library, MH.2.45.

Gessner was born in Zurich in 1516.[4] After his father died with Ulrich Zwingli in the Battle of Kappel (1531), he was supported by several mentors and friends to study at Strasbourg, Basel, and Paris. He spent three years (1537–40) as the professor of Greek at Lausanne, made a brief visit to Montpellier where he met the professor of medicine Guillaume Rondelet, and returned to Basel to obtain his medical degree in 1541.[5] From then until his death he taught Aristotelian philosophy at the Carolinum in Zurich, where he was also town physician from 1554.[6] He died in 1565, not yet fifty years old, having edited or authored more than sixty books.[7]

Managing Correspondents

In a letter written to his friend Johannes Kentmann in March 1555, Gessner expressed his intention to publish a history of plants.[8] Although by then he had heard rumors of the imminent publication of the sequel volumes of Fuchs's *De historia stirpium*, containing more than a thousand pictures (*figuras*), he declared that he would not be deterred in his resolve to publish such a history himself, since the Alps and his friends were the source of many beautiful and rare plants. As in his other works, such as the *Bibliotheca universalis* and the *Historia animalium*, Gessner hoped to be comprehensive; he would write about *all* plants and bring all published pictures of plants together into one volume. He would write briefly (*breviter*) and crisply (*argute*) about each plant. Here Gessner drew a clear distinction between his history of plants and the *Historia animalium*, which totaled almost 3,500 folio pages in four volumes.[9] A year later, Gessner repeated to Fuchs the point about brief and concise descriptions of plants:

> I have decided to gather together in one volume the writings of all those who have written usefully about plants, especially the ancients and the best of the moderns, [in a manner] more briefly and more crisply [*brevius argutiusque*] than I have done in my history of animals, and practically without philological notes, and I have already written out a few leaves.[10]

Gessner was also serious about gathering all pictures of plants already published, as he promptly asked Fuchs's permission to borrow from Isengrin the woodblocks of plants.[11] He planned to assemble in one volume pictures of plants printed by Fuchs, Bock, Dodoens, Mattioli, William Turner, Belon, and Adam Lonicer, in addition to his own drawings and those from Kentmann.[12] While borrowing woodblocks from all published books on plants remained rather impracticable, pictures of plants already printed served as a starting point for Gessner as he searched for other plants whose pictures he had not seen in

Fig. 7.3 Drawings of *gladiolus indicus* (top and center) and *Iris Illyrica* (bottom right), plants both sent to Gessner by Calzolari. Gessner added a fruit of a plant (bottom left) from Coudenberghe because it was from India and seemed to be related to the *gladiolus*. Erlangen, Universitätsbibliothek, Ms 2386, 284r.

print or otherwise.[13] To this end, as was the case with his *Historia animalium*, Gessner sought the help of numerous correspondents, including Francesco Calzolari (1522–1609), the famous apothecary of Verona; Peeter van Coudenberghe (1517–1599), a merchant apothecary in Antwerp (fig. 7.3); Ulisse Aldrovandi (1522–1605), the naturalist collector of Bologna whom Gessner regarded the most diligent and extensive collector of natural things;[14] imperial physicians Rembert Dodoens (1517–1585) and Johannes Crato von Crafftheim; English physicians such as John Caius (1510–1573) and William Turner (d.1568); Felix Platter and Theodor Zwinger (1533–1588), physicians and professors of medicine at Basel; Samuel Quicchelberg (1529–1567), scholar and adviser on collecting to Albrecht V; and Jacques Dalechamps (1513–1588), the Lyonnais physician.[15]

Gessner needed to ensure, however, that he did not end up with the commonest plants from all over Europe. He frequently had to remind his correspondents that he only wanted pictures of plants that were rare—or at least unknown to him—or whose pictures were not yet published.[16] From each correspondent Gessner first requested a catalog or list of plants' names in order to determine whether they had plants he did not have.[17] If so, he would request that the actual plant be sent, preferably with roots and a bit of earth in a wooden box, so that he could grow it in his own garden and have its picture drawn *ad vivum*.[18] If a plant or seed was not available, Gessner would ask for a picture. Requests for pictures of plants thus figured prominently in Gessner's letters to his friends.

Managing his correspondents and, in particular, controlling the quality of pictures they sent was a tricky task. For example, Gessner felt that a picture sent by the Strasbourg physician Sebald Hauwenreuter (1508–1589) was "feigned" (*ficta*).[19] He also complained that pictures of plants that had once belonged to Sigismund, Duke of Austria (1427–1496), sent to Gessner by the Nuremberg physician Hieronymus Herold (d. 1566), were not *ad vivum*.[20] Gessner was prepared to pay for artists hired by his correspondents. For example, he asked Joachim Camerarius the Younger (1534–1598) to jot down the cost for pictures.[21] To the budding medical student Jean Bauhin the Younger (1541–1612), Gessner explained that he was prepared to pay four plapparts for each picture of a plant, though, ever mindful of saving costs, he also told Bauhin to check with him first to see whether the pictures were necessary.[22] A friend in Chur, the pastor Johannes Fabricius Montanus (1527–1566) had similarly hired a painter to draw plants for Gessner, but Gessner was unhappy with that painter's skills; he pointed out that his own painters could draw a dried plant better and more vividly than Montanus's painter could draw a fresh one. When Montanus then came across a rare plant, Gessner therefore asked him to send a fresh specimen if he could, or a dried one with its flowers and leaves pressed in a book, rather than use a painter to have them drawn.[23] Eight months later, Gessner had to repeat more bluntly—after which he apologized—that he would really rather save the cost of paying Montanus's painter.[24]

In return, Gessner offered to his correspondents other plants, seeds, pictures, and books, as well as a chance to have a plant named after them. For a plant which was not known to antiquity, Gessner proposed to name it after its "discoverer"—meaning not the first person ever to find it, but the first person to communicate it to him. Hence, he offered to name the *Schelmenkrut*, a species of *gentiana*, after Benedikt Marti Aretius (*c.*1522–1574), since he was the first to tell Gessner its German name and explain its effectiveness against pestilence.[25] Gessner also suggested to the younger Joachim Camerarius that he pick a plant unknown to the ancients.[26] Gessner's notes on his drawings, such as "This plant first found by Master Jacob Baumann," could thus form the basis of naming plants after his correspondents in the future.[27] Naming a plant after

Fig. 7.4 *Pulmonaria* drawn by Jos Murer, with corrections by Gessner. A leaf (bottom right) is crossed out with the words “this leaf shouldn’t be [here]”; next to another leaf (top left), Gessner wrote vertically, “The stem with the flower should be higher than this leaf.” Erlangen, Universitätsbibliothek, Ms 2386, 58r.

someone was a gift by which Gessner could return their favor of having given it.[28] Such exchanges appear not to have obliged exclusive loyalty on the part of the correspondent: Crato sent branches of cinnamon to both Gessner and Mattioli, and Calzolari sent copies of the picture of the *daphne cneorum* to both.[29]

Managing Artists

Gessner also hired artists for himself.[30] On the pictures he recorded payments to painters as job lots ("I paid 1 *fl.* to the painter up to here") or by the hour ("2 hours," later crossed out).[31] It has been difficult to identify positively the artists who might have worked for Gessner on the plant drawings, except for Jos Murer (1530–1580), the glass painter and mapmaker who had also drawn Gessner's portrait in the third volume of the *Historia animalium* (1555).[32] For instance, Murer drew the *pulmonaria* (fig. 7.4), which Gessner corrected extensively.[33] Despite his having paid for their work, painters' drawings did not always show the details Gessner wanted to see, and so he often had to intervene and correct their drawings.[34] Josias Simler (1530–1576) remembered how Gessner was constantly present while the painter was drawing pictures of plants, assiduously trying to prevent the artist from displaying mastery or whatever took his fancy, and to ensure instead that he imitated nature as closely as possible.[35] Such close supervision was not uncommon: Charles L'Ecluse supervised Peeter vander Borcht with similar care, and indeed micromanagement of artists by naturalists continued into the seventeenth century and beyond.[36]

In the spring of 1562, Gessner reported that he was making good progress with his history of plants.[37] From the summer of 1563 to the summer of 1565 he was busy working with a painter and a block cutter.[38] Yet here, too, were some problems. While during summer the painter was out drawing what was in bloom, and had nothing to give to the block cutter,[39] in winter the painter and the block cutter were occupied with other work elsewhere and could not be hurried unless the publisher, probably Froschauer, pressed them to do so.[40] Froschauer also told the block cutter not to let Gessner have more than one picture in proof at a time; the pictures had to be inserted into the master copy one at a time to avoid errors.[41] These comments by Gessner imply that during this period, Froschauer was paying at least for the block cutters.[42] In 1565, the health of "my painter" was a constant topic in Gessner's letters: he had fallen ill, he was recovering, he had fallen ill again.[43]

Gessner himself could draw (fig. 7.5). Most of the pictures we can attribute to him were drawn in the last few years of his life, and they suggest an accomplished draftsman with a fine eye for details and outlines.[44] Gessner and his artists frequently deployed a style in which the entire plant was drawn with clear and continuous lines, and partially colored with watercolor without the outlines

Fig. 7.5 Gessner wrote here that he himself had drawn (“*pinxi*”) the leaves (either side of the stem) in 1563, and that he regarded his drawing as having shown better form, color, and hairiness. Erlangen, Universitätsbibliothek, MS 2386, 49v, detail.

Fig. 7.6 This picture of the *rapunculus sylvestris* is typical of Gessner’s drawings of plants, combining clear outlines and partial coloring with watercolor, which preserves the details of the lines. Erlangen, Universitätsbibliothek, Ms 2386, 433r.

being blotted out (fig. 7.6). It appears that Gessner was particularly keen on capturing the lines and shapes that made up an object's external appearance. He thus impressed on Theodor Zwinger that the flower of the *populus alba* should be drawn "in its color and with all its lines [*suo colore et lineamentis omnibus*]."[45] The emphasis on crisp, continuous lines may well have been a reason why Gessner employed Murer, who also worked in glass painting (fig. 7.7)—a craft that required clear directions for outlines.[46]

Icon Absoluta

Gessner frequently asked for a complete or perfect picture of a plant. He wrote, for example, to Adolf Occo III (1524–1606) for a complete picture (*iconem absolutam*) of the *coccigrya*, because Gessner already had a dried branch with leaves, a fruit, and its fluffy seeds (*pappis*) but wanted it to be made "more complete [*integriorem*]" with its flowers.[47] Of the *sagapenum* he also asked for a "perfect" picture (*picturam perfectam*), which appears to have meant the same thing as a "complete" picture.[48] For Gessner, a "complete" picture would record all parts of a plant: root, stem, shoots, leaves, flowers, fruits, and seed pods.

Such pictures of plants had to be "completed" over time, often across several years: in the case of the *parvus verbascum* (fig. 7.8), the violet flowers growing in Gessner's garden were recorded in 1562 and the roots in 1564, probably when Gessner was prepared to uproot the plant. In the case of the plant called *tragoriganus*, Gessner's painter drew it for him partly from a dried plant sent from Italy by Giacomo Antonio Cortuso, and partly from a specimen growing in his own garden; Bauhin's sending him the flower "completed" the plant.[49] On the pictures of plants, Gessner also recorded details observed in his own garden, such as when they flowered or seeded.[50] A picture thus allowed him to build, gradually over time and from various sources, the entire plant through all its stages and parts.

It is worth noting that virtually none of the sketches shows any trace of individual blemishes, torn leaves, or insect-holes.[51] Gessner also drew on Fuchs's pictorial conventions. The picture of the *dianthus* diachronically shows the flowers blooming red and withering white (fig. 7.9). The picture of the *leucoia* shows five varieties as if existing in a single plant: flowers in pink, gray, red, and white, all with four petals, and another flower with five-petaled flowers in white (fig. 7.10). Surely these are expressions of a drive towards "completeness."

Gessner was well aware that local climate affected the types of plants available; he observed that the garden of Joachim Kreich (d. 1575), court apothecary at Torgau, had many rare things that could not be cultivated in Zurich, which was too close to the snowy mountains.[52] The Fugger gardens in Augsburg were another good source for exotic plants.[53] Gessner also compared notes with other

Fig. 7.7 Glass painting by Jos Murer from the Abbey of Wettingen, Aargau, dedicated by Caspar Falck and his wife Salome Amberg (1569). The scene is based on Albrecht Dürer's woodcut of the Adoration of the Magi (1503) and his painting of the same topic for Frederick the Wise (1504).

Fig. 7.8 Gessner wrote that this was the *parvus verbascum* (center) he had in his garden in 1562. Its roots (bottom left) were drawn in 1564. Erlangen, Universitätsbibliothek, Ms 2386, 318r.

Fig. 7.9 Gessner noted that the flowers of the *dianthus* were first red, then later turned white when they withered. Erlangen, Universitätsbibliothek, Ms 2386, 283r.

Fig. 7.10 Five varieties of *leucoia* merged into one branch—pink (A), red tending toward blue (B), red (C), and white (D), all of which have four petals; and at far right, white flowers with the rarer five petals. Erlangen, Universitätsbibliothek, Ms 2386, 377v, detail.

Zurich residents: the *lilium croceum* flowered in the garden of the surgeon and lithotomist Peter Hafner on 12 June 1564, but it had already flowered on 26 May in Gessner's own garden, even though it was cold and rainy.[54] The *scorzonera* grew and flowered with natural loam in a dry, sunny spot in the garden of Jacob Baumann (1521–1586), a wound surgeon also resident in Zurich, but Gessner himself could not get the plant to grow.[55] Pictures could thus act as a means to overcome the limitations of climate and soil that Gessner experienced in growing plants. He also appreciated, however, that regional variation could give rise to an infinite number of variations in species, most of which had to be ignored.[56]

Gessner was not an "armchair" gardener, wholly reliant on others to supply plants or their pictures. He had his own well-stocked garden outside the city walls, though in 1558 he had to sell it because of financial difficulties.[57] He later bought it back and appears also to have kept a garden close to his home.[58] Gessner's drawings also served to record where various plants were in his gardens.[59] In 1561 he described his own garden as being very small but full of differ-

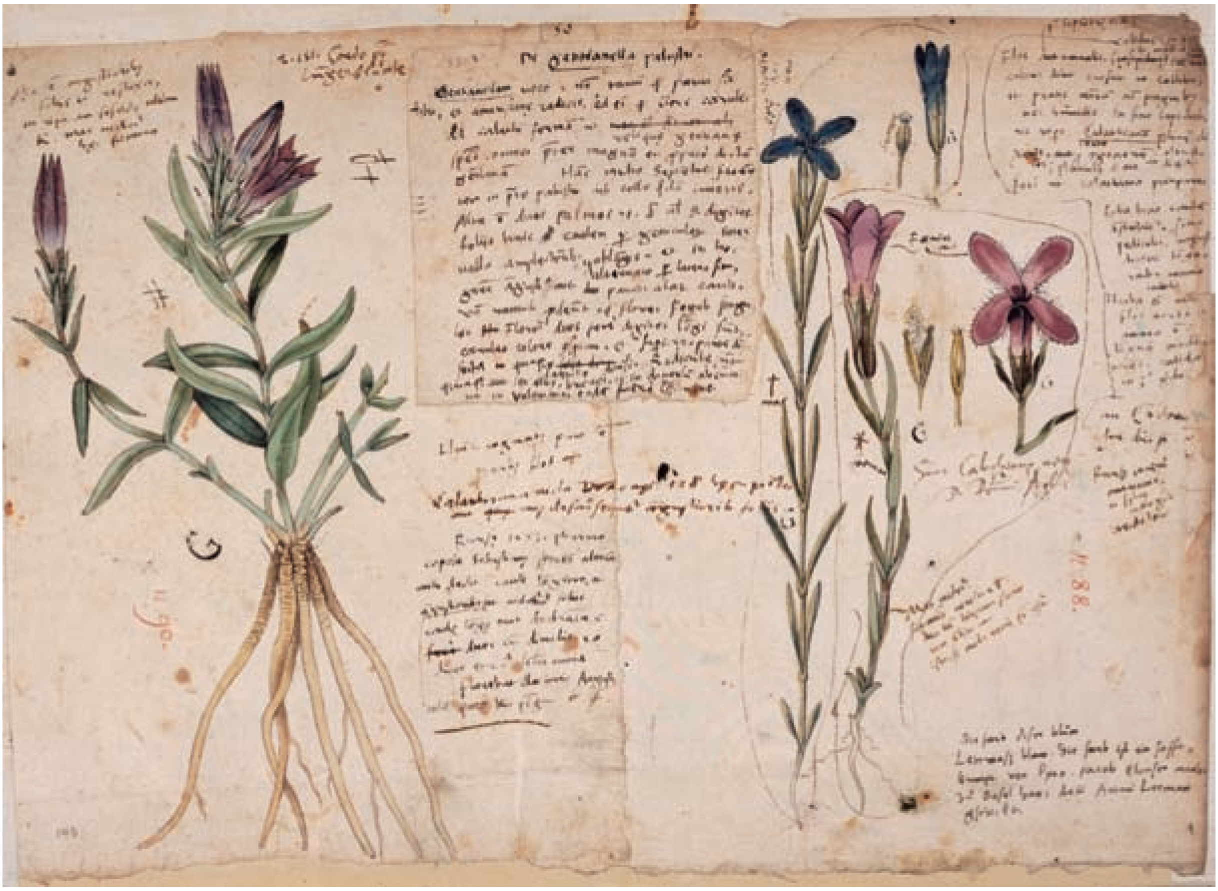


Fig. 7.11 The picture of a *gentianella* on the left was drawn in 1553, the one on the right in 1564. The two have been glued together with a third piece of paper containing textual description of the *gentianella palustre*, dated 1552. At bottom right, Gessner noted that the the flower's actual color was litmus blue. Erlangen, Universitätsbibliothek, Ms 2386, 143v.

ent kinds of plants, all shared with Hafner and the apothecary Johannes Jacob Clauser, a school friend—both of whom, according to Gessner, also had their own larger gardens.[60]

Gessner also made several excursions, most famously to Mont Pilatus (described in 1555 in *Descriptio montis Fracti*), as well as to the Alps and to nearby baths.[61] The plants found on these excursions were entered on his pictures, as was the cost of the trips.[62] Gessner also had people bring him plants; in 1553 he paid two batzen to a "Herr Sturm,"[63] while his own wife, Barbara, brought home a plant he had not seen, as had "Frau Wellenberg" and "Imcker Schaerer."[64] Gessner, in fact, was happy to consult common folk on such matters.[65]

As Gessner was keenly aware, plants would eventually die, wither, or neither flower nor seed the following year. He kept dried specimens in a herbarium, apparently glued onto large paper.[66] Many of Gessner's own pictures contain references to this herbarium, and he also had pictures drawn after dried specimens. The problem with dried specimens was that they did not well retain the color of fresh plants. Gessner wrote on his drawings: "The dried flowers [of the *Rote Fluhblümlein*] are so [dark purple]. The fresh ones turn red beautifully"; "Tobias Egli sent me blue flowers of [the *Feuerkraut*], dried, and they have probably changed into such a color because of dryness."[67] Gessner was also quite specific about shades of color, as when he noted that the color of a *gentianella* flower (fig. 7.11) was that of a pigment called litmus blue, a dye extracted from lichens that had been sent to him from Lyons.[68] Pictures were Gessner's way of retaining and fixing the vivid colors and shapes of fresh plants, which were all too transient.

Through these pictures, we can thus trace Gessner's effort in collecting, growing, and studying plants. He sought to make whole the fragmented knowledge he and his friends and acquaintances had of plants. He recorded plants he had grown in his garden or found on his excursions, as well as plants that could not or would not grow in his gardens. Pictures enabled him to compile gradually over time and space plants that were complete and perfect and would retain their fresh forms and colors. This was something that could not be done readily in a garden, or by using a herbarium alone.

An Unknown Plant

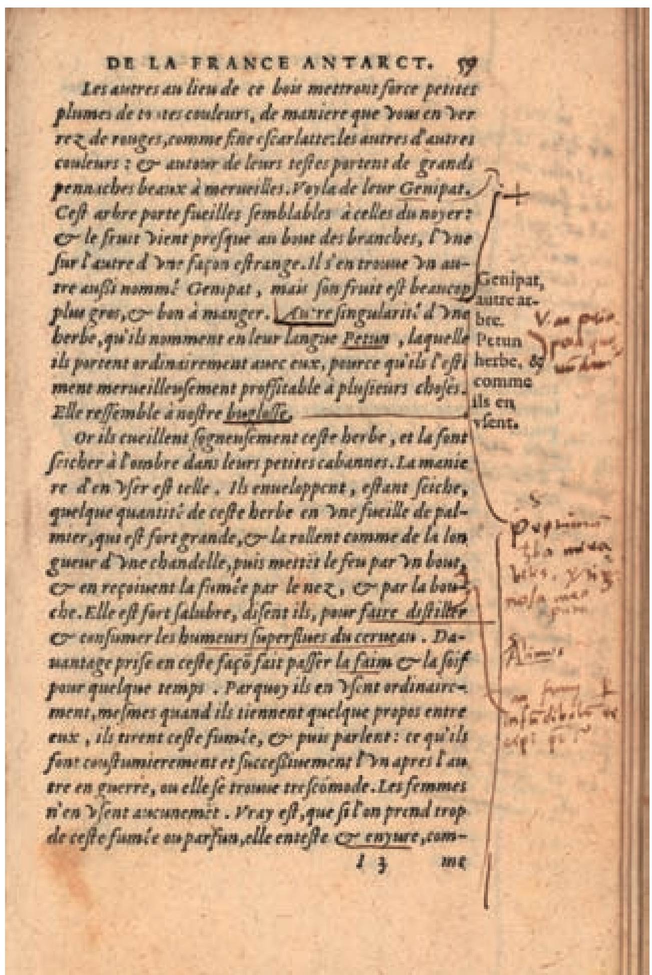
Gessner's drawings also record his process of identification. The plant pictured here (fig. 7.12) was first recorded as one unknown to him—*herba mihi ignota*—grown from a seed sent to him either from France or Italy in 1554.[69] A morphological description followed, portraying it as being much like a combination of known plants:

> Leaves like the *lapathum*, soft, succulent, somewhat sharp—also pungent, almost like the *noli me tangere* so it probably has some poison. The first taste is somewhat sharp—(see if it is the *zinziber caninum*) and smooth. The stem is rather round, though not without some protruding edges, green, moderately hairy, fatty (as is also the flower-cup, such that fingers stick to it because of its viscosity), a foot or higher, solid, but the marrow inside is spongy. The flowers are sallow or of a diluted yellow color (or in shape and division similar to the flowers of the *arthritica*), the pretty petals enclosed almost to its middle part by green cups are detachable, and when they fall off, the seedpods grow out of it and are roundish like the *avellana*, in which [there are] seeds.[70]

Fig. 7.12 An unknown plant. The inscription “n. 56” and the uppercase letters A to G in red are for the eighteenth-century edition of Gessner’s *Historia plantarum* (see fig. 7.2). The inscriptions on the left are by Thomas Penny (signing himself “T. P. Angl.”), who studied Gessner’s pictures after his death, and by Gessner’s student Caspar Wolf (1532–1601). Erlangen, Universitätsbibliothek, Ms 2386, 13r.

Gessner further noted that it flowered in July in his garden and seeded in August, that its root was useless and that the whole plant was soft and limp without smell, and that it grew to three cubits in a rich soil.[71] The seeds did not present any heat, despite Gessner chewing on them frequently and for a long time.[72]

Gessner tentatively gave the unknown plant a "fictitious" name, presumably because of its possible poisonous quality and the similarity of its leaf's shape to that of a sorrel: *lapathum apocynon* (literally "sorrel-dogbane").[73] He then wrote: "It is *priapeia* to Rondelet."[74] Gessner knew Rondelet personally from when he had studied at Montpellier and he subsequently corresponded with him, but we appear not to have Rondelet's own explanation of the *priapeia*'s properties.[75] Gessner also wrote: "Is it a plant related to Thévet's *petun*?"[76] André Thévet's (1502–1590) *Les singularitez de la France antarctique* (1558) described the prepa-



DE LA FRANCE ANTARCT. 59

Les autres au lieu de ce bois mettront force petites plumes de toutes couleurs, de maniere que vous en verrez de rouges, comme fine escarlatte: les autres d'autres couleurs: & autour de leurs testes portent de grands pennaches beaux à merueilles. Voyla de leur Genipat. Cest arbre porte fueilles semblables à celles du noyer: & le fruit vient presque au bout des branches, l'vne sur l'autre d'vne façon estrange. Il s'en trouue vn autre aussi nommé Genipat, mais son fruit est beaucoup plus gros, & bon à manger. Autre singularité d'vne herbe, qu'ils nomment en leur langue Petun, laquelle ils portent ordinairement auec eux, pource qu'ils l'estiment merueilleusement proffitable à plusieurs choses. Elle ressemble à nostre buglosse.

Or ils cueillent soigneusement ceste herbe, et la font seicher à l'ombre dans leurs petites cabannes. La maniere d'en vser est telle. Ils enueloppent, estant seiche, quelque quantité de ceste herbe en vne fueille de palmier, qui est fort grande, & la rollent comme de la longueur d'vne chandelle, puis mettét le feu par vn bout, & en reçoiuent la fumée par le nez, & par la bouche. Elle est fort salubre, disent ils, pour faire distiller & consumer les humeurs superflues du cerueau. Dauantage prise en ceste faço fait passer la faim & la soif pour quelque temps. Parquoy ils en vsent ordinairement, mesmes quand ils tiennent quelque propos entre eux, ils tirent ceste fumée, & puis parlent: ce qu'ils font coustumierement et successiuement l'vn apres l'autre en guerre, ou elle se trouue trescómode. Les femmes n'en vsent aucunemét. Vray est, que si l'on prend trop de ceste fumée ou parfun, elle enteste & enyure, com-

i 3 me

Genipat, autre arbre.

Petun herbe, & comme ils en vsent.

Fig. 7.13 The plant called *petun*. From André Thévet, *Les singularitez de la France antarctique* (1558), [59]r. In the right-hand margin of the page (upper annotation), Gessner wondered whether the *petun* might be what some call the *priapeia*. Gessner's copy, Basel, Universitätsbibliothek, Hx. VI. 30.

ration and use of a herb called *petun* by the New World inhabitants who rolled its leaves, set it alight, and inhaled its fumes to cure various ailments.[77] In one of his own copies of Thévet's book (fig. 7.13), Gessner wrote a similar question on the page on the *petun*: "Is it the *priapeia* of certain people?"[78] On the next page Gessner compared his own experience with that of Thévet, who had written that the smoke of the plant caused him to perspire and feel so weak that he fainted.[79] Gessner recorded in the margin that he similarly felt dizziness—not from the fumes, however, but from having eaten its leaves.[80]

On his drawing of the "unknown plant" (fig. 7.12), Gessner further added, "Dodoens has this too."[81] In his copy of the French edition of Dodoens's *Histoire des plantes* (1557), which showed a picture of a plant called *hyoscyamus luteus* or *Iusquiame iaulne* (fig. 7.14), Gessner wrote, "*Priapeia* of others . . . Baumann

Fig. 7.14 Next to the woodcut of the *hyoscyamus luteus* (top right), Gessner wrote that it was the *priapeia* of others, and that it was also called the *lunaria* in Augsburg. Rembert Dodoens, *Histoire des plantes* (1557), 305, detail. Zentralbibliothek, Zurich, 16. 17.

said that in Augsburg it is also called the *lunaria*."[82] It must have been after this point that Gessner struck out "*herba ignota mihi,*" and written over it, *hyoscyamus luteus*, and also deleted the tentative name *lapathum apocynon*.

In 1561, Gessner added to his *De hortis Germaniae* (On the gardens of Germany) a list of those people of whose gardens he had received catalogs, along with a list of rare plants found in those gardens. There, Gessner mentioned two varieties of the *hyoscyamus,* white and yellow, found in the catalog of Peeter van Coudenberghe.[83] Gessner reported that Coudenberghe had himself wondered whether these varieties actually belonged to the *hyoscyamus*; Gessner also added that the *hyoscyamus luteus* was a foreign plant that some said came from Syria, that it had a sharp taste, and that "some people in Montpellier" called it *priapeia* from the shape of its seedpod.[84] Fuchs, to whom Gessner had sent its seeds, and who had the plant depicted by Albrecht Meyer (fig. 7.15) some time in 1555 or 1556, explained that it was called *priapeia* "because it is very effective in treating ulcers of the pudendum which is also called *priapus*, or because it displays on its stem a round head, reddish, resembling a head of a cabbage."[85] Fuchs explained that this plant's German name, *Schwantzkraut*, came from the German name for the male genitals.[86] This may well have been Rondelet's reasoning for calling the plant *priapeia*.[87]

A little while later, Gessner went back to the picture and wrote: "Check in Mattioli, 460b."[88] The 1563 edition of Mattioli's commentary on *De materia medica* included this plant on the verso of page 460 as *hyosciamus III*.[89] Thus, Gessner studied this "unknown plant" from at least 1554 to 1563. We now call it tobacco, *Nicotiana rustica*.[90]

Gessner's pictures of plants recorded many questions of this kind—"research questions," one might say, directed to himself. Next to these he later wrote the answers, or crossed out the original questions: "See if Fuchs has this—he does at p. 86, but ours is another species"; "See if it is the *scorodoprason*—this is bigger"; "Is this *pulmonaria* to some people?" (The last question was crossed out, indicating that the answer was no.)[91] These questions were usually answered through other books, such as Fuchs's *De historia stirpium*, Dodoens's *Histoire des plantes*, Mattioli's *Commentarii in libros Dioscoridis*, Bock's *De stirpium . . . differentiis*, and Cordus's *Annotationes*, as well as the works of Pliny the Elder, Theophrastus, and Dioscorides. From some copies that have survived, we know that Gessner wrote further queries in the margins or next to the pictures, and made references to other books as well as to his own drawings.[92] On a few occasions he drew in his books.[93] For example, he painted a picture of the flowers of the pear, seen from the front and back (fig. 7.16), next to a woodcut by Mattioli that only showed the fruit. This may be regarded as Gessner's way of "completing" a picture, but such examples in his books are relatively few. Nor is it clear why he chose the 1563 edition rather than the 1557 edition of Dodoens's herbal

Fig. 7.15 *Priapeia* or *nicotiana* drawn by Albrecht Meyer (signature at bottom right). From Leonhart Fuchs, *Codex* 11 123, 3 (1):265, ÖNB/Wien/E26.105C.

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uocantur, nos uerò Lomie dicimus: tametsi Limonia, cùm sint gustu omnibus iis speciebus acidiora, ob id succo & frigidiora, & sicciora esse, argumento duci possit. Quin & Aurantia cortice calidiora censenda sunt, quandoquidem is reliquis acrior, atq; amarior gustatu deprehenditur. Aurantiorum (quemadmodum etiam de punicis superius diximus) in Italia tria obseruantur genera, dulcia, acida, & uinolenta, siue mista. Dulcia in omnibus partibus excalfaciunt. Aliorum uerò succus refrigerat, prout maiore, seu minore referta sunt aciditate. Quocirca febricitantibus ad restinguendam sitim, acida quidem, & uinosa, non autem dulcia sunt exhibenda. Fit è Limoniorum succo, sicut & citriorum, serapium ad restinguendum bilis feruorem non inutile. Item & ad pestilentes febres, & eas, quæ contagione non uacant. Aqua, quæ è Limoniorum succo cadentis aquæ balneo, & uitreis organis extrahitur, præterquàm quòd mulieribus expetitur pro fuco ad faciem expoliendam, uitiligines ubicunq; sint, & totius corporis maculas emendat, uaros delet, & acaros interimit. Serapium admista febribus acutis, et contagiosis mirè succurrit. Epota uentris tineas enecat: id quod etiam præstat succus recenter expressus, unciæ pondere potus. Cæterùm non parum laboris impendisse uidetur Brasauolus in præfatione sui de simplicium examine libri, ut doceret, unde emanauerit Arantiorum uocabulum. Sed licet ibi plura de eius origine referat; ea tamen, meo quidem iudicio, non multùm nomini quadrant. Quandoquidem ego potius existimauerim, uulgò Arantia, quasi Aurantia, altera expuncta litera, dicta fuisse. Nam cùm hæc poma auri colore reluceant, ab auro meritò nomen accepisse uidentur: unde, quantum equidem reor, Aurantia, hoc est, aurea mala dicta fuere.

Nomina. Reliquum est, ut singulis malis sua reddamus nomina. Mala ita Latinè dicta, Græcis μῆλα uocantur: Arabibus, Taffa, seu Tufaba: Italis, Mele: Germanis, Oepffel: Hispanis, Mansanas: Gallis, pomes. Ea uerò, quæ Græcè κυδώνια μῆλα, Latinè Cotonea, & Cydonia mala dicitur: Arabicè Saffargel: Italicè, Mele cotogne: Germanicè, Quitten, aut Kutten: Hispanicè, Membrillos, & Marmelos: Gallicè, Conting. Quæ autem Græcum nomen habent μελίμηλα, ἢ γλυκύμηλα, eorum Latinum est Mellita, uel Dulcia mala: Arabicum, Melomelle, & Galopomelle: Italicum, Mele dolci. Mala, quæ περσικὰ μῆλα, καὶ [illegible] Græco nomine, Latino Persica mala appellantur: Arabico, Saueb, seu Chaueb: Italico, Pesche: Germanico, Pfersich: Hispanico, Pexegos: Gallico, Pesches. Μῆλα ἀρμενιακά, πραικόκκια, καὶ βερικόκκια quæ Græci, Latini Armeniaca mala, et Præcocia nominant: Mauritani, Mermex seu Mirmix, Mex, Mesmes, siue Mismis: Itali, Armeniache, Bacoche, Moniache, et Grisomele: Germani, S. Iohans pfirsich: Hispani, Albaricoques, Albarchigas, et Aluaricoques: Galli, Abricot. Mala deniq; Medica μῆλα, ἢ κιτρόμηλα à Græcis uocata, Latinis similiter Medica mala, aut Citromala, et Citria dicuntur: Italis, Cedri, et Citroni: Germanis, Citrin oepffel, Iuden oepffel, et Citronaten: Hispanis, Cidras: Gallis, ung Citron.

Ἄχρας. PYRA. CAP. CXXXII.

PYRORVM multa genera. Quæ tamen omnia adstringunt: proinde adduntur conuenienter in repellentia cataplasmata. Decoctum è siccis, & cruda ipsa aluum sistunt: ieiunos esitata lædunt. Achras pyrastri genus est, quod tardissimè maturescit. Vim pyro adstringentiorem habet, & ad eadem conuenit. Stringunt etiam eius folia. Ligni pyrorum cinis efficaciter his auxiliatur, quos fungi strangulant. Aiunt fungos, si syluestria pyra cum eis coquantur, innoxios fieri.

Pyrorum cōsideratio. QVONIAM Pyra uulgatissima sunt non modò in Italia, sed ubiq; in tota Europa; ideo superuacaneum duxi eorum arbores per historiam explicare. Multa, ac uaria apud nos Pyrorum numerantur genera, quemadmodum & apud antiquos. Qui, ut Plinius refert libro, & capite XV. celebrauere superba, falerna, decumiana, dolobelliana, pompeiana, liceriana, seueriana, tyranniana, fauoniana, lateriana, aniciana, tiberiana, signina, purpurea, sementina, laurea, amphorina, coriolana, cucurbitina, & alia, quorum enumeratio longa foret. Quæ sanè uariæ appellationes mutatæ sunt, uel ab hominibus, qui primùm ea in ciborum usum reuocarant; uel à locis, unde uenerant; aut à notis, quas aliquibus fructibus acceptas referebant; aut à colore proprio; aut à tempore, in quo ab arboribus decerpebantur. In hoc itaq; nostri quoq; Hetrusci antiquorum consuetudinem secuti, uariis nominibus à diuersis inditis causis sua Pyra uulgò appellant moschatelle, giugnole, ciampoline, roggie, ghiacciuole, spinose, quadrane, caruuelle, papali, san Nicolo, durelle, zuccate, campane, uernereccie, gentili, porcine, sementine, & plura alia habent aliis nomenclaturis appellata. Cæterùm si quis uellet in nostratibus ueram Pyra collatione assequi, operæpretium esset, ut unumquodq; eorum genus peculiarem, perspicuamq; habuisset descriptionem: quandoquidem fieri non potest, ut ex sola nomenclatura innotescant.

Pyrorum facultas. Porrò in uniuersum de eorum uiribus

Fig. 7.16 Gessner painted in the flowers of pears, as seen from the front and back, thus “completing” the printed woodcut which had only showed the fruits and leaves. From Conrad Gessner’s copy of Pietro Andrea Mattioli, *Commentarii* (1558), 154. Zentralbibliothek, Zurich, DrM 438.

to draw the seedpods and denticulated petals of the flowers of the *lampsana* or *Milcken*.[94] What is worth noting here is that he marked some of his books in a style similar to that of his drawings.

Even on drawings of plants better known to him than the *priapeia*, Gessner made references to entries in other books, to the dried samples in the herbarium, to the plants in his gardens, and to other pictures, thus weaving a complex web of cross-references. Gessner's pictures record the extent to which his process of identification was bookish; he tried to make sense of a new, "unknown" plant through the scholarship of others, a tendency common to Renaissance scholars and described by Gianna Pomata and Nancy Siraisi as "learned empiricism."[95] In order to compile the universal history of plants, Gessner tried to read all the books about plants by ancient and modern authors; by the end of his life he claimed that he had incorporated 260 books into his study of plants.[96]

What was ultimately rendered visible on those sheets of paper now in Erlangen? I suggest that it was Gessner's *object of study*. Its visualisation required patient coordination of correspondents, careful and constant supervision of artists, comparison of soil and climate, a certain amount of sampling and chewing of the plant, and extensive reading of books. These were all necessary tools with which to establish a "complete object" that transcended the transience of an individual plant found at a particular place and time. Such an object was necessary for scholarly study, which aspired not just to comprehensive coverage but also to general claims about medicinal efficacy that would be valid for all members of a given species wherever they grew.

Pictorial Commonplaces

The pictures, drawn on loose sheets of paper, were numbered and distributed over two hundred shelves in Gessner's home.[97] This was probably done to allow Gessner ready access to each picture he would study across a number of years. Earlier, in the second volume of his *Bibliotheca universalis*, he had explained how he compiled an index by excerpting texts, cutting them out of books, grouping the strips of text by general themes, sorting them further into more specialized topics, and then placing them in boxes.[98] This meant that later they could be brought together readily, and not just for compiling an index:

> . . . I know many learned men who are pleased to apply this convenience to almost all their studies; whether it is something to be written or something to be taught orally in public, they collect the subject matter of their discourse roughly and arrange it in the following manner. Both material that was recently compiled and that which had long since been acquired is being prepared for use on separate slips (not mounted), so that when needed for whatever subject

> is to be treated, they can produce them and select from many slips those that serve best for the present purpose; the slips are fastened together with small pins, and are then arranged in whatever useful order one wishes to have them for the purpose of a discourse; what seems to be appropriate is noted down or left out at will, the slips then being put back again in their place.[99]

Gessner's point was that his form of excerpting and ordering for an index could also be used for composition and instruction; indeed, he regarded this method as Erasmus's way of compiling commonplaces.[100] Commonplaces were notable or worthy passages extracted and collected under general headings, often in a notebook, and this method of reading, encouraged by Erasmus and others, became a way to parse and integrate information from various sources for composition in the sixteenth century.[101]

Using slips of paper indeed appears to have been Gessner's way of working and reworking his compositions, as was the case with his own copy of the *Historia animalium*.[102] Sometimes he also glued together pictures of plants, as can be seen in the picture of the *gentianella* (fig. 7.11) in which the plant on the left was drawn in 1553 and the one on the right in 1564, and both drawings were stuck together in the middle with a description from 1552.[103] Similarly, Gessner used pictures from printed books by either cutting them out or copying them.[104]

We do not know the precise intended format of his *Historia plantarum*, but Gessner did publish some of his findings in 1561, when he reedited Valerius Cordus's (1515–1544) *Annotationes* on Dioscorides's *De materia medica*. The woodcut illustration of the *chamaenerion* in that book was based on one of Gessner's pictures, and the morphological descriptions were copied from two other sheets.[105] One entry was thus made up of several pictures. Using slips of paper to coordinate information from quite disparate sources, which were textual as well as observational, and arranging them as the basis for compilation was a method also used by Aldrovandi in preparing his *Ornithologia*.[106] These drawings may be described as *pictorial* commonplaces from which Gessner hoped to compile his book.[107] Rather than being mere haphazard records of his thought processes, they embodied a method of study and composition. A book compiled by this method was, as in the case of Gessner's *Historia animalium*, a book that could be read like a dictionary: the reader did not need to read the book sequentially from beginning to end, but could instead dip into topics of interest.[108]

Pictures were thus essential for Gessner throughout the course of his study and investigation of plants over space and time. His drawings and annotations helped him create an object of study from a variety of sources. Gessner shared with Fuchs the effort to study an object of some generality and completeness, to which Gessner referred, using the same adjective as Fuchs, as an *icon absoluta*. The sheets of drawings functioned as slips of commonplaces that were the basis of compiling a book. Indeed, Gessner's drawings were "bookish" also in the sense that their annotations pointed to other printed books as references or questions to be answered. Books thus shaped the way in which he organized his knowledge of plants in his drawings, even before their publication.

CHAPTER 8

The Authority of Pictures:
Gessner, Mattioli, and Jamnitzer

Pictures of plants, as I have suggested in the previous chapter, were for Gessner the principal method that enabled him to pursue a scholarly study toward a comprehensive *Historia plantarum*. There is no doubt that he believed that pictures were integral to his study of plants. But how effective were pictures when the identities of plants became disputed? And why did Gessner think that pictures were the best way to help his study? This chapter examines the authority of pictures through a dispute Gessner was embroiled in, and through a piece of artwork that inspired him.

Gessner versus Mattioli

At eight o'clock on 18 April 1565, Gessner was writing a letter to Adolf Occo in which he contested Mattioli's orders to banish *doronicum* from the pharmacies on the grounds that four drachms of it had killed a dog.[1] There were plants such as the *asparagos* which, according to Dioscorides (*De materia medica*, 2.125), could be poisonous to dogs but not to humans. Gessner reported that he had in fact eaten the *doronicum*, often with great pleasure, and that he had also taken the powder of its root coated in honey without any harm. To prove Mattioli and others wrong, earlier that day Gessner had taken *two* drachms of it with hot water, knowing that one drachm of it could kill a dog. At eight o'clock he reported that so far he felt no change. He confidently declared: "I do not want you to think that I am so reckless or inexpert that I would try [*experiri*] on myself something that can bring immediate danger."[2]

Normally in this period, possible poisons or antidotes were tried out first on animals and then on condemned prisoners.[3] Ambroise Paré (1510–1590) related the unpleasant death of a condemned cook who agreed to take poison and then a bezoar stone (purported to be a universal antidote) on the promise that if he survived, his life would be spared and he would be pardoned by King Charles IX.[4] Gessner was somewhat unusual in that he regularly tasted parts of plants, including white hellebore, and tested untried medicines on his own body.[5] In this case, however, Gessner became unwell, as he confessed to Occo five months later.[6] Although he felt fine while writing the first letter to Occo, some time later his bowels and stomach felt distended and his whole body grew weak; he was sick for two days. When it appeared that he was not going to die immediately, he took a hot bath—a common method for inducing perspiration—and was cured. Astonishingly, Gessner's verdict on the *doronicum* was that it was not inherently poisonous, but also that the roots' excessive wetness could cause inflammation of the stomach, from which one could not die so easily. He still disagreed with Mattioli, insisting that the *doronicum* should not be thrown out of pharmacies since the plant above the root was safe and useful. He recommended that it should instead be renamed *pseudo-doronicum*, and that for recipes of ancient authors which specified the use of *doronicum*, the apothecaries should instead use *galanga* or *zedoaria* along with a bit of citrus rind, since the Arabic *durungi* was derived from the word for citrus. By 1565, Gessner's position against Mattioli was firmly entrenched, especially since this was related to their acrimonious dispute over the true identity of Dioscorides's *aconitum pardalianches*, which Dodoens claimed in 1557 to be same as the apothecaries' *doronicum* (fig. 8.1).[7]

The original dispute was over the first type of *aconitum* described by Dioscorides (*De materia medica*, 4.76):

> Some call it *pardalianches*, others *cammaron*, others *thelyphonon*, others *cynoctonon*, and others *myoctonon*: it has three or four leaves like the cyclamen's or the cucumber's, but smaller and not as rough; the stem is a span tall; the root is like a scorpion's tail and shining like alabaster. They say that its root, when brought near a scorpion, paralyzes it, and that it stirs again when white hellebore is set before it. It is mixed with analgesic medications for the eyes and it kills leopards, swine, wolves, and every wild animal when placed on slices of meat and thrown to them.[8]

Fig. 8.1 The image of the *doronicum Romanum*, identified by Dodoens as the *aconitum pardalianches*. Gessner tried to correct the shape of the root, noting that the joints had to be more articulated. From Rembert Dodoens, *Histoire des plantes* (1557), 583, detail. Conrad Gessner's copy, Zentralbibliothek, Zurich, 16.17.

The rough chronology of events surrounding the identification of this plant was as follows. In 1542, Gessner had suggested that the *aconitum pardalianches* was commonly called the *tora*.[9] In the same year, Fuchs identified it with a plant known as the *uva versa*, also called the *herba Paris*.[10] In 1544 in the first edition, in Italian, of his commentary on Dioscorides's *De materia medica* (without pictures), Mattioli explained that he had seen the plant in Trent, Naples, and Rome.[11] He doubted Fuchs's identification of the plant with the *herba Paris*, and also pointed out that the poisoning power of the *napellum* was far more ferocious than that of the *aconitum*.[12] Gessner, in the section on wolves in his *Historia animalium* (1551), wrote an extended discussion of the *aconitum* as a plant that was harmful to wolves, and repeated his identification of the *aconitum* with the *tora*.[13] In 1554 Mattioli extended his earlier criticism, now in Latin, of Fuchs's identification of the plant with the *herba Paris*, and produced a picture of what he regarded to be the true *aconitum* (fig. 8.2).[14] At this point, Mattioli did not deal with Gessner's views on the *aconitum*.

Fig. 8.2 The *aconitum pardalianches* (*primum*) in Pietro Andrea Mattioli, *Commentarii* (1558), 537, detail, with Conrad Gessner's annotations. Zentralbibliothek, Zurich, DrM 438.

Fig. 8.3 Gessner's *tora* identified as the *aconitum pardalianches*. From Conrad Gessner, *De raris et admirandis herbis* (1555), 38, detail. Cambridge University Library, N*.11.15(E).

In 1555 Gessner published a book on some rare plants called *lunaria*, the *De raris et admirandis herbis, quae sive quod noctu lucant, sive alias ob causas, lunariae nominantur* (On rare and wonderful herbs which are called lunaria either because they glow by night or for other reasons). The testimony of one Johannes Franciscus Maluetius of Verona, who said that the *tora venenata* was called a *lunaria*, probably because its leaves were shaped like the full moon, gave Gessner the opportunity to discuss the *tora* again.[15] Gessner explained that he had already identified the *tora* with Dioscorides's first type of *aconitum* (*aconitum primum*) in the *Historia animalium*, and that he had to establish that the picture printed in the book on the *lunaria* (fig. 8.3) was actually that of the *aconitum primum*.[16] This image had been sent to Gessner by Gabriele Falloppio (1523–1562), the distinguished professor at Padua. Gessner then cited the section on the wolf from his *Historia animalium* to indicate how the woodcut image fitted his earlier description of the *tora* plant.

Fig. 8.4 Johannes Kentmann's image of the *aconitum pardalianches*. This was not printed in Gessner's book on the *lunaria*, but his description of it there is fairly accurate. Herzogin Anna Amalia Bibliothek, Fol. 323, 87v.

At this point, Gessner introduced a description of the *tora* from another picture, which he had received from Kentmann. This picture, Gessner explained, showed a plant that was similar, but with three leaves sprouting from one root. Two of the leaves were very small without stems; while the middle one was large; the plant also had a stem without a flower, which sprouted another more pointed leaf, as in Falloppio's picture; there were about ten small roots.[17] Gessner did not include Kentmann's picture in his book on the *lunaria*, but his description is a reasonably accurate description of the original, which has survived (fig. 8.4). Gessner cited additional credentials for Kentmann's picture: Aloisius Romanus, the prefect of the physicians' garden at Padua, had judged this to be the true *aconitum pardalianches*, found on Monte Baldo between Padua and Verona.[18] Kentmann's *tora* was different from Falloppio's, but Gessner's point here was that the difference between the plants was due to the difference in their sizes: smaller plants sprouted a single leaf and acquired a second or a third as they grew from the roots, which also increased as the plant grew. Gessner did not have Kentmann's image printed, probably because Falloppio's picture better fitted Gessner's earlier description in the *Historia animalium*, but he needed Kentmann's image in order to preempt a possible objection that the woodcut in the book on the *lunaria* showed a plant with only one leaf when Disocorides's description mentioned three or four. Gessner also cited Guglielmo Gratarolo (1516–1568), the physician from Bergamo, in saying that the same plant, commonly called the *tora*, produced a single leaf.[19] Therefore, he concluded, there was no doubt that the *tora* shown in the woodcut was the *aconitum primum*. He reminded his readers that he had made this identification as early as 1542, and claimed that he was also the first to show a picture of the true *aconitum primum*. Gessner thus carefully staked his claim on the identity of the *acontitum primum*, citing the words and images of several physicians. Of course he was aware that his readers would know that Mattioli had published a picture of the plant a year earlier. Gessner declared that Mattioli's picture (fig. 8.2) of the *aconitum primum* was "obviously fictitious" (*plane fictitia*); Mattioli had either made it up to fit Dioscorides's description or had been deceived by somebody else.[20] If Mattioli were to point to two or three erudite men and provide testimony publicly, as Gessner had just done, Gessner would withdraw his comment and thank him instead.[21]

Mattioli and Gessner had thus disagreed over the identity of Dioscorides's *aconitum pardalianches*, and had both published images to back up their identifications. Gessner must have realized that in cases of contested identification, a picture of a plant in itself did not necessarily carry additional weight. Any accusation that another's picture was fictitious raised the stakes, however, as it was a charge that could be made against one's own pictures. Gessner marshalled learned testimony to ensure that his pictures were reliable, and his recording of the names and status of those who had given him plants, descriptions, and identifications may have been for the purpose of being able to cite them as witnesses in the future.[22]

In 1558, Mattioli hit back in a new edition of his commentary on *De materia medica*. To his objections from 1554, he added in the 1558 edition an appendix in small print, criticizing and ridiculing Gessner's character. He pointed out that Gessner's own image of the *aconitum primum* was as different from the genuine plant as a raven differed from a swan. Where were the leaves like those of the cyclamen or the cucumber? Where was the root like a scorpion's tail, or the root shining like alabaster?[23] Mattioli also lampooned Gessner's request for learned testimony. Mattioli would have been happy to send him the actual plant, but Gessner did not ask for that; he asked for testimonies. Alive to testify were Giorgio Liberale, the painter who had drawn the plant; Petrus Spezzalancia, who had dug up the plant; and Franciscus Melchioris, a physician from Trent who traveled with Mattioli—as well as Mattioli himself, and even the mountains which and produced the plants. How extraordinary it was that men would be so obstinate as not to believe that anything existed beyond their lands and seas, unless they had seen it themselves![24] Overreliance on seeing, either by oneself or by authentication, Mattioli explained, was thus a limitation on knowledge. He underscored the importance of the mastery of ancient texts, the study of objects, and trust in others—especially himself.

Gessner read Mattioli's 1558 edition carefully, correcting typographical, grammatical, and factual errors and omissions—even correcting the index where Mattioli had recorded just two locations of Gessner's errors (*lapsus Gesneri*) by adding the pages of four more places where Mattioli had criticized him.[25] Gessner was not happy with Mattioli's comments. In private he called him "a man probably more ambitious than learned."[26] In 1563, Mattioli published a German edition of his commentary, with pictures larger than in the previous editions. He naturally insisted on including the image of the *aconitum*, which Gessner called a monstrous cross between two different species—the root of the *Schuppenkraut* and leaves of the *doronicum*—and which was as feigned or fraudulent (*fictum et fraus*) as Mattioli's other pictures were.[27] The 1563 edition was the latest in a series of republications Mattioli was engaged in, each time revising and augmenting his commentary on Dioscorides's *De materia medica*, each time also revising his approval or disapproval of contemporary commentators.[28] Mattioli boasted that he had sold thirty-two thousand copies of his commentary, and indeed its frequent republication must have had the effect of flooding the market and making his book so ubiquitous that it became a work one could readily refer to.[29]

On hearing of the imminent publication of a further Latin edition in 1565, and wondering how different it would be from the German edition of 1563, Gessner wryly remarked that the task of describing plants would be infinite and one that could be augmented forever, especially if one wanted to seek out all the variations.[30] One point that Gessner was prepared to acknowledge about the pictures in Mattioli's 1563 edition was their large size, though not their truth or accuracy.[31] Size also made an issue of cost, as Gessner pointedly remarked on the labor and expense he had to expend to make his pictures "very true" (*veriores*) and "very accurate," without a patron.[32] This was presumably another dig at Mattioli, who had been at the imperial court since 1554, successively (and successfully) serving Ferdinand I and Maximilian II. Gessner would repeatedly tell his correspondents that pictures did not have to be large.[33]

In the end, pictures in printed books did not resolve the controversy between Mattioli and Gessner over the identity of the *aconitum pardalianches*.[34] In this dispute Gessner sought to garner the support of learned friends and colleagues through his letter writing, but with little success, as Candice Delisle has shown.[35] Indeed, one of the physicians, Girolamo Donzellini, whom Gessner asked to adjudicate the matter, came down on Mattioli's side, pointing out that a picture of a plant matching Dioscorides's verbal descriptions did not undermine the learning or authority of Mattioli. For Donzellini, a picture of a plant that did not match nature did not constitute an argument against Mattioli's identification.[36] This was in stark contrast to the attitude of Gessner, who expected verbal descriptions and accompanying images to match, as evidenced from the markings in his books. In his copy of Mattioli's *Commentarii* (1558), for instance, Gessner pointed out that the picture of the *ligusticum* did not show that its leaves were more incised at the top of the stalk than the leaves of the *fertulae campanae*, as described in the text. In his copy of Dodoens's *Histoire des plantes* (History of plants, 1557), he noted next to the woodcut identifed as *Satyrium trifolium* (three-leaved *satyrium*) that the plant in the image was two-leaved.[37]

Gessner's disagreement with Mattioli shows the limitations of the authority of pictures in settling scholarly arguments or disputes. This is despite the fact that Mattioli regarded pictures as important, included many in his commentary, and even had them enlarged. That both Gessner and Mattioli used pictures in their study of medicinal plants did not guarantee that they would agree on the function or authority of images in scholarly knowledge of nature, let alone be able to use pictures to resolve their scholarly differences.

Gessner on Jamnitzer

The question remains, then, why Gessner felt he needed pictures for studying plants at all. Compared to Mattioli, Gessner was meticulous in his insistence that pictures should reflect an actual plant in nature, and that verbal and pictorial descriptions should match. His drawings, as we saw in the previous chapter, deployed clean and continuous outlines with vivid watercolors. This form of picturing reflects the way Gessner understood what an image *ad vivum* should entail, a point Gessner expressed in some detail when he received a gift around the time that he declared his ambition to compile a universal history of plants.

On 22 June 1554, Gessner wrote to his friend Georg Fabricius (1516–1571), the poet, historian, and rector of a school in Meissen who had helped mediate the dedication of the second volume of the *Historia animalium* to Valentin Gravius, "Decimarius and Senator" of Freiberg, a well-known mining town in Saxony.[38] Gessner reported that Gravius returned the favor of Gessner's dedication with the gift of a "mineral mound" (*montem metallicum*) in which minerals and "things dug up from earth" (*fossilia*)[39] were combined into a mound almost a foot high; another was a painted silver image of a grasshopper and spider among vegetation.[40] The first gift can be identified as a *Handstein* (literally, "hand stone"), also known as *lapis manualis* or *Bergwerk*, in which mineral ore, rocks, and crystals were combined together with figurines carved out or inserted among them (fig. 8.5).[41] The second gift was most probably a "nature cast" created by the Nuremberg goldsmith Wenzel Jamnitzer (1508–1585; fig. 8.6).[42]

Gravius's gifts to Gessner were objects of art crafted of minerals or metals, material that would have been valued by someone like Gravius, who lived in the booming mining town of Freiberg.[43] Jamnitzer is known to have produced *Handsteine*, and although there is no concrete evidence to link him to the *Handstein* given by Gravius to Gessner, it is worth noting that both the *Handstein* and the "nature cast" had Jamnitzer's hallmark of having been crafted out of nature while retaining some aspects of the original, natural material.[44] This type of object also appealed to princely collectors such as Archduke Ferdinand II (1529–1595) for their virtuoso blend of nature and art.[45]

Gessner's letter to Fabricius offers us an unusual insight into how Jamnitzer's craftsmanship was appreciated by a contemporary, and what was entailed in an *ad vivum* image for Gessner.[46] Gessner argued that the "nature cast" was *ad vivum* because it reproduced all the form and figure (*forma figuraque*) with every kind of line (e.g., straight, oblique, transverse, curved, curled, long, short) that shaped the natural object. For Gessner, *figura* was a shape that could be defined by lines on a plane or a surface, such as a triangle, quadrangle, or sphere. *Forma*, on the other hand, could be either external or internal. Internal and essential *forma* could be grasped by reason alone. External *forma* was the appearance of the whole thing, made up of many shapes (*figurae*), including the arrangements, placement, and proportion of individual parts, which in turn have their own shapes.[47]

Gessner wrote in his letter to Fabricius that the image (*icon*) of the "nature cast" represented not so much images (*imagines*) resembling other things as the "things themselves [*res ipsas*]," which Gessner described as "*auto to auto*"—so

Fig. 8.5 *Handstein* by Caspar Ulich, St. Joachimstahl (1556/62). Silver, gold-plated, argentite, 31.7 cm high. KK_Nr. 4148, Kunsthistorisches Museum, Vienna.

Fig. 8.6 Writing casket, Wenzel Jamnitzer, Nuremberg (1560/70). Silver, nature-cast, 6 × 10.2 × 22.7cm. KK_1155, Kunsthistorisches Museum, Vienna.

that except for the materials from which they were made, no difference could be discerned between them.[48] The Greek phrase "*auto to auto*" (literally "itself itself"—i.e., its very self) is from Plato's *Alcibiades Major* (129B and 130D).[49] As in the example of "humans themselves," which denotes the feature that is common to all humans and allows the identification of humans as opposed to the identification their various individual or accidental qualities, "itself itself" refers to "the common feature" of a thing.[50] We are more familiar with this "common feature" of Plato's under the name of "form." Though Gessner believed that the internal, essential form was graspable by reason alone, here in the letter he appears to have been willing to conflate the external form consisting of lines and shapes with the essential form (*auto to auto*) when he identified an image *ad vivum* with the thing itself in nature, despite the difference in the materials of which they were made (silver or natural). [51]

Gessner waxed lyrical about the "nature cast," claiming it as an art worthy of Parrhasius, the artist who excelled Zeuxis, whose picture of grapes birds had flocked to, by painting a picture of a curtain which Zeuxis mistook to be real (*Historia naturalis*, 35.36).[52] For Gessner, the new art of nature cast did not diverge from its original in any way except in the material used. Jamnitzer probably made his casts by taking the mold of insects or small animals, burning out their bodies, removing the ashes, and pouring hot metal into the cavities left behind.[53] Whether or not he knew precisely how the casts were made, Gessner likened this kind of image-making to "Medusan petrification" that retained all the external shape and form of the original object, but not the original material.[54] Gessner's idea of the nature cast as an *ad vivum* image here had in common with Girolamo Cardano's *ad vivum* nature print and the plaster cast of the face of Francis I that contact with the object was required, which in turn required the maker of the image to be present, observing the object being depicted. Yet, direct contact or observation was not the most interesting feature of an *ad vivum* image.

Gessner was essentially following the Plinian ideal that the best form of art was that which imitated nature as closely as possible.[55] Pliny related (*Historia naturalis* 35.36) how Apelles painted a picture of a horse for a competition, and then brought in live horses that neighed at the sight of his picture.[56] In this case, the touchstone of a painting imitating nature was nature itself, as an animal reacted to the painting as if it were another animal.[57] The point about the contest between Zeuxis and Parrhasius, in contrast, was to show that artistic mastery could cause a human to react to a painting as if it were the object itself. This is indeed the point Gessner developed in his letter to Fabricius. The difference between an art object and an object in nature was that the former lacked movement, but a superb image *ad vivum* would capture the eyes of the beholder so strongly as to trigger the same response in the viewer as would the actual living object itself—an experience Gessner also called *ad vivum*:

> . . . this is the highest degree to which the artist's talent [*ingenium*] can advance: to emulate nature in such a way that *things that do not exist appear to exist*. The spider is not harmful, yet is most like one that is threatening to be harmful; the grasshopper does not jump, but it appears to be on the point of jumping. The strawberry is not fragrant, the lily does not emit aroma, the rue does not exhale [an] unpleasant [odor], the daisy does not smell, [and] the milfoil is not pungent, if you consult the senses by which these things are determined. If the same [senses] are restrained and (as we are wont to), trust is placed in the eyes alone, all these promise smell and taste, [they] allure and attract.[58]

Locating the supreme talent of an artist in the ability to represent something that did not exist or was virtually impossible to depict (e.g., feelings, attitudes, or voice) was how Erasmus had praised Dürer as the "second Apelles."[59] In a similar vein, Gessner praised the artist who could evoke motion, taste, and smell. He promoted a very a strong sense of "seeing" in which sight substituted for the other senses: "seeing" alone became sufficient for the viewer to recognize the object and all its attendant qualities that were in fact nonexistent or invisible. It also presupposes that the beholder already knows what a strawberry tastes like or what a lily smells like.[60] This was the crux of what made an image *ad vivum* for Gessner: that it produced a reaction similar to that of seeing the object itself. It is the *effect* in the beholder that makes the image *ad vivum*, with some cooperation from the beholder's senses. An image becomes "the thing itself" simply by being seen.

This point about the effect of an image *ad vivum* is also pertinent to understanding other contemporary claims of *ad vivum* images of persons from the Old Testament or Roman history that obviously could not have been taken directly "from the life," or similar claims about pictures of contemporary events or figures that were copied from other sources.[61] This may well have to do with a peculiarly malleable sense of substitution in this period, as Christopher Wood has recently suggested, but for my purposes it is sufficient to emphasize the fact that more often than not, the phrase *ad vivum* in this period pertained to the desired result or effect in the viewer, rather than to whether the image maker had actually seen the object represented.[62]

The elements of Gessner's images *ad vivum* were the many lines that made up the shape of an object and its colors. Jamnitzer's craft retained the lines and shapes, changed the underlying material, and added color. Gessner drew pictures of plants on paper using clear outlines and adding transparent watercolor, as seen in the previous chapter. His obsession with lines and colors continued to the end of his life with fossil objects, which he classified according to their shape (e.g., simple linear shapes, simple bodies, composite bodies) and expected to be colored in *De rerum fossilium . . . similitudinis*.[63] In the preface to this book, Gessner wrote:

> Picturing certainly is an art that is proper for man, and noble; for the most part it affects those beholding it with astonishment and with delight at the same time. Indeed the images [*imagines*] and shapes [*figurae*] engraved upon things by nature—in truth like some hieroglyphic characters, even truer than those celebrated in the sacrifices of the Egyptians—reveal something of their grandeur. Especially those that have not come about fortuitously, but are distinctly natural and (if I may say so) specific, and appear always to be cleaving to some genus as if particular to it, such as to the genus of plants or fossils.[64]

Hieroglyphics, understood as pictograms that expressed the essence of things themselves and as a language engraved on pillars of ancient temples and known only to Egyptian priests, had fascinated many a learned scholar in Gessner's time.[65] They were studied with especial enthusiasm in the belief that the ancients had possessed a form of Christianity (*prisca theologia*) before the birth of Christ, and Horapollo's *Hieroglyphica*, which claimed to decode these pictograms, was also studied avidly. Gessner himself had read Valeriano Bolzoni's 1556 edition of *Hieroglyphica*.[66] Gessner's point in the quotation above was that nature's hieroglyphics were "truer" than the pictograms wrought by human hand.[67] They revealed more than just objects in nature—they revealed the grandeur, surely, of the Creator.[68] The images and shapes in nature were God's hieroglyphics; they were "specific" to each group of plant or fossil, and hence by implication they expressed the essence of those species. Gessner had earlier equated the study of nature with praising God: in his *Historia animalum* he called the description (*historia*) story of each animal a hymn to divine wisdom and goodness.[69] Tracing and studying the shapes and forms of nature's hieroglyphics thus acquired a religious significance for Gessner, and in this respect it is appropriate that Karl Schmid described Gessner's picture of a plant as "a devotional image of research [*Andachtsbild der Forschung*]."[70] Gessner believed that pictures were the best way to study nature, because God had impressed nature with lines, shapes, and colors. Gessner studied nature, this book of God's, through books and the erudition of others; he envisaged his pictures as a basis for writing the definitive, scholarly book about medicinal plants. Gessner's pictures of plants, then, may justifiably be called pages from the book of nature. This is why pictures had such authority in knowledge-making for Gessner.

In this part, I have focused on the works on medicinal plants by Fuchs and Gessner. They typify the period in the development of natural history that Ogilvie has called the age of the "phytographers," who were concerned with the morphological description of classical plants and their identification through such description.[71] The pictorial descriptions Fuchs and Gessner sought were not "counterfeits," but something more general and complete, characterized best by the adjective "absolute." With the help of correspondents, gardens, and a herbarium, Gessner gradually formed a picture of a general and complete object of study to be used as a commonplace. Fuchs published his pictures which embodied a general object of study, and this enabled him to justify his interpretation of the efficacy of ancient plants. For both Gessner and Fuchs, pictures were an integral part of their scholarly argument. Their use of images was based on an epistemology that saw external features (i.e., accidents or forms) of plants as the key to establishing their medicinal essences. Such an epistemology, in turn, was underpinned by an ontology—in Fuchs's case, of medicinal substances that could not be understood unmediated by fallen man; in Gessner's case, of God's hieroglyphics imprinted on creation.

Equally strong was the conviction of Cornarius that recovery of ancient knowledge should be textual, not pictorial. Mattioli, who happily included pictures in his commentaries on Dioscorides, did not agree with Fuchs, Cornarius, or Gessner regarding the uses or uselessness of pictures; rather, he sought to underscore his own authority at every turn, irrespective of pictures. Fuchs, Cornarius, and Mattioli were successful in having their books published; Gessner did not live long enough to see his book through publication. There were strong epistemological or intellectual reasons for these university-educated physicians to believe that images could or could not contribute to knowledge about the natural world, whether or not they had the financial means to render pictures into printed form.

These humanist physicians saw the printed book as the principal means of presenting what they regarded as proper knowledge and understanding of the ancients, even though the printed product by no means fixed the state of knowledge. Fuchs used different languages and formats to translate and localize his universal knowledge. Mattioli's many editions flooded the market and rendered his work commonly available. Gessner used at least two different editions of Mattioli's commentary, different versions of Dodoens's herbal, and Fuchs's book as he continually studied plants through his own drawings, which in turn were to be the basis of his own book. Nature was to be understood through books, and it was something to write a book about.

PICTURING HUMAN ANATOMY

PART III

For both Leonhart Fuchs and Conrad Gessner, one of the important reasons for using pictures to study plants was that pictures enabled them to visualize objects in some generality. Despite their naturalistic representation, the pictures were of objects that were as "complete" as possible. A similar tendency can be found in the pictures in Andreas Vesalius's book *De fabrica humani corporis*. Like Fuchs and Gessner, Vesalius was a physician with humanist leanings who saw pictures as an integral part of his own project of reviving ancient anatomy. Vesalius, of course, was not the first to include pictures of human anatomy in a book; medieval surgical tracts often included anatomical figures.[1] What needs to be appreciated, however, are the many different and indeed ingenious ways in which Vesalius used pictures in the age of the printed book. Much of my account in this part is devoted to his use of pictures. Chapter 9 looks at how Vesalius used pictures in the bloodletting controversy and in the dissection hall, before the publication of *De fabrica*. In chapter 10, I examine the many different ways in which pictures helped Vesalius develop the view of a canonical body and establish his own revival of ancient anatomy. I focus in chapter 11 on the relationship between text, image, and body within the printed book, and contrast Vesalius's position with the works of such contemporaries as Dubois, Eustachi, and Platter, whose views of him ranged from hostile to favorable.

CHAPTER 9

Vesalius and the Bloodletting Controversy

"Pains in the Side"

Bloodletting was the commonest form of medical prophylactic and treatment in premodern Europe. It was believed that it cured pains, fevers, and pestilential disease; clarified urine; cleansed the stomach; strengthened memory; sharpened the hearing; stopped tears; promoted digestion; and drove away anxiety.[2] Although the actual bloodletting was normally administered by barbers, surgeons, or the *fleubotomarius* using lancets, cupping-glasses, or leeches, the complex rules that governed the timing, site, and manner of bloodletting caused learned physicians increasingly to seek to control and supervise it—a move naturally resented by the other practitioners.[3]

In the sixteenth century a controversy over bloodletting was sparked by a humanist physician and admirer of Erasmus, Pierre Brissot. Brissot had obtained his doctorate in medicine in 1514 at Paris, where he taught Aristotelian philosophy for ten years and Galenic medicine for four.[4] He claimed to have achieved spectacular success with a new method of bloodletting when Paris was hit in 1514 by a wave of "pain in the side" (*dolor lateralis* or *pleuritis* in Latin, then meaning a general "pain in the side" rather than a specific inflammation of the pleura, as in the modern meaning of the term). In 1518 Brissot planned to visit the New World to find new medicinal plants, but he was delayed in Evora, Portugal, and stayed there to practice for a few years. There, too, he encountered an outbreak of "pain in the side," and once again he was successful in treating the patients with what he claimed to be the "truly" Galenic and Hippocratic method.[5] Brissot's claims were printed posthumously in 1525 as *Apologetica disceptatio, qua docetur per quae loca sanguis mitti debeat in viscerum inflammationibus praesertim in pleuritide* (An apologetic debate, in which it is taught from which places blood should be let in visceral inflammations, especially for pain in the side), edited by his pupil Antonio Lúcio of Evora and dedicated to Prince Alfonso, cardinal and brother of King John of Portugal.[6] Brissot's arguments display a typical humanist disdain for Arabic commentators and enthusiasm for Greek authorities. The ancients had distinguished two types of bloodletting: revulsion and derivation.[7] Revulsion meant drawing noxious humors away from the affected side; derivation drew out the localized noxious humors from a point much closer to the affected part. Brissot condemned the traditional, and what he considered to be spurious, method advocated by the Arabic commentators of treating revulsion as bleeding from the site opposite and most distant from the affected part. Brissot argued against a position maintained by "a royal physician" by showing that the latter's grasp of Galenic and Hippocratic texts was limited, that he had used a faulty text of Galen, and that the Arabic commentators had misinterpreted Galen.[8] In turn, Brissot quoted extensively from Galen, sometimes in the Greek but also from the new Latin translations such as *Methodus medendi* by Thomas Linacre and *De arte curativa ad Glauconem* (To Glaucon on the method of healing) by Niccolo Leoniceno.[9] From these quotations, Brissot argued that revulsion need not be carried out from the most distant or opposite side, but should instead follow the principle of "being in line with" (*e directo*) the site of the

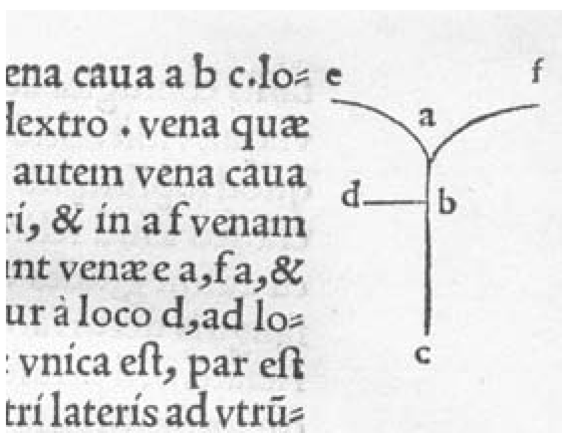


Fig. 9.1 Argument by distance. In this "diagram" (*diagrammate*), Brissot explained that *abc* denoted the vena cava, *d* the site of "pain in the side," and *e* and *f* the veins in the right and left arms; and that the distances between *d* and *e* and between *d* to *f* were thus equal. Therefore there was no difference between selecting the right or left elbow for bloodletting in cases of "pain the side." This diagram was based on the assumption that the vena cava was the main vessel serving the thoracic region and that it branched out symmetrically to the veins of the arms. From Pierre Brissot, *Apologetica disceptatio* (1525), bjr. Bayersiche Staatsbibliothek, München, 4 Path.53 m.

phlegmon—which he took to mean the *same* side as the pain.[10] His disdain for Arabic commentators, his penchant for Greek or Greek-based translations, and his posthumous gift to the University of Paris of a Greek dictionary mark Brissot as a physician with classical leanings.[11] What is a little unusual is that he also added a line diagram to make the point that because "pain in the side" existed in the thoracic region, there was no difference in distance between selecting the right or the left elbow (fig. 9.1).

Brissot's *Apologetica*, published first in Paris in 1525, appears to have caught the attention of several other university-educated physicians. He was supported in his position by Giovanni Manardi, one of Leoniceno's students; Matteo Corti (1475–1542), professor at Padua and Bologna; and Leonhart Fuchs.[12] Julius Caesar Scaliger (1484–1558) also attacked the Arabic commentators by way of a geometric figure (fig. 9.2). Instead of distance, his argument was about the volume of blood: Scaliger argued that there was less humor between the site of the "pain in the side" and the vein of the same side (recommended, as Scaliger saw it, by Galen) than between the affected site and the vein of the opposite side, and that blood should be let from the arm on the *same* side, since more of the noxious blood could be drawn with less total blood being let.[13] Scaliger also confirmed from experience that incising the vein on the same side as the affected site was better than doing so from the opposite side.[14]

Meanwhile, Jérémie de Dryvere (1504–1554) at Louvain, Andrea Thurini (1473?–1543), physician to the king of France and to Pope Clement VII, and Benedetto Vettori (1481–1561), professor of theoretical medicine at Padua, all opposed Brissot's position and wrote against bloodletting from the same side in cases of "pain in the side."[15] The escalating heat of the controversy can be gauged from the accusation, hurled at the supporters of Brissot, of being "Lu-

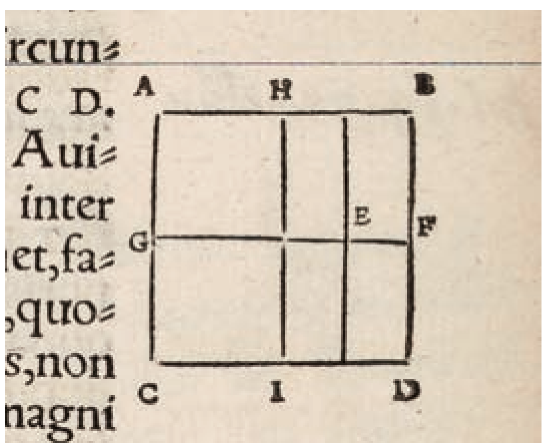


Fig. 9.2 Argument by volume. Scaliger explained that *ABCD* referred to the human chest, *HI* the middle of the chest, *E* the site of pain, *F* the "Galenic vein," and *G* "Avicenna's vein." He arged that there was more humor between *G* and *E* than between *E* and *F*, and that *F* should therefore be incised. From Hippocrates, *Liber de somniis*, edited by J. C. Scaliger (1539), 39, detail. Size of the square, 2.2 × 2.2 cm. Cambridge University Library, Adv.c.13.1.

therans."[16] Bloodletting, like the French Disease of the late fifteenth century, quickly became the most hotly debated topic among learned physicians in the 1530s: every physician in Europe seems to have written about it.[17]

Vesalius and Bloodletting

It was against this background of a raging controversy over bloodletting that the young Andreas Vesalius arrived to study medicine in Paris in 1533. He had arrived from the Collegium Trilingue in Louvain, a college set up by Jerome de Busleiden, who had been inspired by Erasmus's call for an education based on the three classical languages of Hebrew, Greek, and Latin.[18]

At Paris, meanwhile, Jacques Dubois and Johannes Guinther von Andernach (c.1505–1574) were enthusiastically reviving and establishing Galenic medicine, especially anatomy, in print and in person.[19] Guinther had already begun his translation work, which in his lifetime would amount to more than forty tracts of Galen.[20] Among them were translations of newly recovered works such as Galen's *De anatomicis adminstrationibus* (1531) and *De placitis Hippocratis et Platonis* (On the opinions of Hippocrates and Plato, 1534), as well as his tracts on bloodletting such as *De curandi ratione per venae sectionem* (*On Treatment by Venesection*, 1536) and *De venae sectione adversus Erasistratum* (*On Venesection against Erasistratus*, 1536).[21]

To help students wade through the large number of ancient works now recovered, Dubois compiled *Ordo et ordinis ratio in legendis Hippocratis et Galeni libris* (The order and the rationale of the order in reading the books of Hippocrates and Galen, 1539) in which he listed more than thirty ancient anatomical works, including *De usu partium* (*On the Usefulness of the Parts of the Body*), which he described as "the most beautiful, the most learned, and manifestly divine" of all anatomical works.[22] In Dubois's view, very little could be learned or gained from other books, such as the works of Guy de Chauliac, Mondino de' Liuzzi, or Alessandro Benedetti, which were "full of barbarity and grossest ignorance."[23] Dubois lambasted the pictures by Berengario da Carpi in particular as a "hodgepodge," "sumptuous but useless," and "shadows." For Dubois, a medical student needed to reach down into the human body and handle its parts, not just stop at the surface displayed in a picture. He asked, rhetorically: If Galen said that plants did not need to be displayed but should be taught and learned with one's hands, surely he would not have tolerated futile and inane pictures of the human body. Would he have accepted a physician trained by pictures, unless he intended to cure picture-people (*pictos homines*)?[24] Dubois published further works to help students study particular topics that were scattered through a large number of ancient books—for example, on the causes and symptoms of disease (*Methodus sex librorum Galeni in differentiis et cau-*

sis morborum et symptomatum, 1539) or on how to make medicines (*Methodus medicamenta componendi*, 1541). These textbooks shared the title of *methodus*, by which Dubois meant synoptic tables (fig. 9.3) aimed to help those who were "moderately learned," namely students.[25] Guinther also compiled an introductory guide to the newly available *De anatomicis administrationibus*, entitled *Anatomicarum institutionum ex Galeni sententia libri IIII* (Four books of anatomical instruction, according to the opinions of Galen, 1536). Paris thus was the center where Galen's anatomical knowledge, including that of the veins and arteries, was being revived and taught. Vesalius appears to have quickly developed an aptitude in dissection, as Guinther praised him in 1536 for discovering seminal vessels that were very difficult to detect.[26]

In 1538, Vesalius moved to Padua as a demonstrator (*ostensor*) and lecturer in surgery at the university. There he published a series of six anatomical figures, now commonly known as *Tabulae sex* (Six tables).[27] An inscription on the last figure indicates that they were printed by the Venetian printer Bernardino dei Vitali at the expense of Jan Stephan Calcar (c. 1499–c. 1546), a painter.[28] Between 1494 and 1539, Vitali's publications included scholarly, classical, and humanist materials. For medical topics his printing was restricted to teaching materials, such as Berengario da Carpi's *Isagoge breves* (*Short Introduction to Anatomy*, 1535), which included figures copied from an earlier edition. In 1538, the year Vitali printed Vesalius's anatomical tables, he also printed Guinther's *Institutiones*.[29]

Calcar, who may have been a student of Titian or a member of his circle, appears to have been in Venice from around 1532.[30] Three figures of the veins and arteries were drawn by Vesalius, and Calcar drew the three figures of the skeleton (fig. 9.4) that Vesalius had articulated.[31] It is not explicitly stated that Calcar cut all six of the woodcuts, but since Calcar is recorded as having paid for the printing, the woodblocks are likely to have belonged to him. As Vesalius explained, these figures arose out of a teaching context:

> Not long ago . . . upon being chosen lecturer in surgical medicine at Padua, I was dealing with the treatment of inflammation. In the course of explaining the opinion of the divine Hippocrates and of Galen on revulsion and derivation, I happened to draw [*delineavi*] the veins on paper, thinking that what Hippocrates understood by the expression *kat' ixin* can thus be pointed out [*demonstrari*] more readily. For you know how much verbiage of disagreements and quarrels has arisen in this tempestuous time, while some affirm that Hippocrates had indicated the agreement and straightness of the fibres; others I know not what else. My sketch [*delineatio*] of the veins pleased the professors of medicine and all the students so much that they earnestly sought from me a picture [*descriptionem*] of the arteries as well as of the nerves. Because

QVINTA. 17

Prauas qualitates cibi & potus appetentis, vt acida, acerba, acria, cimoliam terram, testas, carbones extinctos, & alia absurda pro vitiosi humoris in ipsis vincentis ratione.

Prauum aliquod excrementũ & vitiosi humores ventriculi tunicas imbuentes, vt in citta, id est, pica seu malacia viris interdum accidente affectu, sed mulieribus vtero gerentibus frequẽtissimè ad secundum, aut tertium vsque mensem. Nam mense quarto humores ij vincuntur, coquuntur, à fœtu iam grandi absumuntur, à quibus ferè fit cacochymus & intemperatus.

Causæ symptomatum Primi & cõmunis sensus, scilicet, Vigiliæ: Siccitas & calor immodicus. Mœror, solicitudo, dolor.
Veterni, frigida omnia magis q̃ humida.

TABVLA QVINTA DE CAVSIS SYMPTOMATVM FACVLTATIS ACTIonis animalis motricis & principis.

Causæ symptomatũ facultatis, vel actionis animalis motricis Motus voluntarij

Aboliti, id est, Paralyseos, dictæ prius in stupore tactus, sed vehementiores aut plures, aut in corpore ad patiendum promptiori.
Apoplexiæ, copia pituitæ in ventriculis cerebri.

Debilis, id est, Stuporis, eædem quæ in stupore tactus.
Dyspnœæ, in libris de dyspnœa.

Depravati

Conuulsionis: Inanitio seu siccitas immodica, vt in ardentissimis febribus & fidibus musicis aëre sicciori.
Repletio seu humor immodicus neruosa corpora nimis extendens, vt in phlegmone & fidibus musicis, aëre pluuio.

Tremoris: Facultatis motricis imbecillitas ex intemperie frigida: Corporis vniuersi à, Originis neruorũ à, Aliarum partiũ natura imbecilliorum & noxæ opportuniorum à: Senectute frigida, sicca, venere (Immodica, Intẽpestiua), Timore, dolore magno, Frigido aëre, balneo (lõgo), Potu largiore vini etiã meraci. Potu intempestiuo & immodico frigidæ aquæ. Ignauia & diu omissa exercitatione post multos cibos.
Obstructio neruorum à succis multis, crassis, lentis, ita vt exigua facultas motrix in partem affluat, nisi dum confertim irruens, illos excusserit.

Rigoris:
Cum febre: Calidæ & rodentes: Aëreæ, refrigeratione sola hic rigor curatur, non sudore, vomitu, deiectione.
Humidæ aspectu, vt bilis flauæ in tertiana exquisita & ardẽte febre, vacuatiõe curatur.
Frigidæ: Aëreæ, calfactione sola curatur.
Humidæ, vt atra bilis natura frigida putredine calfacta, rigorem quartanæ gignit. Hic coctione, vel vacuatiõe, vel ambabus curatur. Humor verò & spiritus sine humore calidissimus aut frigidissimus per corpus transiens, horrorem, nonnũquam rigorem excitat.
Sine febre: Aëris frigidi vel aquæ frigidæ repentinus vel diuturnus occursus. Hunc sanat calfactio.
Aquæ feruentis balneum corpori non præcalfacto repẽte & confertim occurrens.
Aquæ dulcis & tẽperatæ balneũ frequens post cibum.
Ignauia & otium.
Repletio frequẽs cibi & potus præsertim frigidi tẽpratura & suapte natura pituitam gignentis. Hic multo calore vix vincitur.
Timor & dolor, interdum & medicamentum mordax vlceri impositum.

B iij Sed hic ri

Fig. 9.3 A "method" for students. Jacques Dubois tabulated symptoms of malfunctions of the voluntary motor ability into three types: lack of ability (*abolitus*), indicated by paralysis or apoplexy; weakness (*debilis*), suggested by insensitivity and difficulty in breathing; and distorted function (*depravatus*), indicated by convulsion, shaking, and rigidity. From Jacques Dubois, *Methodus sex* (1539), 17, page 28.5 × 19 cm. Cambridge University Library, K.3.35.

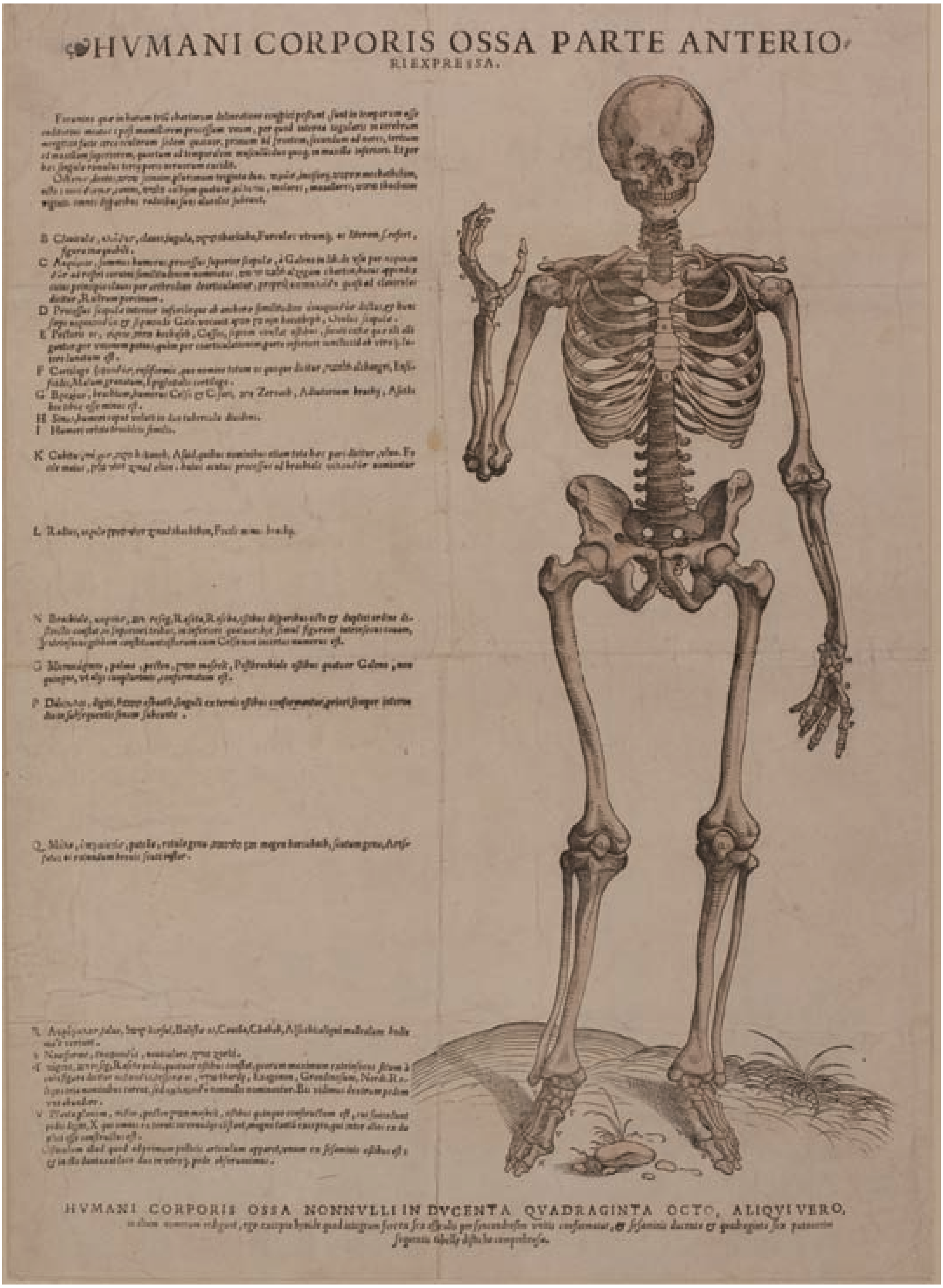


Fig. 9.4 Andreas Vesalius, *Tabulae* (1538), fourth figure. At *K*, Vesalius gave the name *ulna* as well as the more medieval *focile maius*, and at *N* he identified the *karpos* with the *raseta* (compare fig. 0.4). This helped the user make the transition from traditional names of body parts to Hellenized ones. University of Glasgow Library, Department of Special Collections, Hunterian Az.1.10.

> the administration of anatomy is part of my professional duties, I could not disappoint them, especially since I knew that delineations [*lineamenta*] of this kind would bring no mean help to those who attended my dissections. I believe that it is not only difficult, but also entirely futile and impossible, had I wished to obtain knowledge of the parts of the body or of the use of simples from pictures or formulas alone; but no one will deny that they assist greatly in confirming memory in such matters.[32]

The words used here, such as "inflammation" and "revulsion" signal that Vesalius was engaging with the most topical debate of the time. He also explained that it was his drawing that helped his audience understand a point about another key phrase of the debate, *kat' ixin*—the Greek for *e directo*, or "in line with".[33] He swiftly limits, however, what he claims for pictures: they cannot be the sole means by which knowledge of anatomy or medicinal plants is obtained, though they can be helpful for memory—for confirming what has already been learned. This qualification of the use of pictures may well be an oblique reference to the passage in Galen's *De simplicium medicamentorum facultatibus* (6.1). The utility of pictures for strengthening memory was of course a well-worn topos by this time.[34]

In the anatomical tables the veins, arteries, and bones are keyed with letters, and in the margins Vesalius lists for each letter the name of a part of the body in Latin and Greek, often with additional names in Hebrew and Arabic. Many of the terms had recently been established by his teachers, Guinther and Dubois (e.g., coronary, interseptum, pinnula, azygos, intercostal and mammary veins, iliac and mesenteric arteries), while the Hebrew reflected the medical terms current among Italian Jewish doctors, one of whom (probably Lazarus de Frigeis) Vesalius must have consulted.[35] These anatomical figures reflect a humanist attempt to help the transition from Arabic-based names to Hellenized forms (fig. 9.4). The figures were a pictorial concordance to pristine anatomical terms.[36]

In the second figure, depicted at B (fig. 9.5), was the "azygos" vein, coined by Guinther—literally a vein "without a mate."[37] Through this picture Vesalius entered the bloodletting controversy:

> This unpaired vein [the azygos], which is described as nourishing eight lower ribs, we have never seen arise from below the right auricle of the heart [in man], though in dogs and monkeys [it arises] a little above it. Wherefore it is better for pain in the side tending downward to employ venesection rather than purgative medicines. And as for the view of Hippocrates, I hold Galen to have spoken unclearly about this vein in the second book of the *De victus ratione in morbis acutis*. Moreover, from the place of origin of that vein and because of the agreement and direction of its fibres or texture, it seems not

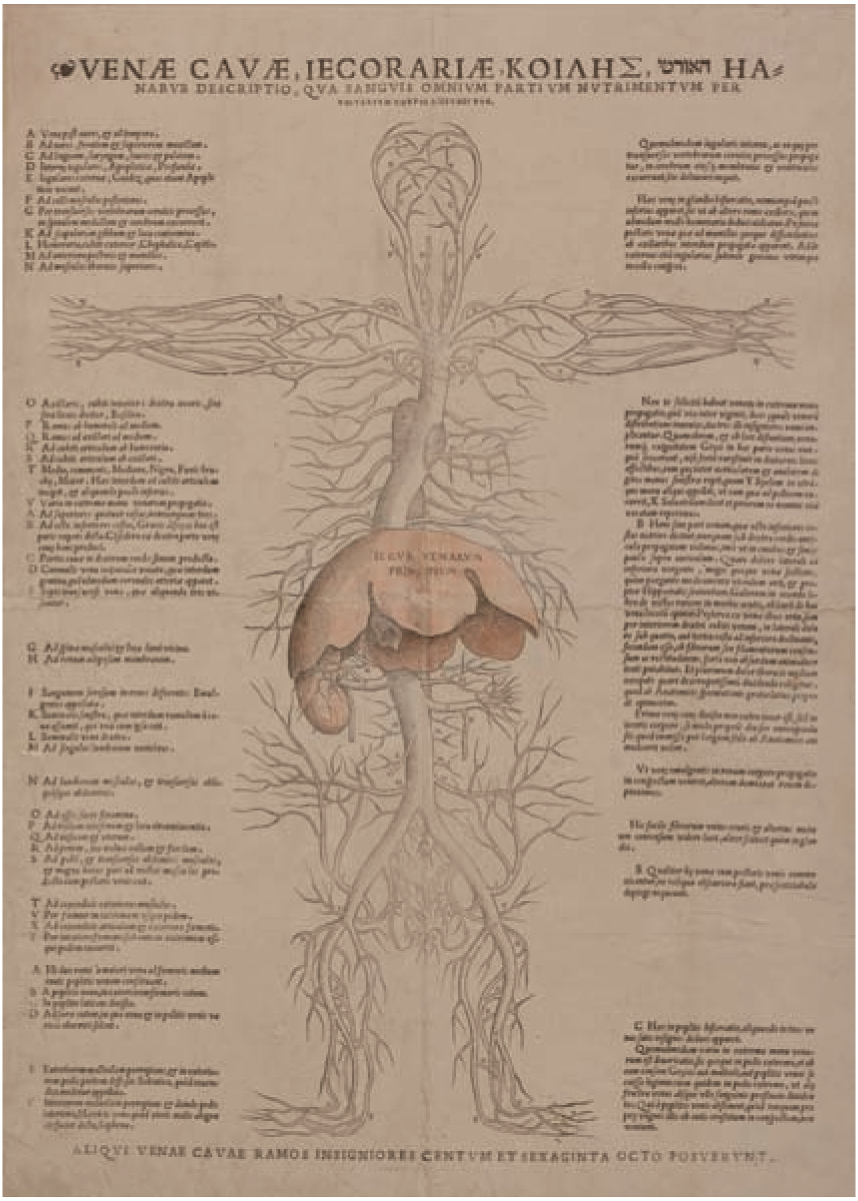
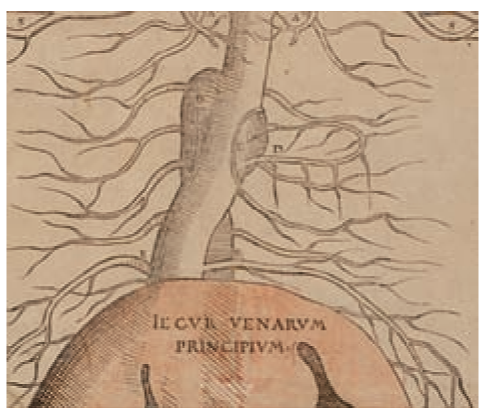


Fig. 9.5 Andreas Vesalius, *Tabulae* (1538), second figure. This illustration depicts the vena cava as well as the liver, "the source of all veins." In the detail, *B* (almost illegible in the shading behind the vena cava) is designated as the azygos vein. University of Glasgow Library, Department of Special Collections, Hunterian Az.1.10.



> completely unreasonable to open the inner vein of the right elbow always for pain in the side at the level of the third or fourth rib or lower. Now thoracic pain usually affects the middle region, therefore, venesection should be considered rather for the right [than the left] side; a point which I wish would be deemed more worthy of deliberation by anatomists [*anatomicis*].[38]

The depicted features of the azygos vein agree with Vesalius's description in that the vein issues from the vena cava *above* the heart. The point was that since noxious blood must not be drawn through a vital organ like the heart, drawing the humors out of the veins of the arms thus becomes preferable to evacuation through the stomach; furthermore, the azygos vein issues from the right of the vena cava, which means that the veins in the right arm are "in line with" the azygos vein. The position of the azygos vein and its implication for treating thoracic inflammation were, Vesalius hinted, at variance with Galen's description of the vein in his commentary on the tenth aphorism of the second book of Hippocrates' *De victus ratione in morbis acutis* (On diet in acute diseases). The tenth aphorism suggested that pains in the chest above the diaphragm should be treated with bloodletting. Galen's commentary on this—taking into account the next, related aphorism (aphorism 11) which stated that for pains under the diaphragm, purgatives should be used—offered an anatomical explanation of why there should be a distinction between upper and lower pains in the chest: namely that in humans, the azygos vein issued from that part where the vena cava "touched" the right auricle of the heart.[39] Vesalius pointed out that Galen's description here was unclear.[40] Instead, his description of the azygos vein, as presented in the picture, supported the conclusion that for thoracic inflammation generally (without distinguishing upper or lower pains), blood should be let from the right elbow.

Ocular Belief

Vesalius made a stronger case in the following year, 1539, in *Epistola, docens venam axillarem dextri cubiti in dolore laterali secandam melancholicum succum ex venae portae ramis ad sedem pertinentibus, purgari* (A letter, teaching that in cases of pain in the side, the axillary vein of the right elbow be cut, and that the melancholic juice is purged from the branches of the portal vein extending to the fundament).[41] This problem of bloodletting in the case of "pains in the side" was now presented as being of utmost significance since the emperor himself had expressed serious interest in it.[42]

Vesalius set himself up against two opposing camps in the controversy over which vein to cut in cases of "pain in the side." The first camp stated that the vein of the inner elbow in line with the affected side sufficed for revulsion or derivation; the second camp argued for cutting the cubital vein (i.e., vein of the forearm) in line with the affected side for derivation, and veins much further away for revulsion—that is, the popliteal vein at the back of the knee, or the venule running between the little and the ring fingers. Vesalius then listed the classical texts on which these positions were based. Both camps agreed with Galen's classification of bloodletting in *De curandi ratione per venae sectionem*. Aversion, bloodletting against the flow of the blood, was divided further into two: revulsion at a distance and on the opposite side, and derivation at the nearest and healthiest site. Venesection, which was not contrary to the flow of blood, used means such as scarification, leeches, or rubbing.[43] Revulsion "at a distance," the second camp argued, meant the "greatest distance," on the basis of passages from the *Methodus medendi*, from *De natura hominis* (On the nature of man), and from *De constitutione artis medicinalis* (On the composition of the art of medicine). However, Vesalius pointed out, this second camp ignored further statements by Galen to the effect that for revulsion, contrariness could suffice. This implied distance was not the defining feature of revulsion.[44] The first camp said, using *De arte curativa ad Glauconem* (2.17), that the distinction between derivation and revulsion was about whether humors had accumulated or were still flowing, and that both should be performed as close as possible to the affected side. Vesalius criticized this first group for not showing how the inner vein of the elbow was the nearest for "pains in the side."[45] He argued instead that what determined the site of bloodletting was whether a vein was "in line with" the affected side, meaning "according to the straightness and direction of fibers."[46]

Vesalius concluded as the title of his letter indicated: in cases of pain in the side, the axillary vein of the right elbow should be cut. There were, however, two passages from Galen and Hippocrates that appeared to contradict the basis of Vesalius's position. These were, as Vesalius had already noted in the *Tabulae*, Galen's description of the azygos vein and the Hippocratic aphorism that purgatives rather than venesection should be used for treating the inflammation of the lower thorax (*De victus ratione in morbis acutis*, 2). Vesalius first pointed out that Hippocrates was not really talking about "pain in the side," as the pain referred to in the text was specified as occurring under the diaphragm, and there were no ribs under the diaphragm. Instead, this passage, Vesalius argued, meant that for inflammations of sites under the diaphragm (such as the loin), which were separated from the veins of the elbows and were closer to the stomach and intestines, purgative drugs were more effective.

This was a classic humanist move of clarifying the sense of an ancient author when texts appeared contradictory. Believing that Hippocrates was talking about thoracic inflammation, Galen had made the comment that the azygos vein issued from the region of the auricle of the heart, which Vesalius interpreted to mean from "under the heart."[47] This would suggest that the azygos vein was too far away from the veins of the arms, and that venesection from those veins would make noxious blood go through the heart. Vesalius's description was now in direct contradiction with Galen's text. He justified his own description thus:

> To this question of the origin of the vein I can add no other testimony except ocular belief [*fidem oculatam*]. 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 natural 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 that of all who at Paris, at Padua, and at Louvain and elsewhere were present many times at my public demonstration 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, when the duty of publicly demonstrating and dissecting had been recently asked of me.[48]

The phrase *fides oculata*—literally, "eyed faith"—connotes belief or conviction acquired through the eyes, and was a phrase well known in the context of testimony—for example, in Justinian's *Institutes*, which stated that "the truth imprints itself more on the minds of men when it is witnessed by the eye than through the ears."[49] Vesalius claimed credibility for his own description of the azygos vein by invoking the belief of the eyewitnesses who attended his dissections and the authority of "the most learned spectators" at Padua.

Vesalius then introduced a picture (fig. 9.6), "so 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 tackle the matter in the manner of the mathematicians [*more mathematicorum*]."[50] "In the manner of the mathematicians" is a notable phrase in a tract on anatomy. Perhaps Vesalius had earlier figures by Brissot or Scaliger in mind. The woodcut here is certainly not a naturalistic "counterfeit" of a dissected body; instead, it is a schematic figure that picks out just the veins feeding the thorax and those veins connected to the arms. Using this figure, Vesalius made a general case by discussing all possible sites of inflammation for "pain in the side": If F is the location of the inflammation, then A is cut; if G is the location, then B is cut; if D is affected, A is opened; and if E is affected, then B is cut; if I and K are the locations of pain, then A is cut; and if L is the location, then A is still opened because blood affected at L can lead nowhere except to I, with which all the fibers of L are in continuity and to which they lie closest.

Given that the pains of the left three upper ribs (cases G and E) were very rare, Vesalius's point that the axillary vein of the right elbow be cut was applicable to *dolor lateralis* most of the time, as declared in the title of his booklet.[51]

In Euclidean geometry the diagram, say, of an equilateral triangle is an object abstracted from physical properties, and is universal in the sense that it stands for all cases of equilateral triangles. Properties deduced via the figure would thus be applicable to all equilateral triangles.[52] Vesalius's figure of the azygos vein is used similarly, in that it is taken to be universal because all possible cases in which an inflammation can occur in the thorax can be considered with this one figure. Yet Vesalius's figure must also retain a relationship with the physical world because it represents a bodily object: its precise physical configuration—such as right and left of the vena cava, below or above the auricle—mattered.[53] Thus, despite possessing universality "in the manner of the mathematicians," Vesalius's figure differs from a purely geometric figure that deals with objects which are abstracted from physical matter (and which thus

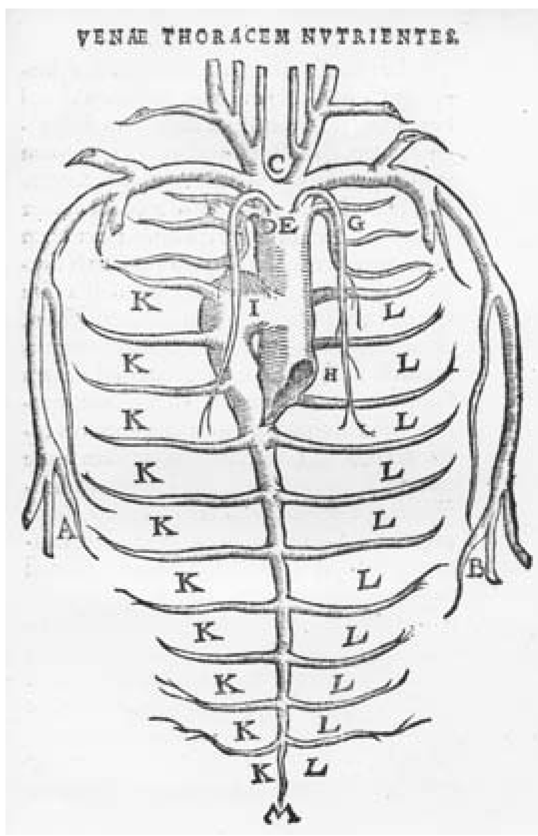


Fig. 9.6 Woodcut of the azygos vein, rendered "in the manner of the mathematicians." From Andreas Vesalius, *Epistola* (1539), 41. © The British Library Board, 783.g.1.

make no claims about the physical world), and is perhaps more analogous to the figures used in engineering or perspective in the period.[54] The thrust of Vesalius's argument using the figure of the thoracic veins was that given the anatomical configuration and position of the azygos vein, his rule for opening up the vein of the right arm was valid most of the time. What Vesalius did not show, however, was the validity of the depicted shape and position of the azygos vein itself, which was different from what Galen had described. So how did Vesalius argue that his description was true to the object and Galen's not? The short answer is that he did not. Vesalius introduced the picture, saying "in this *true*, but somewhat crude figure [*in hac vera, quamvis rudiori figura*] . . . ." The truth of the figure was simply asserted.[55]

To be fair, Vesalius was not the only person who failed to explain how figures of veins could be "true" to the objects they claimed to represent. Neither did Brissot or Scaliger (both of whom used line figures to make physical points about the veins) provide such an explanation; nor did contemporary authors of mixed mathematics discuss how there could be a reliable match between abstract geometrical figures and the physical things they represented.[56] Reliability in representation was not a widely discussed issue, though it is worth noting that Pierre Belon (1517?–1564) introduced the idea of *ratio geometrica* as a way to determine the true shape of the dolphin. Belon argued that although dolphins were depicted in ancient coins and statues with their backs bent, this did not mean that their backs were fixed permanently in that shape—such a depiction was in fact a result of the liberty (*libido*) taken by painters and sculptors, just as it pleased them to fashion the fleur-de-lis in a way far removed from its own nature—but using *ratio geometrica*, the natural shape of the dolphin's body could be determined without one being deceived by the speed with which the dolphin moved.[57]

What is noteworthy about the physicians who wrote on bloodletting was that they deployed geometrical figures to generate universal arguments about the physical body. The appeal of "the manner of the mathematicians," it should be noted, was not of quantification, but of the universality of argument it could bring to bear on discussions of the physical world. It was this kind of universality that continued to be an important consideration for Vesalius, as will be discussed further in chapter 10.

In the Dissection Hall

In his writings, Vesalius had invoked the testimony of his eyewitnesses in the dissection hall. In his time, the dissection hall was a temporary structure, containing, for example, a table and four steps of benches in a circle that seated almost two hundred persons.[58] The audience included surgeons, students, doctors, professors, and some paying spectators.[59] Unlike at Montpellier, it appears that there were no young girls in the audience, or children who acted as fetchers or cleaners.[60] In 1540 Vesalius was invited by the students of Bologna to conduct public dissections.[61] They took place in the church of San Francesco, and ran parallel with the lectures by Matteo Corti at the church of San Salvatore.[62] A German student named Baldasar Heseler attended these dissections and took copious notes. Of the eighteenth session, he recorded thus:

> First of all, [Vesalius] said, I shall show you today how true my view [*opinio*] about the venesection in [the case of] pain in the side is, about which there is today among us great controversy, and I shall demonstrate to you that the picture which I have published is true and corresponds to this body. You will see how from the vena cava there issues one branch running to all the ribs and nourishing the whole thorax. He pointed out to us [*ostendebat*] the pictures [*depictiones*] which he had published in his little book and in his *Tables*, and he compared them with the present subject, and to be sure, they corresponded completely [*omnino conveniebant*]. For I saw this with my own eyes, as I stood quite near.[63]

I have already discussed the two pictures mentioned here: the one in the *Epistola*, on the *dolor lateralis*, and the other in the *Tabula*. But I think that here, Heseler recorded much more than the simple fact that Vesalius used his own pictures in the dissection hall.

To us, using a picture in the dissection hall certainly seems a reasonable thing to do, given that seeing a particular detail in a dissection could be quite difficult, since one would also see all sorts of other things such as muscles, fat, cartilage, nerves, and veins, intertwined and joined together.[64] Thus a figure picking out only the structures one needed to focus on would be a useful teaching aid. But the particular picture Vesalius used in this dissection was not simply meant to help the student see features that were difficult to see. As Singer and Rabin have pointed out, the azygos vein as depicted here cannot be found in the human body, as it does not issue from above the heart, is not as large, and does not stretch out as far to the right inside the body as Vesalius would have it.[65] Yet, according to Heseler's diary, at least one student was persuaded that the picture "corresponded completely" with the body. In effect, Vesalius had won over a student to seeing the body in the way he wanted him to, and to believing that his interpretation of the azygos vein was true. We may recall that in the booklet on the *dolor lateralis*, Vesalius had invoked a "true" picture and the "ocular belief" of the witnesses to his dissections to render credible his description of the azygos vein. Here in the dissection hall, Vesalius persuaded a student to form that very ocular belief—by means of a picture.

Given that the structure depicted in Vesalius's picture could not be found in a human body, what Heseler saw "with his own eyes" was what was presented in the *picture*, which in turn described what was required for Vesalius's own interpretation to be "true." The use of pictures was necessary in the dissection hall even in the presence of an actual human body, as the pictures functioned to establish a correspondence between Vesalius's interpretation and the body.

The case of the azygos vein was not unique. On other occasions Vesalius pointed to pictures from Johannes Dryander's *Anatomia capitis humani* (*Anatomy of the Human Head*), or drew on the dissecting table during his demonstrations: "With many illustrations [*figuris*] he showed us the form and shape of the muscles, sketching with a bit of charcoal on the anatomy table . . . ."[66] Nor was the dissection attended by Heseler unique in its use of pictures. In 1537, even before Vesalius's *Tabulae sex* was printed, another student, Vitus Tritonicus Athesinus, copied down sketches that Vesalius had drawn in the dissection hall at Padua, and one of them clearly shows the exaggerated size and configuration of the azygos vein.[67] These pictures may well be regarded as "visual aids" in the sense that they indicate to the viewer the details they should see, but for some reason are unable to. The pictures are not made for research or discovery, but for teaching a particular view or interpretation of the human body. They present what those attending the dissections *ought* to see, according to the teacher. It is intriguing to note that Heseler's way of seeing the human body in the dissection hall ends up being something akin to the experience of reading—that is, reading Vesalius's interpretation of the structure of the human body in a picture that reflects his own interpretation. Vesalius "pointed at" (*ostendo* is an action and verb most appropriate for an *ostensor*) his picture, directing his students to read the body in a particular way.[68]

Heseler's case, and the case of the azygos vein, show how those who attended public dissections could come to see and understand the human body in a Vesalian way by means of pictures. It would be a little unfair to judge Heseler as having been "fooled" into believing that he saw in the body what was not there. After all, anatomy is a messy business, particularly when blood is not drained properly from the body, and an impressionable student can be susceptible to the words of a charismatic teacher, especially in a dissection hall full of other students.[69] Nor would it be fair to criticize Vesalius for cynical manipulation of his audience through pictures; clearly he believed that he was in the right, and went so far as to correct the text of Galen. In the 1542 edition of *De dissectione venarum et arteriarum*, as a gloss on Galen's description of a vein issuing from the heart and tending downwards to the *left* of the thorax, Vesalius wrote that either the text in the manuscript was mangled or Galen's view was clearly contrary to truth, and that "right" should be read for "left."[70]

Vesalius, then, had joined the serried ranks of learned humanist physicians in the most hotly debated and topical controversy of his time. Pictures played a crucial role in justifying Vesalius's own solution to the controversy in print and in the dissection hall. And it appears that the reactions to his pictures were favorable enough to spur him on to undertaking more figures of the nerves, muscles, and bones:

> . . . If the opportunity of bodies offers, and Joannes Stephanus, outstanding artist [*insignis pictor*] of our age, does not refuse his services, I shall by no means evade that labor.[71]

CHAPTER 10

The Canon of the Human Body:

Vesalius's *De Humani Corporis Fabrica*

As I have discussed in the previous chapter, Vesalius used pictures effectively in getting across his position in the bloodletting controversy, both in print and in the dissection hall. He extended his use of pictures in his next book, *De fabrica*. With his own financial investment, Vesalius carefully crafted the book, worked closely with artists, and deployed pictures in a variety of ways to restore and reestablish a pristine anatomical knowledge. This chapter focuses on *De fabrica*, which has rightly been called Vesalius's magnum opus as he used pictures to embody a canonical body, a teleological method, and an adjudicating authority, all of which were integral to his pursuit of ancient anatomical knowledge.

The Book

In 1543, the Basel printer Johannes Oporinus printed Vesalius's *De humani corporis fabrica libri septem*, a book of more than seven hundred pages in a large folio format (approximately 43 × 29 cm). As Vesalius wrote to his friend Johannes Gast (d. 1551), he wanted to have his book printed on the best paper with generous margins, the additional cost of which he offered to pay.[1] The larger the book, the happier Vesalius would be; even if Gast were to laugh at such a desire, nothing would delight Vesalius more than an impressive edition of his own work.[2] Its companion piece, *De humani corporis fabrica librorum epitome* (Epitome of the books on the fabric of the human body), was even larger (over 56 × 40 cm), consisting of thirty pages of large anatomical figures and text.[3] Vesalius called the *Epitome* a "pathway" and an "index" to *De fabrica*.[4] In August 1543, Gast told the theologian Heinrich Bullinger (1504–1575) that the retail price of *De fabrica* was four florins and four and-a-half batzen, and of the *Epitome* ten batzen (i.e., *De fabrica* cost about six times more than the *Epitome*).[5] This roughly tallies with what Oporinus later charged in 1547 for both, five florins and three batzen.[6] The tariffs for meals with meat at a guesthouse in Basel was set in 1546 at three schilling, a little less than meals with fish at two batzen, which would mean that *De fabrica* and the *Epitome* together were worth about thirty-nine meat meals or thirty-four fish meals in Basel at the time.[7]

The title page of *De fabrica* (fig. 10.1) is one of the most famous pictures in the history of anatomy; there are many ways to read it.[8] Here I confine myself to features that resonate with Vesalius's own words. In the preface, Vesalius lamented how the three parts of medicine—regimen, medication, and surgery (called "work of the hand")—once practiced together by all ancient physicians, had since become separated as physicians confined themselves to internal medicine and relegated the preparation of diet to patients' servants, the mixing of medicines to druggists, and surgery to barbers.[9] In particular, the ancient study of anatomy had suffered a "deplorable and most disastrous shipwreck":

> . . . When the whole practice of cutting was handed over to the barbers, not only did the physicians lose firsthand knowledge of the viscera but also the whole art of dissecting fell forthwith into oblivion, simply because the physicians would not undertake to perform it, while they to whom the art of surgery was entrusted were too unlettered to understand the writings of the [ancient] professors of anatomy. It is quite impossible that such people should preserve for us that most difficult and abstruse art which had been handed over to them; nor is it possible to prevent that evil fragmentation of the healing art from importing into our Colleges that detestable ritual whereby one group performs the actual dissection of a human body and another gives an account of the parts: the latter aloft on their chairs croak away with consummate arrogance like jackdaws about things that they have never done themselves but which they commit to memory from the books of others or which they expound to us from written descriptions, and the former are so unskilled in languages that they cannot explain to the spectators what they have dissected but hack things up for display following the instruction of a physician who has never set his hand to the dissection of a body but has the cheek to play the sailor from a textbook. So the teaching in our college is all wrong, and days are frittered

Fig. 10.1 Title page, Andreas Vesalius, *De fabrica* (1543), page size 43 × 28.5 cm. Cambridge University Library, K.7.3. This copy once belonged to Sir Theodore Turquet de Mayerne.

> away in ridiculous inquiries; a butcher in a shambles could teach a practitioner more than the spectators are shown amidst all this racket . . . . So much did the ancient art of medicine decline many years ago from its former glory.[10]

Earlier accounts and depictions of scenes of dissection, such as the one from Johannes Ketham's *Fascicolo di medicina* (fig. 10.2), confirm Vesalius's point that traditionally the professor read out the text of Galen while a barber-surgeon cut open the body, and sometimes another (the *ostensor*) pointed out the organs being discussed.[11] For Vesalius, this division in the dissection hall symbolized precisely the fragmentation of medical knowledge across different practitio-

Fig. 10.2 Johannes Ketham, *Fascicolo di medicina* (1493), Fiiv, colored by stencil. 2011. Image © Metropolitan Museum of Art/Art Resource/Scala.

ners. In contrast, in the frontispiece of *De fabrica*, Vesalius is depicted as the single person in charge of the dissection. He is seen dissecting a woman who, according to Vesalius, had tried to avoid hanging by claiming pregnancy falsely.[12]

The portrait of the author (fig. 10.3) shows Vesalius dissecting the forearm and the hand with his own hands. As O'Malley has pointed out, the piece of paper on the table contains the opening line of the chapter in *De fabrica* on the muscles of the fingers (book 2, chapter 43).[13] There, Vesalius explained how the tendon of the first muscle moving the fingers (flexor digitorum superficialis to us) had a perforation to allow the tendon of the underlying second muscle (flexor digitorum profundus) to pass through, as the "almighty Creator" had

Fig. 10.3 In this portrait Vesalius is seen using his hands to show that the tendon of the first muscle moving the fingers of the hand (flexor digitorum superficialis to us) has a division through which an underlying tendon of the second muscle (flexor digitorum profundus) passes. From Andreas Vesalius, *De fabrica* (1543), *6v. Woodcut 19.7 × 14.5 cm. Cambridge University Library, K.7.3.

arranged with "outstanding ingenuity."[14] Since antiquity, the hand had symbolic significance as defining humanity.[15] Moreover, the forearm and the hand were the structures with which Galen's *De usu partium* and *De anatomicis administrationibus* began. The very fact that Vesalius is holding the arm and the muscles with his own hands reinforces the point in his preface that beginners in anatomy should "use their hands . . . as the Greeks did and as the essence of the art demands."[16] The inscription on the edge of the table gives the date of the portrait as 1542, when Vesalius was twenty-eight years old. Underneath, in the shadow of the table top, is a further inscription—"swiftly, pleasantly, and safely" (*ocyus, iucunde et tuto*)—which Saunders and O'Malley have identified as indicating the manner by which Aesclepiades reputedly urged physicians to cure a patient.[17]

The title of the book, *De humani corporis fabrica* (On the fabric of the human body), is of Galenic lineage, since it was also the title given to a tract by Theophilus Protospatharius (seventh century), translated by Giunio Paolo Grassi and published in 1536.[18] Theophilus was an author known for his work on the urine and pulse, commonly included in the *Articella*, a late medieval textbook of medicine comprising a variety of texts.[19] According to Grassi, who was unsure of his exact dates or details of his life, the virtue of Theophilus was that he lived after the time of Galen, was a Christian, and wrote a tract which was much shorter and more succinct than Galen's *De usu partium*, which ran to seventeen books.[20] To Grassi, Theophilus showed how the human body, the container of the soul, was more divine than other animals.[21] Indeed, Theophilus's work viewed the human body as a creation of God,[22] and dealt with the hands, arms and feet (book 1), lower venter (book 2), middle venter (book 3), upper venter (book 4), and the spine and the male and female generative organs (book 5). This redacted form of Galen's *De usu partium* fitted in well with the projects promoted by Dubois and Guinther to teach the newly revived Greek medicine in manageable and summary form, and thus it was included in the 1539 edition of Guinther's *Institutiones*.[23] In calling his work *De humani corporis fabrica*, Vesalius may have been aligning his work with this Christianized, Galenic, anatomical work, which he appears to have read.[24] Perhaps it is in this spirit that we should understand Vesalius's gesture of pointing upwards to heaven on the title page—a gesture made in the midst of an adoring audience, which has also been compared to Raphael's *Disputa*.[25]

The Artists

It appears that more than one artist took part in the production of the images for *De fabrica*, though Jan Stephan Calcar was probably involved in creating some of them, given Vesalius's reference to him in the *Epistola* (1539).[26] There

Fig. 10.4 Jan Stephan Calcar, *Portrait of Melchior von Brauweiler*, 1540, 1.09 × 0.88 m. The sitter is identified as Melchior von Brauweiler (1514–1560), a patrician from Cologne, by the coat of arms on the column and by the initials on the ring of his index finger. He was twenty-six years old in 1540, and he later became a member of the Cologne City Council. Louvre Museum, Paris, INV 134. © RMN/Franck Raux.

is no contemporary evidence that supports Titian's involvement, though his name came to be associated with *De fabrica* when engraved copies of the Vesalian woodcuts were issued as manuals for artists and sculptors in the late seventeenth and early eighteenth centuries.[27] Three drawings (two of which are mirror images of the printed version) are associated with the title page, and therefore with Calcar—though none can be confidently established as the original design, since mirror copying of well-known masterly images (sometimes with minor amendments) could be a form of training rather than evidence of an original design.[28]

The author portrait can be attributed more securely to Calcar because its composition echoes his portrait, dated 1540, of Melchior von Brauweiler (1514–1560), a patrician from Cologne who was visiting Venice.[29] Calcar shows Brauweiler in a pose fashionable among Italian portraits of the time, with one arm akimbo, the other arm resting on the base of a classical column, and a letter in his hand (fig. 10.4).[30] It is a pose and background Calcar used in other portraits.[31] The gesture of the protruding elbow allowed the sitters to show off their wealth, status, and taste through their sleeves.[32] In Brauweiler's case, he is shown wearing a black brocaded overdress with a belt or cord that tucks in the drape at the back, and with sleeves in what looks like vertical strips of black satin. Black was the standard color that men who reached the age of majority (twenty-five) were expected to wear in Venice—which may be the reason for the occasion of the portrait, since Brauweiler would have just reached that age in 1540.[33] The portrait of Vesalius shows him in a similar overdress with a drape at the back, similar brocaded patterns, and separate sleeves, and in the background there is a column with an Ionic capital. Although several later copies of the Brauweiler portrait are known, given the proximity of their dates of composition, it is likely that the author portrait of Vesalius was based on the original Brauweiler composition.[34]

There are two drawings in red chalk that have been associated with the *De fabrica*;[35] one is in Sacramento and the other in Munich. The drawing at the Crocker Art Museum, Sacramento (fig. 10.5), shows a collection of bones: the femur and its detachable epiphyses at both ends, the pelvic bone with its coxendix, the lower jaw depicted from two slightly different angles, the bones of the toe and the tarsal, and a skull in the foreground.[36] Given that seven of the eleven bones depicted in the sketch are produced in reverse on one page (fig. 10.6) of *De fabrica*, and given the incisions in the drawing, Kaufmann must be right to conclude that this was the drawing from which the image for the woodcut was prepared.[37] The drawing of the two jawbones from slightly different angles seems to reflect a point that Vesalius was always concerned about: to present the human structures at angles that would show their parts as clearly as possible.[38] The lower jawbone in the middle of the Crocker drawing achieves a bet-

Fig. 10.5 Calcar's drawing of bones includes the femur, its detachable epiphyses, the coxal bone, the lower jaw seen from two slightly different angles, the toe, the tarsal, and a skull. This was the basis of a woodcut (see fig. 10.6) in *De fabrica*. Jan Stephan Calcar, *Studies of Human Bones* (n.d.). Red chalk, incised, on cream laid paper, 29.3 × 19.6 cm. Crocker Art Museum, E. B. Crocker Collection. 1871.127.

Fig. 10.6 This illustration includes the bones of the right femur (*A*, *B*), the lower jaw with teeth (*C*), the coxal bone (*D*), the bones of the right foot in two parts (*F*, *H*), the humerus (*I*), and the back of the scapula (*K*). This picture was for the chapter of Vesalius's *De fabrica* that was concerned with the names of the various parts of bones, namely the epiphyses (*L* to *Q*), processes (*S* to *Y*), heads (*a* to *h*), and smaller structures such as cups (e.g., *o*, described as "lurking between the two Ys" on the humerus). Andreas Vesalius, *De fabrica* (1543), 5, detail. Woodcut approx. 15.6 × 18.5 cm. Wellcome Library, London.

ter view of the jawline's curvature, and better definition of the coronoid process and condyle of the lower jaw, than the one drawn above it to the right—but to achieve this view, the back of the jawbone had to be supported with a prop, perhaps a piece of wood or chalk. The piece of chalk is not shown in the printed version, possibly to maintain visual coherence with the pelvic bone standing vertically without support, though in other woodcuts props such as canine skulls or walls and rope provided visual context that rendered the positions of the body or the bones plausible. The Crocker drawing suggests at least an understanding on the draftsman's part of what Vesalius was trying to achieve.

Another sketch in red chalk at Munich, studied by Martin Kemp, was most probably a preparatory sketch for the second figure of muscles.[39] Its small differences with the final woodcuts indicate the extent of intervention and adjustment Vesalius had made between the drawing and the woodcut in order to optimize the anatomical details that could be included in each figure: where a particular layer or ligament had been shown already, Vesalius would place further details or structures deeper inside, rather than having each figure adhere strictly to a particular stage of dissection. This again suggests a close and intensive collaboration between Vesalius and the draftsman of the myological series. Both of these drawings in red chalk have good reasons to be regarded as being drawn for *De fabrica*, on the basis of which they have been attributed to Calcar.

Other artists associated with *De fabrica* include Sebastiano Serlio (1475–1554), a Bolognese who first worked in Rome and who, after the sack of Rome, was active in Venice until he moved to France in 1541. Serlio is best known for his pictorial publication of classical architecture, published in installments and later entitled *Tutte l'opere d'architettura*.[40] Andrea Carlino has pointed out that Serlio constructed a temporary wooden theatre at the Palazzo Porto-Colleoni in Vincenza, perhaps similar to the one shown in the frontispiece of *De fabrica*, and Pamela Long has drawn attention to the parallel interests of Vesalius and Serlio in pictorially linking parts and the whole.[41] The fourth book of Serlio's *D'architettura* (1537) is best known for his codification of what we now call the five "orders" of classical architecture, comprising the Doric, Ionic, Corinthian, Tuscan, and composite orders, based on the study of Vitruvius as well as of architectural ruins. The column with the Corinthian capital shown at the left edge of the frontispiece (fig. 10.1) of *De fabrica*, assuming that it shows half its breadth, measures 1.8 cm in diameter and 16.3 cm in height, matching the definitions of Serlio and Leon Battista Alberti which specify that the Corinthian column height be nine times its diameter.[42] The architrave depicted in the title page, moreover, resembles the one described under the Doric order by Serlio, who explained the significance of the ox head in the metope as referring to the ancient custom of sacrificing bulls.[43] This motif could be found in the Forum Boarium in Rome and, given the popularity of Serlio's *D'architettura*, it would be rash to credit Serlio himself with the design of the title page.[44] Furthermore, Kemp suggests that the "densely-packed excitement" of spectators in the frontispiece is similar to that in the *Massacre of the Innocents* by Domenico Campagnola, who may well have been responsible for the background of the myological figures in book 2, which included pyramids, obelisks, aqueducts, ruins, and vegetation, some of which may well represent the Euganean Hills outside Padua.[45] What is worth noting is that Vesalius, Calcar, Serlio, and Campagnola, all of whom were active in the late 1530s and early 1540s in Venice or nearby Padua, seem to have shared a similar pictorial vocabulary. And although it is now probably impossible to identify for certain the draftsmen or the cutters of the woodcuts for *De fabrica*, available evidence supports a very close collaboration between them and Vesalius. This was fundamental for Vesalius's various visual arguments to work.

The Pictures

De fabrica contained more than two hundred figures, ranging from a picture of an ossicle five millimeters across and seven millimeters high to the large, full-figure myological portraits that each took up a full page, approximately 42.5 × 28.5 cm, and to the oversize figures of blood vessels and nerves (from the *Epitome*) inserted at pages 313 and 352 of *De fabrica*, each measuring about 56 × 40 cm.[46] Some of the figures were repeated intentionally.[47] There were marginal figures to assist with analogical descriptions, such as hinges resembling the sutures of the skull and figures indicating the direction of fibers and the angles of muscles.[48] Six of the seven books of *De fabrica* begin with large ornamental initials, and each chapter is headed by a smaller decorative initial; both sets of initials depict scenes relating to dissection, surgery, or procuring bodies.[49] The use of differently sized or colored decorative initials to signal different levels of text breaks was a well-known convention in medieval illuminated manuscripts.[50]

The series of muscle figures was arranged sequentially to show layer under layer of muscle, starting with the body's surface.[51] Vesalius directed readers not to just look at a muscle in one figure, but to compare it with the preceding and succeeding figures in order to grasp what was above and beneath it.[52] Looking back and forth between these pictures thus enabled the reader to grasp the sense of layers, and indeed the depth of a body. In the chapters after this myological series, figures of small muscles or of other parts of the body were introduced to explain more detailed points. Once the readers had a general sense of the interrelationship of the muscles, they could thus focus on the smaller parts of the body. Although Vesalius said he did not want to "overburden" his readers with pictures, a large variety of pictorial material was thus included in *De fabrica*, much of which was placed with great care and its functions explained in detail (though see fig. 4.4).[53]

The layers and depth of the body were important also in the accompanying book, the *Epitome*. Vesalius offered readers two different ways of approaching it: one could either read it in the conventional way, starting from the chapter on bones and ending with the full-length nude male and female figures at the middle of the book (fig. 10.7), or one could start from the male nude figure and go backward, turning the pages to understand the layers of the body from its surface down to the bones.[54] The pages after the female nude figure contained pictures of veins, arteries, and organs: Vesalius provided instructions for back-

Fig. 10.7 Nude male and female figures in the middle of Vesalius's *Epitome*. Vesalius suggested that readers could either start from the nude male (i.e., from the surface of the body) and work back to the beginning of the book, or start at the beginning in the conventional way. The pages after the female nude were to be cut up by the reader and glued together to make a layered figure. Andreas Vesalius, *Epitome* (1543), K–L. Cambridge University Library, CCF.46.36.

ing them with firmer paper or vellum and gluing them together to create a multilayered manikin (fig. 10.8).[55] The *Epitome* was thus set up to teach the layers of the human body, either by making readers leaf through the pages in a particular direction or by encouraging them to handle the cutout figures. Perhaps Vesalius had noted the critical comment by his teacher, Dubois, that medical students learned least from pictures.[56] The *Epitome* would have shown how a book, or layers of paper, might help.

In the preface of *De fabrica* to the Emperor Charles V, Vesalius repeated his earlier points about pictures: they were no replacement for the actual experience of dissecting bodies, and so students should undertake dissections with

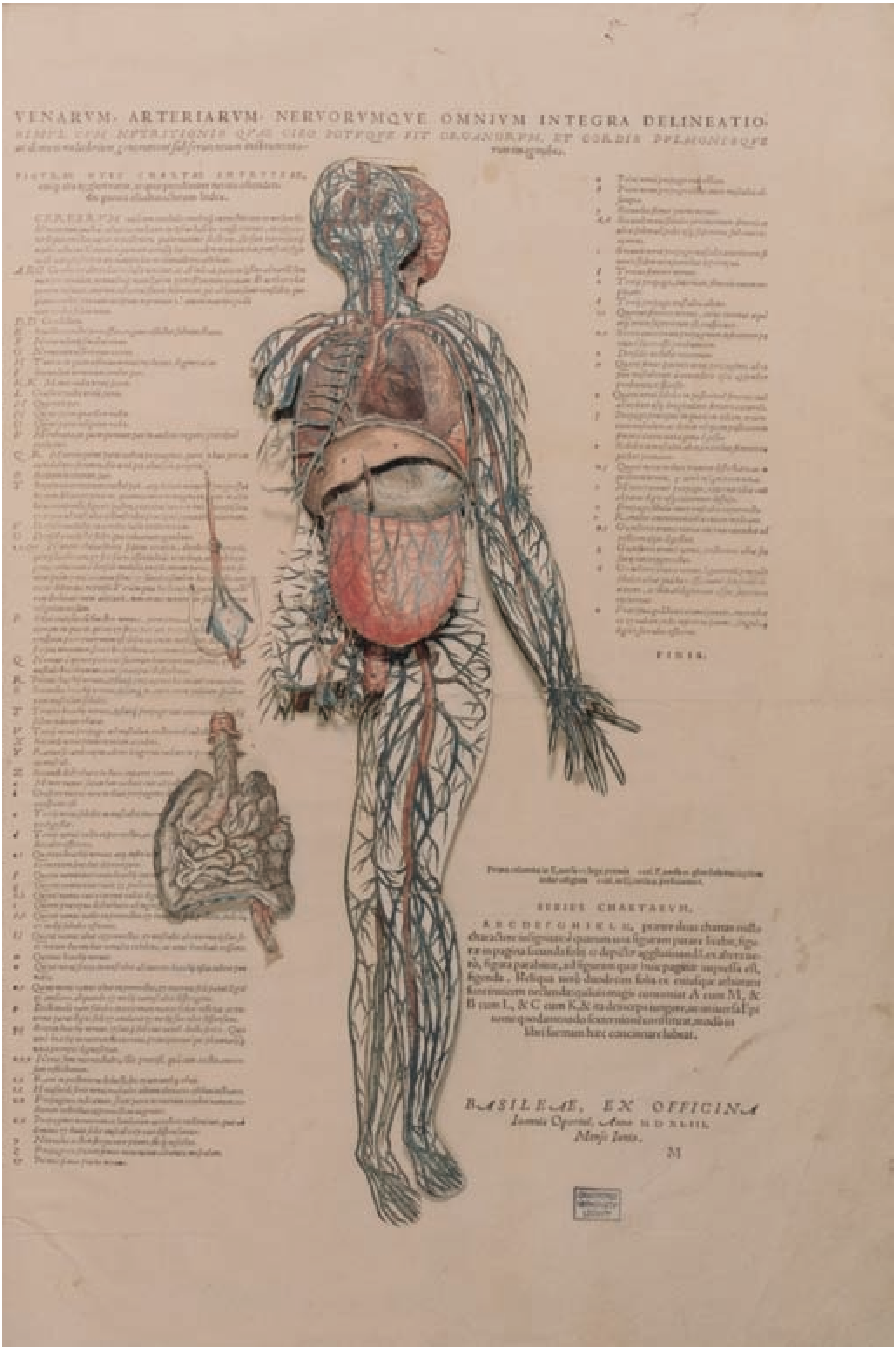


Fig. 10.8 Layered figure. From Andreas Vesalius, *Epitome* (1543). Cambridge University Library, CCF.46.36.

their own hands, as Galen had urged.[57] Yet Vesalius made a case for the use of pictures as a matter of historical necessity, because the ancient practice of oral and firsthand instruction in dissection within physicians' households had long been abandoned.[58] In addition to the historical necessity for instruction by books and pictures, Vesalius stressed the great descriptive power of pictures over textual explanations: pictures assisted understanding of anatomy, for they placed the matter more exactly before the eyes than the most explicit words; there was no one who had not experienced this in geometry and other branches of mathematics.[59] The descriptive power of pictures over the text was a well-known topos: Charles Estienne, Vesalius's contemporary who had also been working on an illustrated book on anatomy (see fig. 4.3), similarly argued that pictures, however mute, could bring things to the eyes in such a way that no further discourse was needed.[60] A "mute" picture referred to the well-known saying, attributed to Simonides, that painting was mute poetry and poetry a speaking picture.[61] This had become one of the standard classical references in the *paragone* literature on the relative merits of the mimetic arts of poetry and painting.[62] Vesalius did not pick up this theme, but instead invoked the usefulness of pictures in geometry, perhaps in line with the "manner of mathematicians" in his *Epistola* on "pain in the side."

Moreover, according to Vesalius, a picture could provide pleasure to those who could not or would not attend dissections.[63] Squeamishness might be unbecoming of a physician, but a picture had the advantage of not requiring the actual presence of the object (and all its attendant sensations, such as smell) to teach something about the object.[64] A similar point was made by Gessner, who argued that animals, especially brutal and hostile ones like lions and tigers, could be studied without fear and examined closely through their pictures.[65] By not being the object it depicts, a picture does not provoke in the viewer the emotions or reactions that the object itself might. An image is not the dissected body itself, and as such it has disadvantages compared to hands-on experience, as Dubois remarked—but the experience of looking at an image of the body may well have advantages over that of looking at the dissected body itself. Hence, Vesalius was clearly aware of the different quality of experience between looking at an object and looking at its representation. Pictures in a book, furthermore, also had other characteristics that could not be found by looking at individual bodies directly.

The *Canon* of Policleitus

De fabrica was intended to, and does indeed, follow closely the order of Vesalius's public dissections at Bologna and Padua.[66] Vesalius acknowledged that private dissection among smaller groups of students was more effective for teaching than public dissections, though he also felt that public dissections should be used for instruction because of the shortage of bodies and the even greater shortage of anatomical experts. While the functions of private and public dissections thus converged, an important distinction was maintained: Vesalius recommended that in private dissections, one should study whatever body one could come by in order to develop dissecting skills and learn about the differences in bodies and the true nature of diseases; in a public dissection, in contrast, the body should be of a middle-aged man or woman with the most temperate complexion, which was, according to Vesalius, the kind of body against which one could compare other bodies, as one did with "the statue of Policleitus."[67] Policleitus (450–420 BCE) was one of the most renowned sculptors of antiquity.[68] Galen described in his *De placitis Hippocratis et Platonis* (5) how Policleitus had written a book called the *Canon* (translated as *Regula* in the first Latin translation of the work by Guinther in 1534), which explained the principles of symmetry and proportion in the human body, namely how the smaller parts relate to one another and to the larger parts, and how the larger parts relate in turn to the whole body.[69] Policleitus made a statue, also called the *Canon*, that Galen frequently cited as a model of a human body whose parts were perfectly proportioned in relation to each other, rather than a body with a perfectly well-balanced mixture of humors.[70] This distinction may well have served Galen to differentiate between what was beautiful and what was healthy.[71] Galen argued, however, that a good proportion among the parts of the body was a result of a good humoral balance, and cited Policleitus's *Canon* as the perfection of every type of balance.[72] Such a body, Galen also stated, was rarely exemplified; its nature could be grasped only through extraordinary dedication, experience, and study.[73] When Vesalius referred to the statue of Policleitus, he was thus signaling an ideal human body of excellent Galenic warrant.

But the bodies used in public dissections by Vesalius were those of hanged criminals, not all of whom could be of middle age or of a most temperate complexion.[74] Vesalius explained how one might nevertheless be able to refer to a *canon* in a public dissection. After describing some rare configurations of the azygos vein and the vena cava, he wrote:

> I had reckoned that the series of veins occurring very rarely should not be considered by a student of anatomy other than as if now and then a sixth finger on the hand or another monstrous thing offered itself to be seen. So far, if I have observed these in public dissections, I would pass over them silently, in case candidates of this art would believe these to be seen in all bodies. But the more assiduously I have directed this to be done, not only in dissections, but also in pursuing the *historia* of the perfect man [*historia absoluti hominis*], the more obstinately have they marveled at the monstrous things, as I have learned by

> experience more than once. Meanwhile, it would be deplorable for these students to have happened on a body for a whole dissection which differed much from the *canon* of men, unless they had assisted frequently at the dissections of perfect and nonmonstrous men, not ignoring the precepts of Galen given to us at the end of the first book of the *On anatomical procedures*.[75]

The implicit identification of the canonical body with the *homo absolutus* suggests that the sense of the adjective *absolutus* here is not just the whole body with no part missing, but rather the body of the "perfect" man, which does not have any monstrous parts. This canonical body, Vesalius cautioned, could be recognized only after frequent attendance at dissections, just as Galen had urged.[76]

Despite the enthusiasm in this period to recover classical art, as witnessed by the statuary court of the Belvedere in the Vatican, no statue seems to have been identified as the *Canon* of Policleitus by 1543.[77] By the 1530s the Belvedere gardens housed classical statues such as the Laocoön and the Apollo. Among them was a torso—lacking the head, arms, and legs from the knee down—that came to be identified as representing the body of Hercules, and became well known across Europe through bronzettes, models, written descriptions, and sketches such as the one now in Trinity College Library (fig. 10.9).[78] Michelangelo, furthermore, is reputed to have called the so-called Belvedere Torso the "most perfect" (*absolutissimum*) sculpture in Rome, and used it as a model for one of the seated male nudes in the Sistine Chapel.[79] Bronzino (Agnolo di Cosimo, 1503–1572) also based his portrait of Cosimo I de'Medici as Orpheus (c. 1537–39) on the Torso.[80]

In *De fabrica* (fig. 10.10), the torso is depicted as revealing the figure of renal and seminal veins. It would be reasonable, therefore, to interpret this torso as a draftsman's conceit to show off his fashionable antiquarian taste on an occasion when the depiction of a full figure was not required; the Belvedere Torso was, after all, famous for the absence of its head, legs, and arms (despite some contemporary descriptions to the contrary).[81] Another way to interpret the statuesque bases for the lower venter would be to see them as the body of a classical hero, thus conveying some sense of perfection and of canonicity to the anatomical strutures revealed.

It is also worth noting other words Vesalius used to describe this body of the *homo absolutus*. Vesalius called it a *fabrica*, which, according to Pigeaud, is derived from a stoic notion expressed in Cicero's *De natura deorum* (*On the Nature of the Gods*) (2), an object that is fabricated, formed, created, or fashioned by a maker, god, nature, and creator of things.[82] These classical terms, also found in their Greek forms in Galen's works, convey the sense that parts of the human body were fashioned and molded in their particular ways to fulfil

Fig. 10.9 A late sixteenth-century drawing (probably Flemish) of the Belvedere Torso, on paper 39.8 × 23.5 cm. The inscription reads: "This pees doeth michellangeli exsteem above al the anttickes in bell federe." Trinity College, Cambridge, MS R.17.3, fol. 22.

Fig. 10.10 Renal and seminal structures in the Belvedere Torso. From Andreas Vesalius, *De fabrica* (1543), [472], detail. Cambridge University Library, K.7.3.

their functions.[83] On one occasion, as pointed out by Pigeaud, Vesalius used the phrase "law of nature": in explaining how bile was excreted from the body, he made the point that by the law of nature (*lege naturae*), all things in the human body were regulated.[84] This agreed with the normative connotation Policleitus's *canon* carried as a *lex* for other craftsmen, as Pliny the Elder had written: "He also made what artists call a *canon*, as they draw their artistic outlines from it as from a sort of standard [*veluti a lege quadam*]; and he alone of mankind is deemed by means of the work of art to have created the art itself." [85] It must be stressed, however, that Vesalius's objective was not to discover a set of general laws governing the morphology or functions of the human body.

Instead of the word "law," it is more common to encounter Vesalius using the phrase "according to nature" (*secundum naturam*). When he explained that the elongated spherical shape was the natural shape of the skull because it followed the shape of the brain, which it was designed to protect "according to nature," he also said that all other shapes of the skull (see fig. 11.1) should therefore be regarded as "not natural."[86] All university-educated physicians would have been familiar with the distinction of the natural, "praeternatural" and "against nature" (*contra naturam*) derived from Aristotelian natural philosophy.[87] Natural things were those things that followed their nature, an inherent principle of change, in order to fulfill their purpose. Such a natural change occurred always, or most of the time. Sometimes, however, a natural thing failed to achieve its goal and produced, for instance, six fingers.[88] Such monstrosities were, alongside disease and putrefaction, classified as "praeternatural." While these praeternatural occurrences were considered to exist under a more general sense of nature, in the sense that their causes might be located in some unstable quality of matter or surrounding conditions, they were not "natural" in that they did not occur always or most of the time. When Vesalius equated the perfect body with the nonmonstrous body in the quotation above, he was therefore also specifying a "natural" body. The canonical body was thus a natural body, with no praeternatural parts.

Establishing the Canonical Body

But how did one go about determining the structure of the canonical, natural, human body? Frequency was certainly an important guide, since natural things occur, according to Aristotle, always or most of the time. It also suggested frequent dissection, a good Galenic practice, as advocated in *De anatomicis administrationibus*.[89]

For instance, next to the marginal heading, "thoracic vertebrae usually [*plurimum*] twelve in number," Vesalius wrote: "There are twelve thoracic vertebrae; sometimes, but rarely, there is one less or one more."[90] This established that twelve was the natural number for the thoracic vertebrae, but that there were rarer, praeternatural cases. Vesalius's readers would have found nothing surprising thus far, since this closely followed a passage from a recently translated work, Galen's *De ossibus* (On bones, 9).[91] In *De ossibus*, Galen went on to say that it was rarer to find one vertebra more than to find one less.[92] Vesalius noted, however, that "to have one less is rarer than to have one more. At Padua, I came across two bodies with thirteen thoracic vertebrae, but so far I have never seen one with only eleven."[93] Vesalius, quoting his own experience, inverted Galen's view of the degrees of rarity: Galen had said thirteen vertebrae occured less frequently than eleven, while Vesalius's experience was the other way around. Admittedly, this was a small point to make, as it did not change the natural number of the thoracic vertebrae, but to those familiar with Galen's *De ossibus*, it would certainly have signaled the care with which Vesalius was conducting his own dissections.

While the fact that he himself had not seen a case of a particular variation did not rule out the possibility of its existence, Vesalius at times was confident that a particular variation, such as a human jaw in two parts, was well nigh impossible: "Though perhaps among so many myriads of people I might some day in some monstrous cross between a dog and a human observe a jaw of this type, that would not make me assert that the human jaw contains a pair of bones."[94] A structure that can only be explained as a cross between a human and another animal would be against human nature, or *contra naturam*, and thus could not belong to humans.

Vesalius also based his frequency arguments on his experience in cemeteries, such as the Cemetery of the Innocents in Paris. Fused vertebrae and incompletely grown teeth were conditions he reported as being commonly found there.[95] Conversely, he argued that rare or impossible cases could be defined by their absence: ". . . Of twenty skulls found in cemeteries, you would be unlikely to find one whose frontal bone is divided."[96] The strategy of citing cemeteries to confirm anatomical details, especially of bone structures, had been deployed before. Henry de Mondeville had referred to the ossuary of the same cemetery as a means of refuting popular misconceptions about sexual differences in the shape of the cranium, and Berengario da Carpi mentioned the cemetery as a place to confirm the true shape of the vertebrae when pictures had failed him.[97] Vesalius's reference to the cemetery for frequency arguments is in line with this traditional topos, but he also cautioned against overreliance on findings from the cemetery: it was impossible to find sets of bones belonging to a single body, desiccation or putrefaction could lead to some parts being separated from others, and some smaller parts could have broken off.[98] In other words, cemeteries could be places for confirmation, but not for discovery. If *De fabrica*'s series of fourteen full-length myological figures against a panoramic landscape was indeed inspired by murals of the "dance of death" painted in 1425 in the cloister that surrounded the Cemetery of the Innocents, it may well have been an oblique reference to the cemetery as a place for studying the human body.[99]

Another place for confirmation of anatomical structures was the dinner table. Vesalius recommended that in order to understand better the structure of ossicles in the ear, students should cut into the head of a calf or a lamb next time it was served for a meal; for the processes of the scapular they should try sheep, goat, or hare; and for the ligament of the neck a calf, piglet, kid, or ox.[100] Such exhortations could have had an immediate didactic effect, since Vesalius's dissections were held before and after meals.[101]

For Vesalius, however, frequency was ultimately not sufficient for determining every canonical structure, as in the case of what is now known as the "Os Vesalianum Carpi," an ossicle just under the base of the little finger in the hands (fig. 10.11). According to Straus and Temkin, the tiny bone shown at N is a skeletal

Fig. 10.11 Bones of the hands. From Andreas Vesalius, *De fabrica* (1543), 115, detail. Cambridge University Library, K.7.3.

aberration found in just over 0.1 percent of Caucasians; Vesalius was in the highest degree unlikely to have seen this structure more than once in his lifetime.[102] Yet it is described in the picture as well as in the text:

> On the outside of the joint between the metacarpal bone which sustains the little finger and the eighth carpal bone lies a bone of this type as if to fill up the vacant area which occurs here because the upper end of this metacarpal bone cannot lie entirely against the eighth carpal bone but goes slightly beyond it on

> the outer side. This bone, when present, seems to strengthen the joint and give some support to the metacarpal bone which sustains the little finger.[103]

The phrase "when present" implies that the bone was not always found, but Vesalius included it in the natural structure of the hand because it fulfilled the function of supporting the little finger. Teleology was the central point of Galen's *De usu partium*—namely, that the perfect and correct form of a part of the body was the one best adapted to execute its functions.[104] Vesalius was typical for a learned physician of his time in adopting teleology as argument and studying Galenic teleology avidly; as Siraisi has shown, however, he did not simply repeat Galen's *telos* of each part of the body, but instead offered his own teleological explanations throughout *De fabrica*, and not just for ossicles as rare as the "Os Vesalianum Carpi."[105] Teleology was the reason for Vesalius favoring the less common six-piece structure of the sacrum over the five-piece structure, and ignoring a fleshy piece of muscle (palmaris brevis to us) in the hand discovered by Giovanni Battista Canani (1515–1579)—"I passed over the muscle in silence seeing that it was established without purpose and, furthermore, that Galen did not mention it."[106]

Hence, a picture of Vesalius's canonical body contains on the one hand parts that are hardly ever visible in dissections of actual, individual bodies; on the other hand it also ignores unusual variations or even common but purposeless structures that could well be encountered in the dissection hall. For all its naturalism, the woodcuts of *De fabrica* do not guarantee an exact match with a dissected body. As noted by Harcourt, the body depicted in those images was not the actual, particular body dissected at a particular place at a particular time.[107] The images were meant to be not a "counterfeit" but a "canon," and that "canon" was determined by establishing the teleological causes of anatomical structures. Thus the "canon" crucially allowed Vesalius to discuss the human body in the most general, universal terms, and teleology allowed him to discuss the structure in terms of causes—which is probably why Vesalius called his anatomy a part of natural philosophy.[108]

Comparative Authority

By putting into practice Galen's exhortation to carry out firsthand dissections of the human body, Vesalius, as is well known, ended up correcting Galen's descriptions, since Galen by his own admission had been unable to dissect humans.[109] This realization did not, however, make Vesalius abandon his pursuit of the practice of firsthand dissection, nor did it repudiate the Galenic physiological system as a whole. As Nancy Siraisi has argued, Vesalius's engagement with Galenic ideas and principles was at the same time complex and subtle,

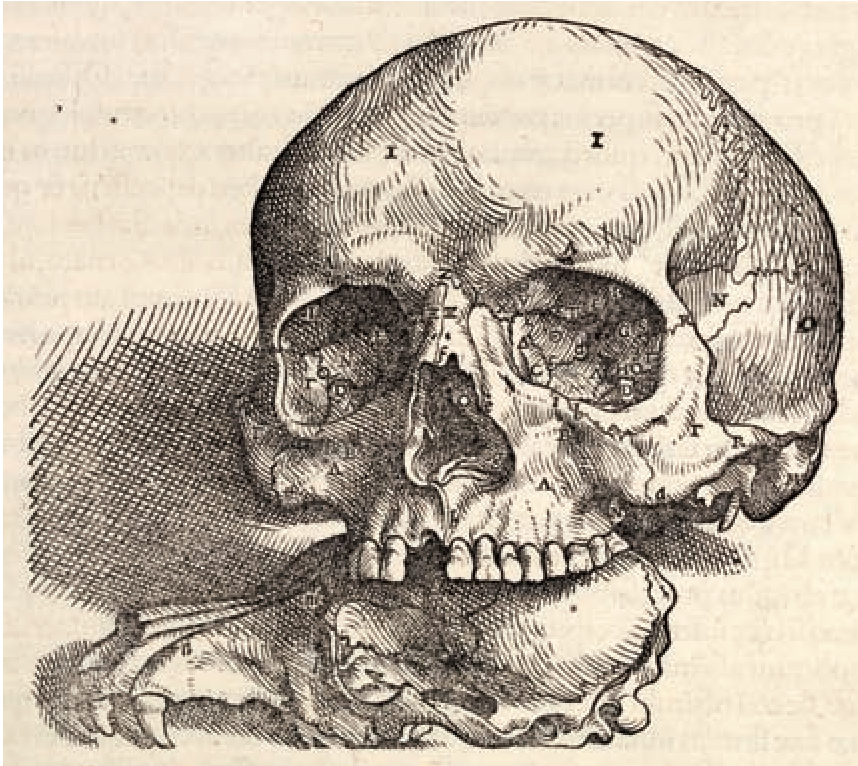


Fig. 10.12 A woodcut of a human skull resting on a canine skull is used to show that Galen's description of two sutures (*n*) on the canine jaw is wrong. From Andreas Vesalius, *De fabrica* (1543), 36, detail. Cambridge University Library, K.7.3.

constructive and critical.[110] Vesalius was not the first to note that Galen was only human and could make mistakes, but the discrepancy with Galen's descriptions meant that Vesalius needed to proceed carefully in his argument. Here too, Vesalius exploited pictures, by juxtaposing human and animal structures.[111]

For example, the point of placing a human jaw atop a canine jaw (fig. 10.12), Vesalius explained, was to position the skull at an angle so that the insides of the eye sockets could be seen—but he had also "portrayed a dog's skull beneath the human one so that Galen's description of the bones of the upper jaw may the more easily be understood by anyone."[112] What was in fact shown here was how Galen's description of the sutures better fitted the canine jaw than a human one.[113]

A more subtle juxtaposition of animal and human structures occurred in Table V. For the structure in the neck X (fig. 10.13), Vesalius wrote:

Fig. 10.13 Table V. The muscle indicated at *X* occurs in dogs, but not in humans. From Andreas Vesalius, *De fabrica* (1543), 184, detail. Cambridge University Library, K.7.3.

Fig. 10.14 Table VI. The muscles indicated at *O*–Γ–*P*–*Q* occur in dogs, but not in humans. From Andreas Vesalius, *De fabrica* (1543), 187, detail. Cambridge University Library, K.7.3.

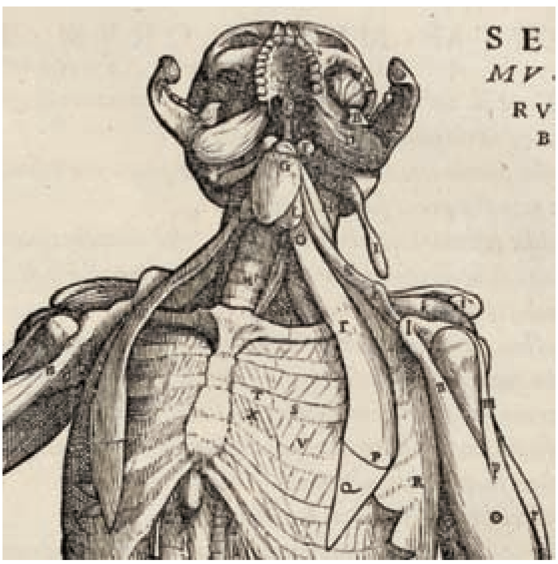
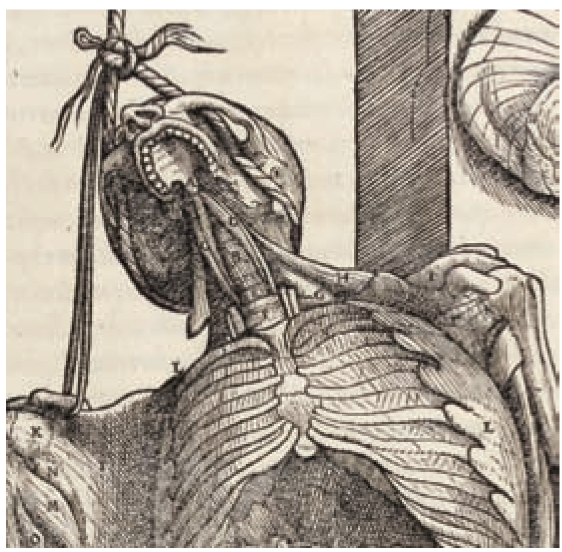


Fig. 10.15 Table VII. In this illustration *H* indicates the human muscle moving the scapula, but the dog muscle shown adjacent to it in the previous two illustrations (see figs. 10.13 and 10.14) is now gone. From Andreas Vesalius, *De fabrica* (1543), 190, detail. Cambridge University Library, K.7.3.



> As this area in man is fully portrayed in Table VII, we have, with excessive devotion to Galen's teaching, depicted here a muscle which is found in dogs but not in man and is regarded by Galen as the third moving the thorax; the whole of it can be seen in the next table, where it is marked Γ.[114]

In the next table, Table VI, at Γ (fig. 10.14), Vesalius noted:

> This part of the chest and neck should have been drawn as in the following table [fig. 10.15, table VII]; but I decided it would not be entirely pointless to depict here from a dog the muscle mentioned by Galen that takes its origin (marked O) from the transverse processes of the cervical vertebrae; it is fleshy as far as the fourth rib, but at the point marked P it becomes a membranous tendon marked Q, and this extends further down to some of the ribs.[115]

Vesalius further explains the point about these animal muscles in his commentary (fig. 10.16), where the alphabetical superscript in the text refers to the key to the marginal text, which I have included in square brackets:

> The third [muscle][g] [g: Γ in Table VI] occurs only in apes and dogs, but I have included it (as I pointed out earlier) lest someone who relies too much on the text of Galen without doing any cutting may talk some nonsense about my having overlooked some muscles, an accusation that I do not deserve. . . . The third [muscle],[h] [h: Γ in Table VI; X in Table V] which stretches along the front of the second muscle, grows out from the inner area of the transverse process[i] [i: O in Table VI] of the second cervical vertebra and is fleshy there. It stretches downward, taking origin also from the following vertebrae, and eventually,

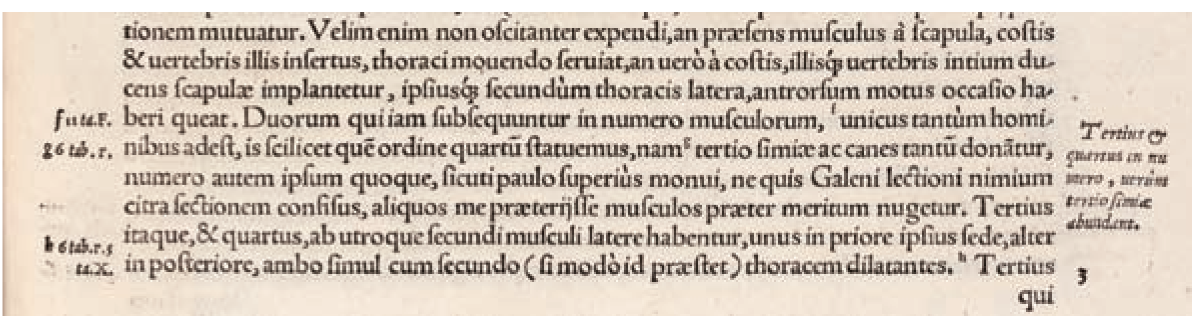

tionem mutuatur. Velim enim non oſcitanter expendi, an præſens muſculus à ſcapula, coſtis & uertebris illis inſertus, thoraci mouendo ſeruiat, an uerò à coſtis, illiſq; uertebris initium ducens ſcapulæ implantetur, ipſiuſq; ſecundùm thoracis latera, antrorſum motus occaſio haberi queat. Duorum qui iam ſubſequuntur in numero muſculorum, [f] unicus tantùm hominibus adeſt, is ſcilicet quē ordine quartū ſtatuemus, nam[g] tertio ſimiæ ac canes tantū donātur, numero autem ipſum quoque, ſicuti paulo ſuperiùs monui, ne quis Galeni lectioni nimium citra ſectionem confiſus, aliquos me præterijſſe muſculos præter meritum nugetur. Tertius itaque, & quartus, ab utroque ſecundi muſculi latere habentur, unus in priore ipſius ſede, alter in poſteriore, ambo ſimul cum ſecundo (ſi modò id præſtet) thoracem dilatantes. [h] Tertius qui

Fig. 10.16. Notes in the internal margins. The superscript *g* in the text is keyed in the margin to refer to the sixth table's **Γ** (see fig. 10.14) and *h* refers to both **Γ** in the sixth table and *X* in the fifth (see fig. 10.13). Andreas Vesalius, *De fabrica* (1543), 287, detail. Cambridge University Library, Keynes.P.7.20.

> enlarged by these various origins, joins up with the first thoracic rib . . . . The fleshy part of this muscle, which is attached to the ribs, proceeds together with its membranous tendon beside the region of the second muscle[m] [m: R in Table VI] that spreads out into fingers and is implanted into the ribs. In my public dissections I have shown quite clearly that this is what it is like in caudate apes and dogs (but it does not make its insertions in the hand-shaped pattern); but so far from being able to affirm that I have ever found or demonstrated it in man I can categorically state that humans do not have it. But in saying this I should not be taken to imply that students should set aside the authority of Galen and cease to look for it in man.[116]

The inclusion of an animal structure in the picture was, as Vesalius explained, to counter the possible charge that he was somehow negligent. Because Vesalius ended up correcting many of Galen's descriptions of the human body, a picture of human anatomy alone (with its discrepancy with the Galenic text) would expose Vesalius to the charge that he had not looked at the body carefully enough, or that he did not know his Galen well. By introducing the structure that matched Galen's description into the image of a human body, Vesalius thus offered a direct point of comparison to his readers.[117]

Vesalius's comparative argument was extended also to cases when there were similarities between human and animal anatomy:

> My assertion that there is so little difference between humans and quadrupeds in respect of this part of the humerus and the elbow joint will, I am sure, surprise the followers of Aristotle and all those who, in their writings on the movement of animals, have relied on his authority and particularly on what he said in his treatise *On the Common Movement of Animals*; among their number are Galen (in book III of *On the Function of the Parts*), Pliny, and among many others, our own Erasmus of Rotterdam in his dialogue on the game of dice (not an anatomical treatise). I choose a single point for comment. Aristotle and those who follow him say that flexion takes place in one direction in man and the opposite direction in quadrupeds: our flexion, they say, is forward and theirs is backward. This is not so. In fact, Aristotle deprives quadrupeds of one bone, the humerus; what he thinks is the joint between their arm and forearm is actually the joint between their forearm and carpus. In fact these animals have an elbow joint just as ours does. But Aristotle failed to notice the humerus, and also the femur, in these animals and in birds, perhaps because it is concealed within their body whereas ours is not. [118]

In this case, the authority in question was Aristotle, and by extension Galen (and others) who followed Aristotle. According to Vesalius, Aristotle had posited a false distinction between humans and animals, and thus pointing out the *similarities* between human and animals became a way to refute Aristotle's claims.

So Vesalius's "comparative anatomy" cut both ways, in showing how an animal structure was different from a human one, and in showing that the two were quite similar. Vesalius's point throughout was to establish that Galen, Aristotle, and others had confused animal and human structures while he, Vesalius, got them right. Nowhere, however, does Vesalius seek to describe the anatomical structure of the whole dog or an ape in a way that would allow a systematic comparison with humans. Rather, the pictorial comparison between animal and human structures functioned for Vesalius as a way to adjudicate between his own opinions and those of others on specific points about *human* anatomy. The

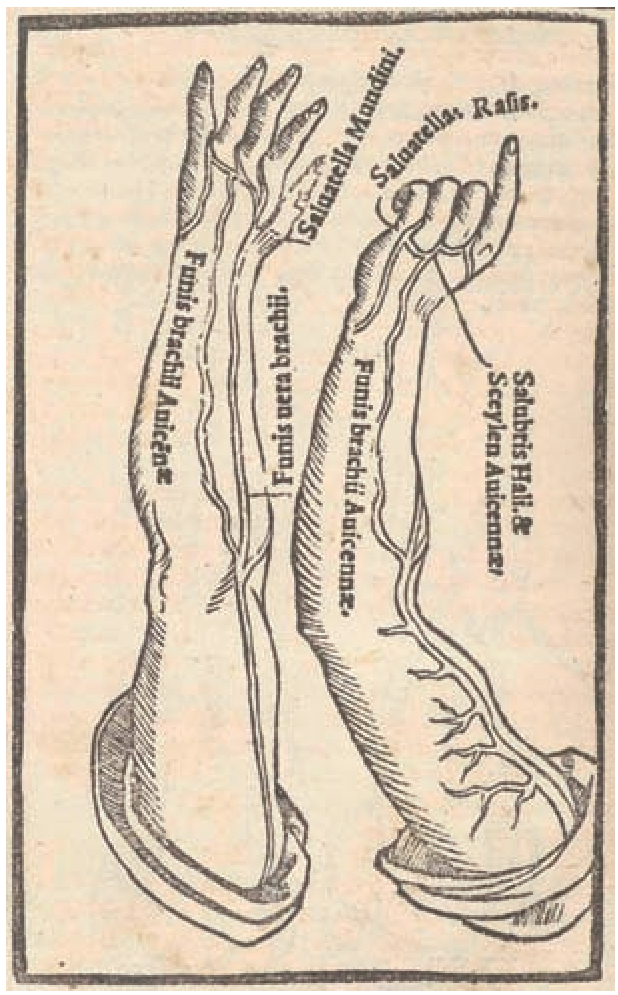


Fig. 10.17 Berengario here showed the "true" *funis brachii* (indicated on the arm to the left) as a branch of the cephalic vein terminating between the index finger and the thumb, to be compared with Avicenna's *funis brachii* (on the arm to the right) terminating near the middle finger near the vein called *sceylen* by Avicenna and *salubris* by Haly. From Berengario da Carpi, *Isagoge breves* (1523), 66v. National Library of Medicine, Bethesda, WZ 240 B488i 1523.

study of animal structures for the sake of understanding human bodies was not in itself a new method of investigation.[119] Nor was the use of pictures to differentiate competing views of medical authorities in itself unique to Vesalius—Berengario da Carpi had done precisely that, albeit in a cruder form, when he used a picture (fig. 10.17) to differentiate between true and false positions of the *funis brachii* and the *salvatella*.[120] Moreover, Vesalius did not always disclose his use of animal structures in his images.[121] When he did, the comparative figures lent his claims a persuasive edge and authority.

Despite impressions to the contrary, therefore, not all of the spectacular anatomical figures in *De fabrica* are human. Nor, strictly speaking, do these figures of the human body with partial animal structures embedded in them always depict the "canonical" body. They are instead a pictorial form of argument, showing that Vesalius's description fitted the anatomy of humans better than those of Galen or Aristotle. The pictures in *De fabrica* thus embodied the canonical body, the teleological method, and the authority that served to establish a newly and, to Vesalius's mind, properly revived knowledge of human anatomy that matched that of the ancients.

CHAPTER II

Text, Image, Body, and the Book

Res, Verba, Pictura

All good humanists would have agreed that a proper match between *res* (things) and *verba* (words) was a necessary foundation of a true description.[1] In his book, Vesalius ingeniously made *pictures* an integral part of establishing a match between *res* (the human body) and *verba* (his interpretation of it). When descriptions of the human body clashed—when it became Vesalius's word against the word of a revered ancient, it was necessary to show that the *res* fitted one set of *verba* better than another. This was done by means of pictures. In the dissection hall, it was also pictures that made the students believe that the body (*res*) matched Vesalius's *verba*. Neither in the book nor in the dissection hall could the process of establishing a correspondence between *res* and *verba* succeed without pictures.

Yet pictures were in turn dependent on the accompanying *verba*. Without the *verba*, it would have been impossible to determine which of the five skulls (fig. 11.1) represented the "natural" form, for instance.[2] Without the text, a novice would have been unable to tell that a particular muscle arrangement embedded in the human figure belonged to an animal, and that it thus showed how wrong Galen was. Without the text that explained what the reader *ought* to be seeing in the picture, the precise point of the

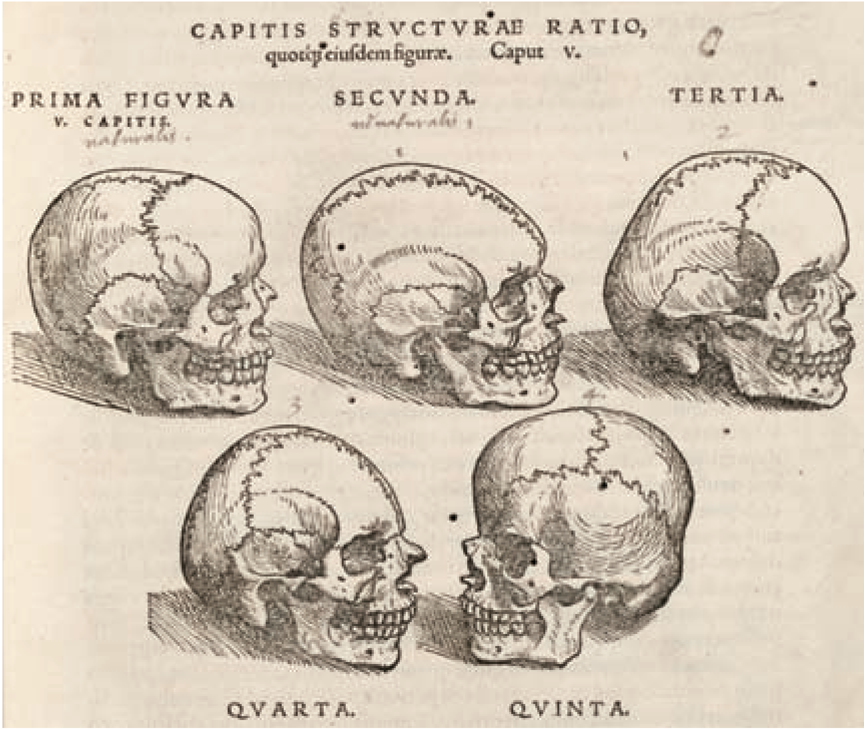


Fig. 11.1 Five skulls, of which only one (top left) is of a "natural" shape. A contemporary reader, Thomas Lorkyn, noted which was the "natural" shape, and numbered the other "non-natural" ones in the order discussed in the text. From Andreas Vesalius, *De fabrica* (1555), 21, detail. Cambridge University Library, N*.1.1(A).

picture would be lost. It meant that these pictures could not be understood fully by those who were illiterate or could not read Latin.

Vesalius was particularly anxious that Oporinus should print the figures in such a way as to ensure that the letters were visible.[3] In *De fabrica*, the figures were also keyed to the text: the keys were inserted into the inner margins of the main text (see fig. 10.16) "so that they should be for the reader a sort of commentary to the text [*commentarius scriptorum*] by indicating in which [figure] the part mentioned may be seen."[4] Linking text and image by a key was nothing unusual, but the extent to which Vesalius tied his text to the figures was extraordinary. By Nancy Siraisi's count, this "visual commentary" would require a conscientious reader to look over to the figures more than one hundred times for a six-page section on the differentiation of muscles.[5] The keys thus linked different parts of the book and guided the readers' turning of pages back and forth to connect passages of text with parts of a picture; in this way, readers were expected to come to an understanding of the human body in depth. This strategy was not, however, an invention by Vesalius, nor was it a form of directed reading unique to the printed book: as Peter Jones has shown, John of Arderne (1307/8–1377) compiled a pictorial manual on surgery that similarly required the reader to turn pages back and forth to make connections between text and image, though it is worth emphasizing that not all surgical tracts contained images or involved such close connections between image and text.[6]

Neither *res*, *verba*, nor *pictura* on its own could establish Vesalius's knowledge of pristine anatomy. It was the complex interdependence of the three, achieved through a reading practice that broke with the linear narrative style (of reading through a book from beginning to end) that established the object of the study, the *homo absolutus*. This *homo absolutus* was not something that one could come across in the dissection hall, as it was a general and idealized object of study—generalized and idealized precisely to make it worthy of a discipline that aspired to the status of philosophy, because it involved causes, particularly final causes.

Pictures could be used by Vesalius in this way because it could be assumed that pictures depicted the *res*. Vesalius drew Oporinus's attention to the pictorial quality (*ratio picturae*) of the figures in contrast to that of the simple line drawings in other textbooks, particularly with respect to the use of thicker lines along the shadings of the shadows, but he never explained how and why such a *ratio* might warrant a reliable relationship between the picture and the *res*.[7] For Vesalius, the reliability of pictures in representing the *res* was ultimately subsumed by the reliability of the author himself.[8] He dedicated his book to the emperor in the hope that such an august association would lend him some authority;[9] he listed prominent public figures who had made bodies available to him, such as the Venetian magistrate, Marcantonio Contarini;[10] and he demonstrated his personal commitment by explaining how he spent much time playing games in the cemetery with his fellow students:

> [At the Cemetery of the Innocents in Paris] we found a rich supply of bones, which we examined indefatigably over a long period until we were able to make a bet with our fellow-students that, blindfolded, we could identify by touch alone any bone which they pulled from the piles over a half-hour period and handed to us. We were forced to these lengths because though eager to learn, we had no teachers to assist us in this aspect of medicine.[11]

Vesalius further described vividly how, with the help of his friend Gemma Frisius (1508–1555), he stole from the gallows the skeleton of a burnt criminal, though in this anecdote there is a hint of his fashioning himself after Galen (*De anatomicis administrationibus*, 1.2).[12] He also provided a detailed "catalog," as it is called in his index, of women he had dissected: prostitutes hanged in Paris and Padua, the mistress of a monk of St. Anthony's at Padua (whose skin was quickly flayed by students in order to prevent identification), and an old woman who starved to death.[13] These details were another way to demonstrate Vesalius's dedication to the study of anatomy, as was a display of an array of dissection instruments (fig. 11.2). Though Vesalius was not the first to display the instruments he used, he explained their details; many were familiar everyday tools applied to the task of dissection.[14] This served to underline the fact that he used these tools with his own hands. These and other rhetorical strategies helped Vesalius instill confidence in his readers that he was reliable in his views about the human body—just as Galen's dissections were fashioned in the epideictic style of rhetoric in order to generate confidence (*pistis*) in the beholder.[15]

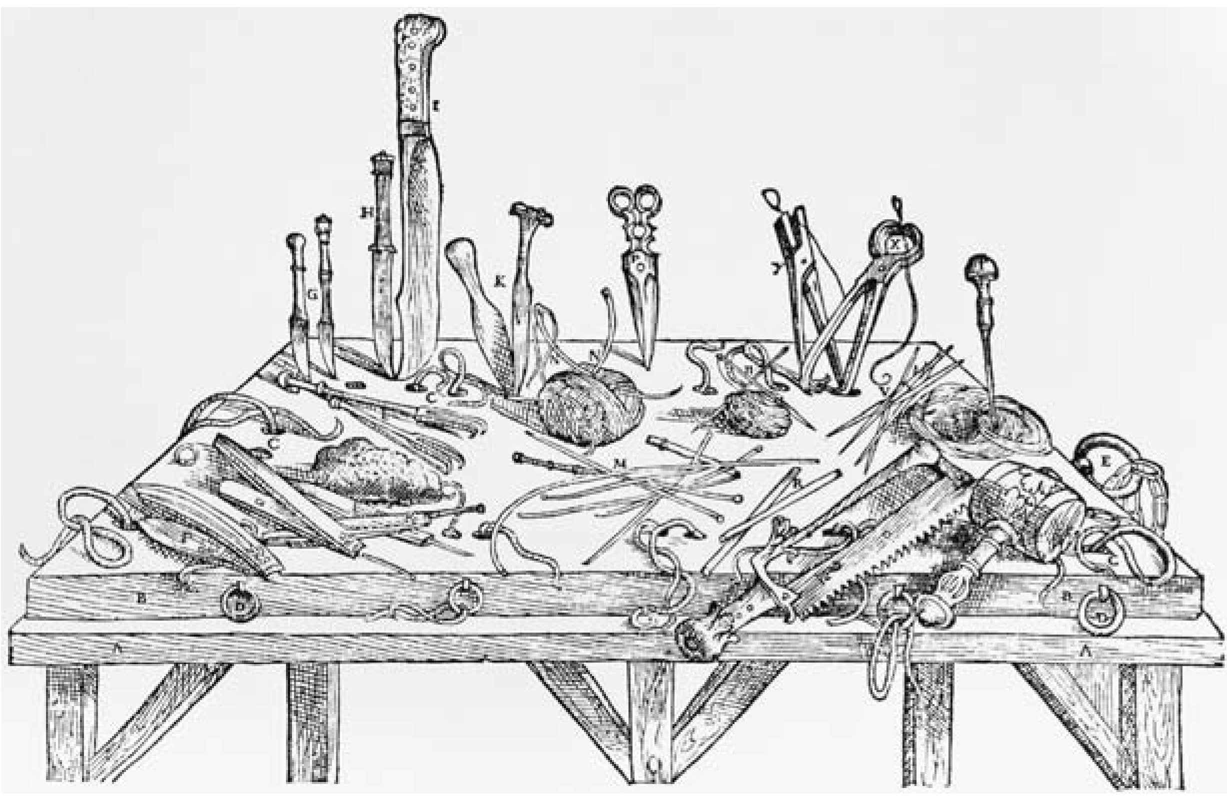
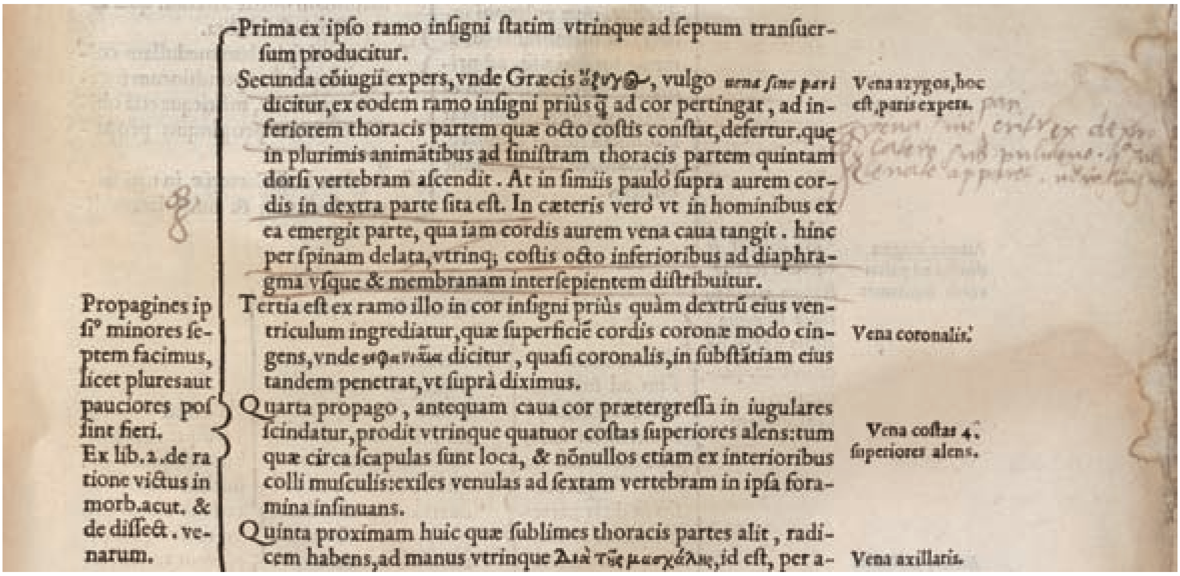


Fig. 11.2 A display of tools for vivisection and dissection made from familiar utensils: barbers' razors, sharp and blunt (*F*, front left corner); small knives for sharpening pens (*G*, back left corner); hooks made from table forks by filing down their tines and bending them into semicircles (*L*, in front of *G* and *H*); tubes made of reeds, for inflating parts of the body (*R*); and curved needles made from ordinary ones (*N*) and stuck in a ball of thick, preferably German thread used for sewing together fascicules of paper for the purpose of ligating vessels. From Andreas Vesalius, *De fabrica* (1543), 235, detail. Wellcome Library, London.

In its design and use of pictorial material, *De fabrica* was probably the most complex of sixteenth-century printed books—a result, no doubt, of the unusual extent of control Vesalius exercised over his pictures by paying for their preparation and collaborating very closely with the artists involved.[16] Yet, for all his efforts, *De fabrica* did not revolutionize anatomy or anatomical books overnight. Dissection practices at universities were slow to change, and use of pictures did not become the norm in anatomical works even in the eighteenth century.[17] In other words, despite the ingenious and complex ways in which Vesalius interlinked *res*, *verba*, and *pictura* in *De fabrica*, his visual arguments were rarely accepted as a whole. What is interesting to note is that rejection of his pictures did not always lead to rejection of his anatomical claims, for example of the structure of the azygos vein. Nor did objection to his description of the azygos vein rule out the use of pictures; even if one conceded Vesalius's authority on anatomy, it did not mean that one had to use pictures in a Vesalian way. In the remainder of this chapter, I will discuss three examples that highlight these points. Vesalius's former teacher, Jacques Dubois, objected to the use of pictures but accepted Vesalius's description of the azygos vein for reasons that were different from Vesalius's own. Bartolomeo Eustachi, who doubted Vesalius's configuration of the vein, used images to make his point. And even after Felix Platter accepted the value of Vesalius's images and discoveries, the experience of reading Platter's book was quite different from that of reading Vesalius's tome. All three of these physicians had very different views about how body, text, and image should be related in their books.

Dubois against Vesalius's pictures

Dubois felt moved to defend "divine" Hippocrates and his admirable interpreter Galen—both of whom he regarded as the most perfect men (*absolutissimos*), who had written nothing untrue in any part of medicine—against the vainest calumnies of a most arrogant and ignorant madman, or *vesanus*—a poor pun on the name Vesalius.[18] Dubois had already expressed in 1539 his criticism of using pictures as the primary means of learning anatomy.[19] He repeated the point later in his commentary on Galen's *De ossibus*, explaining that he had not included pictures of bones with their names because he preferred for students to see, handle, and weigh the bones themselves rather than having to work them out from obscurely shaded images with improperly proportioned lines.[20] Seeing was more certain than hearing in forming belief, but touch was the most certain sense for humans.[21] Ironically, however, we know from a contemporary account by Noël du Fail that in his lectures on *De usu partium* in the late 1530s or early 1540s, Dubois had in fact used figures and images when describing the genital organs, and had also brought in animal or human limbs tucked up his sleeves.[22]


Prima ex ipso ramo insigni statim vtrinque ad septum transuersum producitur.
Secunda cõiugii expers, vnde Græcis ἄζυγος, vulgo vena sine pari dicitur, ex eodem ramo insigni priùs q̃ ad cor pertingat, ad inferiorem thoracis partem quæ octo costis constat, defertur, quę in plurimis animãtibus ad sinistram thoracis partem quintam dorsi vertebram ascendit. At in simiis pauló supra aurem cordis in dextra parte sita est. In cæteris veró vt in hominibus ex ea emergit parte, qua iam cordis aurem vena caua tangit. hinc per spinam delata, vtrinq; costis octo inferioribus ad diaphragma vsque & membranam intersepientem distribuitur.
Tertia est ex ramo illo in cor insigni priùs quàm dextrũ eius ventriculum ingrediatur, quæ superficiẽ cordis coronæ modo cingens, vnde στεφανιαία dicitur, quasi coronalis, in substãtiam eius tandem penetrat, vt suprà diximus.
Quarta propago, antequam caua cor prætergressa in iugulares scindatur, prodit vtrinque quatuor costas superiores alens: tum quæ circa scapulas sunt loca, & nõnullos etiam ex interioribus colli musculis: exiles venulas ad sextam vertebram in ipsa foramina insinuans.
Quinta proximam huic quæ sublimes thoracis partes alit, radicem habens, ad manus vtrinque διὰ τῆς μασχάλης, id est, per a-

Propagines ipsi⁹ minores septem facimus, licet pluresaut pauciores possint fieri. Ex lib. 2. de ratione victus in morb. acut. & de dissect. venarum.

Vena azygos, hoc est, paris expers.
Vena coronalis.
Vena costas 4. superiores alens.
Vena axillaris.

Fig. 11.3 Tabulated description of the human body, including the azygos vein, which is here described as emerging from the point at which the vena cava touches the ear of the heart, and then running down to the diaphragm with eight intercostal tributaries on each side. Thomas Lorkyn noted in the margin that the origin of the azygos vein was on the right, not the left, of the vena cava. From Loys Vassé, *In anatomen corporis humani, tabulae quatuor* (1541), 15r, detail. Cambridge University Library, N*.3.17(B).

It may well be that in Dubois's lecture hall, figures and objects could be useful in illustrating the divine text of Galen.

In a book, however, Dubois appears to have believed that a tabular form would be more useful, just like the format he had used in his textbooks for causes and symptoms of diseases and on medicinal composition (see fig. 9.3). Loys Vassé, a student of Dubois, compiled a textbook on anatomy in tabular form (fig. 11.3), published first in 1540 as *In Anatomen corporis tabulae quatuor* (Four tables on the anatomy of the human body).[23] Vassé in fact credited his teacher with its content, which covered the venters, thorax, head, and limbs in just over forty folio sheets with generous margins.[24] Vassé explained, in a spirit similar to that of his teacher, that he wanted to bring together the anatomical topics of the ancients, which were dispersed widely across many writings, in a kind of compendium and place them before the reader's eyes in tabular form as a "path" (*via*) or "method" (*methodus*) to the divine work *De usu partium*.[25] Vassé pointed out how knowledge of anatomy was, like a mirror, necessary for knowing oneself.[26]

Dubois's own textbook on anatomy, *In Hippocratis et Galeni Physiologiae partem anatomicam Isagoge* (Introduction to the anatomical part of the physiology of Hippocrates and Galen), was published posthumously in 1555. The book's preface is well known for having offered an extensive list of ancient sources to indicate that human (as well as animal) bodies could vary in size and in the number, shapes, and locations of their internal parts.[27] To judge from ancient skeletons and sarcophagi, Dubois pointed out, the ancients had much larger bodies and were capable of amazing feats like those of Milo of Croton, who carried a live cow across a stadium, or like the military exploits of Diomedes (*Iliad*, book 5). Meanwhile, Dubois added, certain other things were impossible for these ancients, such as ambidexterity in women (Hippocrates, *Aphorisms*, 7.43). According to the Bible, people in ancient times also lived much longer. Ancient sources further confirmed that region, climate, or diet could cause variation. There were Asian people with large deformed heads (Hippocrates, *Airs, Waters, and Places*, 14) and Ethiopians with bandy legs because of the heat (*Problemata*, 14); excessive salt taken during pregnancy could cause a child to be born without nails (*Historia animalium*, 7.4); menopausal women and some priestesses in Caria had beards and harsh voices (*Historia animalium*, 3.11). Dubois, of course, did not miss the chance to list "nature's playthings [*ludibrilia naturae*]," the famous monstrous people in faraway lands, such as those who had a single eye, were dog-headed, or were of indeterminate sex, as recounted in Pliny the Elder's *Historia naturalis* (7.2).[28] The contemporary outbreak of the "sweating sickness" in England was another confirmation that climate affected susceptibility to certain diseases.[29]

Dubois divided his textbook into three parts. The first part dealt with the bones, cartilage, ligaments, fat, and marrow; the second book with veins, arteries, muscles, and tendons; and the third book with the rest of the body, namely the head, stomach, and principal organs. In the second of these books Dubois explained, using tabulation, that the azygos vein had always been observed by Galen to originate from under the heart in a body that had seven bones in the sternum, rather than the normal three, and thus a longer thorax. But in "our bodies," because of the shorter thorax, the azygos vein originated from above the heart, more or less inside the pericardion, and ran down the right side of the body, down to the seventh intercostal spaces, nourishing both sides.[30] This largely agreed with Vesalius's description of the origin and shape of the vein.

Thus, according to Dubois, the diminished size of the modern human body had anatomical implications. This was the whole point of his book: to show that the discrepancy between Galen's descriptions and the contemporary human body could be explained in historical terms—the human body had changed. Whether or not one dismisses this explanation as a desperate attempt to save the authority of Galen in the face of anatomical evidence, Dubois was by no means unique in his time in believing that the human body had a history, as Siraisi has pointed out.[31] What is clear is that Dubois did not believe that pictures could be an effective means of resolving the discrepancy between Galen's description and the human body. Dubois had on the whole accepted Vesalius's description of the azygos vein, or at least had conceded that Galen's description did not apply to the contemporary human body, though for reasons completely different from those of Vesalius.[32]

In the last section of the book, entitled "De administratione anatomica" (On anatomical procedure), Dubois explained the choice of a body for purposes of dissection, as well as the method of dissection.[33] He stated that the body should be temperate—meaning well-built, of medium size, young, and very healthy. For the purpose of practicing cutting, however, any body would do. A slender body could show veins, arteries, and nerves more clearly, a fatter body could show the fat, and a tall or short body might show how size could affect parts of the body. The body of a child would be easier to cut because of its softness, while the body of an older person would have more perfectly formed bones, though the tough skin would make it harder to dissect. Dubois recommended that even diseased bodies should be dissected, to learn more about causes of death.[34] In dissecting bodies of executed criminals, a drowned body was preferable to one that had been strangled or beheaded, as drowning kept all the organs intact.[35] Thus, while stating that a temperate, well-built, medium-sized body would be most desirable, Dubois also dealt in his text with various other bodies one might come by, and explained how they could still be useful for the purposes of anatomical study. For the benefit of his students he also added a list of variations that he himself had observed.[36] Hence, his emphasis on the variability of the human body was not an ad hoc excuse for preserving Galen's authority, but an important point about the kinds of bodies his students might encounter in the dissection hall.

For anatomical procedures, Dubois repeated his earlier point that touching and seeing were more important than hearing or reading.[37] Worth noting is that even with structures such as blood vessels that might be too fine and difficult to see, he urged students to use their hands, fingers, or nails to trace their courses, and to make ligatures at certain intervals to preempt effusions of blood by accidental perforation. Dubois even recommended the use of instruments: thin wires made of iron, lead, or plant fiber could be threaded through the vessels to dissect the veins and arteries. One could also blow air into these vessels using a kind of tube or straw in order to make more conspicuous the ramifications—a method Dubois preferred to injecting the vessels with colored liquid.[38] Dubois thus urged the students to use their hands at a point where Vesalius would have pointed at a picture.

It would be misleading to conclude that Dubois's textbook eschewed any generalization about the human body. He did give generalized descriptions gathered from the writings of Hippocrates and Galen, explaining them not with pictures but with tables. The final section of his book suggested ways in which his students could cope with the reality of variable bodies using their own hands. Dubois thus accepted Vesalius's description of the azygos vein, gave a historical reason why it differed from Galen's text, avoided the use of pictures both in his books and in the dissection hall, and insisted that students use their own hands.

Eustachi against Vesalius's Azygos Vein

Bartolomeo Eustachi disagreed with Vesalius's anatomical findings, including the structure of the azygos vein. In 1563 he published a collection of anatomical tracts, *Opuscula*, which was reissued in 1564. In some copies the first twenty-five pages included eight copper engravings, mainly of kidneys (fig. 11.4), completed around 1552.[39] Eustachi explained that there were more figures—indeed, forty-seven of them, drawn by Pier Matteo Pini and engraved by Giulio de'Musi, for a book he was hoping to publish soon, entitled *De dissensionibus ac controversiis anatomicis* (On anatomical disagreements and controversies).[40] As was often the case with ambitiously illustrated books, this book was not published during Eustachi's lifetime, but from the text on the azygos vein included in the *Opuscula*, we can detect the polemical flavor of his projected book: Eustachi first quoted a description from Vesalius in a "syngramma," and then responded against it in an "antigramma."[41]

In the *Opuscula*, Eustachi questioned whether Vesalius's writings contained true descriptions of humans because of Vesalius's frequent use of descriptions from animals.[42] Instead of acting out of ambition and envy, as he charged Vesalius of doing, Eustachi proposed to assess what Galen had taught about the azygos vein against what could be discerned in dissections.[43] He set himself up as following the minds of those who judged points of contention "with sincerity," confirmed by anatomical investigation, rather than simply following brute senses or perverse interpretations. Eustachi argued that he had established that the azygos vein issued from under the heart, precisely as Galen had taught.[44] We would expect him to have had the same problem as Vesalius—namely, how to justify his view that one description was correct and another not. Eustachi's solution was to describe what he saw—that the azygos vein issued from the back and lower part of the cava, a little off center and to the right—in terms of the experience of anatomizing: "Unless you take away the right part of the lung and look to the left at the heart and vena cava, you cannot see the origin of the azygos vein, which should not really be the case if it originates from the right

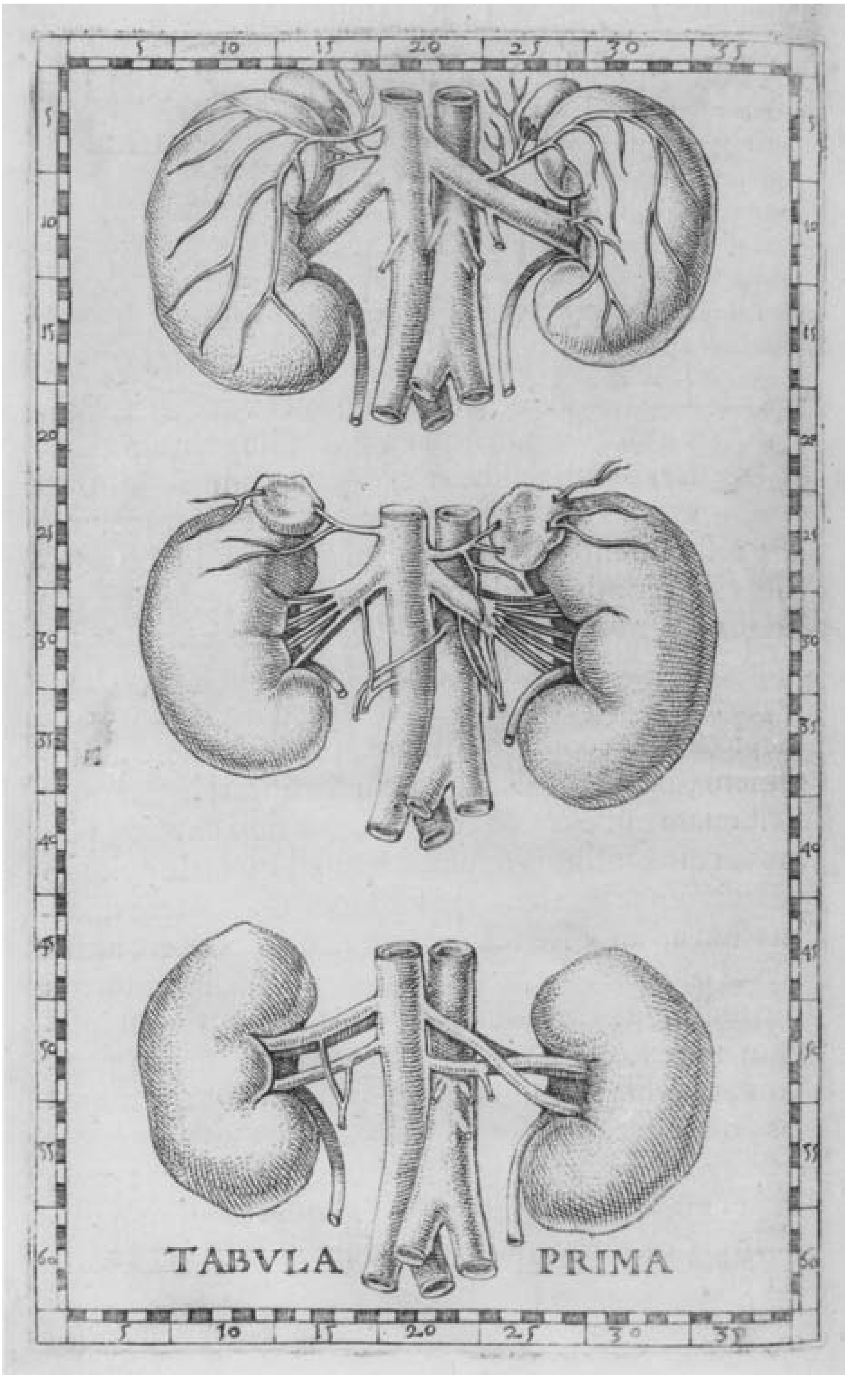


Fig. 11.4 Kidneys on a coordinate system. From Bartolomeo Eustachi, *Opuscula anatomica* (1564), table 1. Eustachi suggested the use of a ruler to locate the points specified in the text. Cambridge University Library, K.9.37. Grid, 16.3 × 9.9 cm.

side of the cava as Vesalius described."[45] So the thrust of the argument was that if the reader dissected a body, this was the experience they would have, and it would show that Vesalius was wrong. This was not a simple prediction of the future experiences of anatomy students, but a form of authoritative rhetoric, familiar to those who knew Mondino's *Anatomia* or Galen's *De anatomicis administrationibus*.

Almost all the plates in the *Opuscula* showed the kidneys, but Eustachi included three azygos veins at the top of the fourth table (fig. 11.5). His plates were surrounded by grids of vertical and horizontal degrees, which would have been a common sight in the period of Ptolemaic maps (see, for example, figs. 1.5 and 3.8). These grids did not indicate coordinates that referred to positions existing elsewhere, in the way that the grid on a map indicates coordinates that refer to positions on the earth. Rather, they were a means of specifying particular points in the pictures. Eustachi suggested ways for the reader to find the precise points. For instance, a copper ruler with markings matching the gradations of the horizontal grid could be placed horizontally against the value of the vertical grid, and then the number read off of the horizontal grid on the ruler, which would specify the point. Alternatively, a reader could use a circular plane made of iron or wood whose circumference was a little wider than the book, with two cords intersecting at right angles fastened to it; by moving the cords to the vertical and horizontal values specified in the index, the intersection of the cords would pinpoint the position in question.[46]

The text on the facing page of the plate (fig. 11.5) first indicated the common structure of the azygos veins using coordinates (with the vertical values given first): "The tip of the azygos vein is at 6, 3÷; 7, 16÷; 7, 29," where "÷" denotes one-half.[47] The grid allowed Eustachi to direct the reader to the same structure across different examples, but it was also a way to maintain scale. Hence, the division of the lower end of the azygos vein was around the tenth thoracic vertebra, at (13, 5) and (13½, 18); but in the third figure it was around the eighth thoracic vertebra (11, 30), as "had been observed by us occasionally."[48] The assumption here is that the azygos veins were represented to scale in relation to each other: hence the difference of the vertical values (11 or 13) corresponded to an anatomical and structural difference (tenth or eighth vertebra).

Eustachi then elaborated on the differences among the three azygos veins. In the first and the third figures, the ends of the two branches of the azygos vein joined up to the (inferior) vena cava under the point from which the emulgent veins issued—they joined at (19½, 3) and (18, 6½) in the first figure, and at (20, 28 2/3) and (20, 31½) in the third. In the middle figure, however, they joined at (20, 16 ¼) and (19, 19½), the left (or right, from our point of view) branch showing that it joined the emulgent vein before producing the seminal vein. In the second figure, two costal branches of the azygos vein joined at two points with a

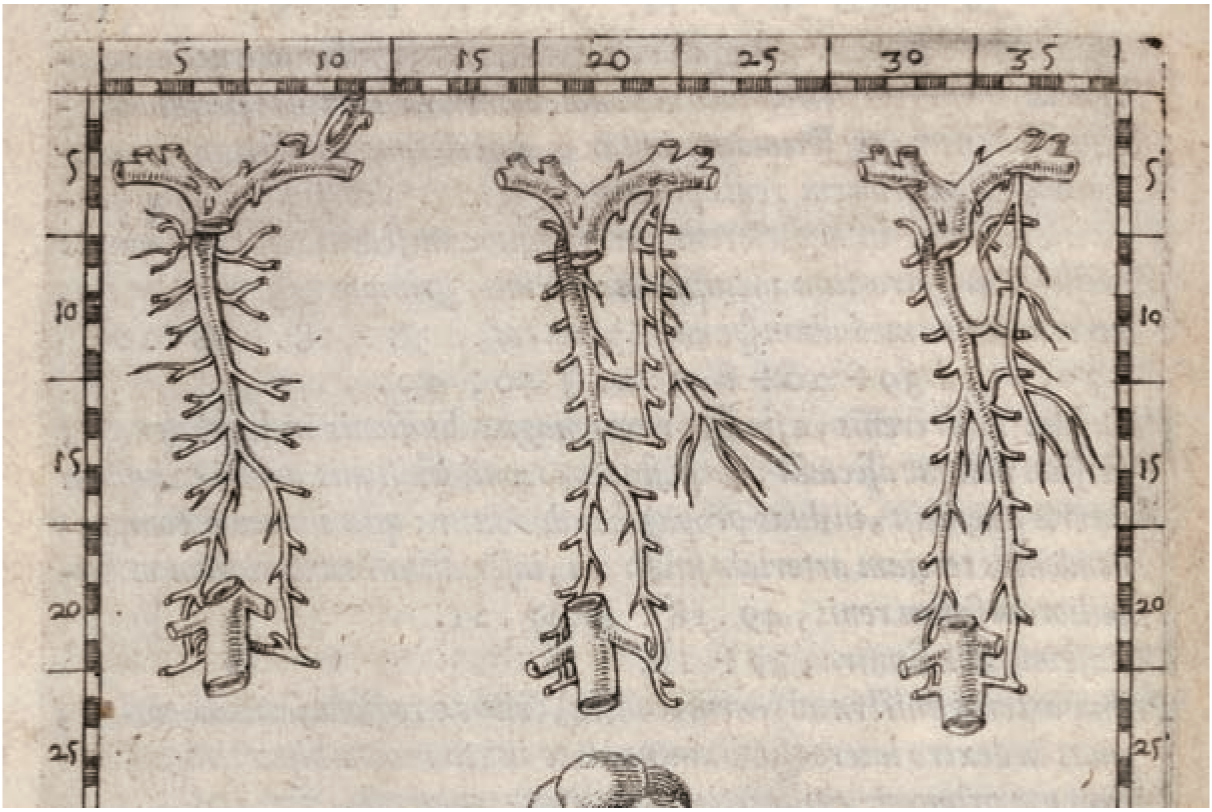


Fig. 11.5 Three specimens of the azygos vein. From Bartolomeo Eustachi, *Opuscula anatomica* (1564), table 4, detail. Eustachi gives coordinates of the grid (vertical value first; "÷" denotes a half), and thus pinpoints the azygos vein in the three figures as: 6, 3÷ ; 7, 16÷ ; 7, 29. Cambridge University Library, K.9.37.

vein running down from the left jugular vein; and in the third figure a very small vein issuing from the left jugular vein joined up with a branch of the azygos vein which issued from the sixth space (8, 30) and arched upwards.[49]

Eustachi's figures of the azygos vein thus were figures of individual veins, with variations peculiar to them, and Eustachi pointed out both the common structures and variations of each using the coordinate system. This was because Eustachi believed that the human body was variable and inconstant.[50] The grid system allowed him to pinpoint which part of the plate he was discussing, and allowed him to deal with individual variations (some of which were very fine structures) without cluttering the plate with a large number of keys.

There appears to have been, however, a gap between these figures and the main text. Eustachi's tract discussing the azygos vein did not refer back to these figures, nor did the descriptions accompanying the figures point to the main text.[51] The three azygos veins in the engraving were all depicted as originating from the back of the vena cava, with small (that is, certainly less pronounced than in Vesalius's images) arches to the right of the body, which did indeed fit with Eustachi's description in the main text, but Eustachi never invoked a match with these figures in support of his argument in the main text, perhaps because a sample of three could not be a satisfactory basis for generalization to someone who believed that anatomical structures were variable. Intriguingly, elsewhere in the tract on kidneys, Eustachi discussed what might be typical configurations of an organ, for which he invoked the idea of a "law of nature" (*lex naturae*).[52]

Eustachi's book was thus a response to what Vesalius had written, and although Eustachi sought to defend Galen's authority, he approached the description of human anatomy through the experience of dissecting, which then was compared with the description by the ancients. Vesalius's work had thus set the agenda for further anatomical research by Eustachi, who queried his descriptions using the same method of firsthand dissection Vesalius himself had promoted. What Eustachi did *not* accept was Vesalius's use of the images of idealized human bodies. Eustachi's images resolutely recorded individual cases, and the grid system allowed him to guide his readers efficiently through variations and common features across different examples. He did not, however, invoke these examples to support his argument in the main text, or his idea of a general "law of nature." Though no single organ was depicted as the ideal or generalized object of study, and no single specimen was designated as the touchstone for all other examples, Eustachi still had a sense that individual organs could embody some aspect of a general law of nature.[53]

In sum, Eustachi did not accept Vesalius's description of the azygos vein on the basis of his own experience of dissection, an approach that Vesalius would have approved of. Eustachi used images in his book, but not in the way that Vesalius had; the engravings reflected his belief in individual organs as embodying a general law of nature, and so he avoided visualization of a canonical structure.

Felix Platter: Canonization and Tabulation

In his *De corporis humani structura et usu* (1583), Felix Platter was explicit in acknowledging that the images in his books were copied from Vesalius: in Platter's mind, no one had had anatomical figures depicted better or more correctly than Vesalius. Platter had even thought of purchasing the woodblocks from Vesalius's heirs when the opportunity arose, but using them would have required a book so large as to be unhelpful to the students. So instead, Platter had Vesalius's images copied and made smaller.[54] He also warned his readers that the fact that certain letters were missing or out of order in the pictures was deliberate and not accidental, because Platter had tried to retain Vesalius's original lettering when merging several of his images into one figure.[55] Platter further explained that retaining Vesalius's lettering allowed the points in his own pictures to be compared directly with those in Vesalius's originals.[56] This amounted to treating Vesalius's images as a yardstick against which Platter's own images could be measured—a form of canonization (fig. 11.6).[57]

Platter's book comprised three parts: two books of text in one volume, and another volume of images. The text was characterized by extensive tabulation

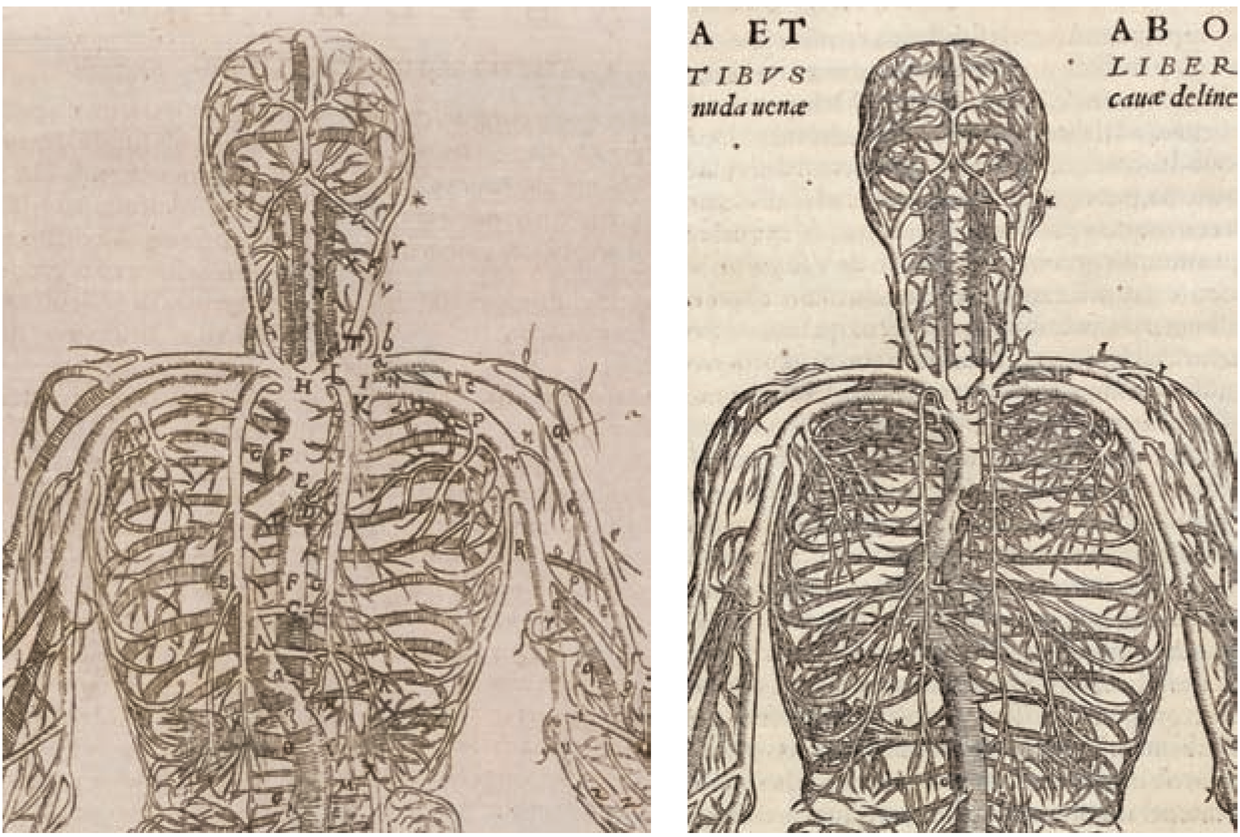
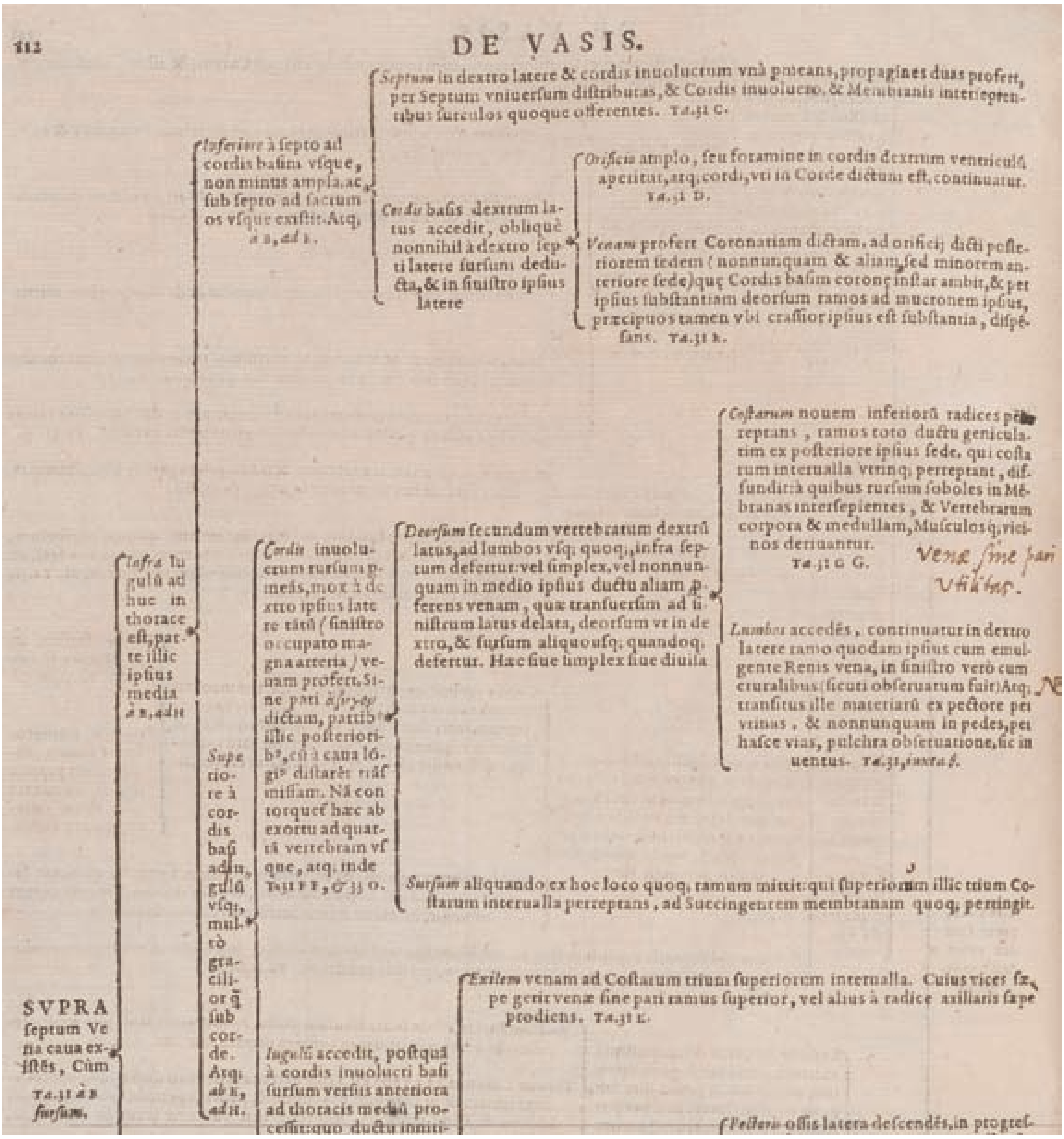


Fig. 11.6 In Felix Platter's etching (a), an asterisk indicates the facial vein running behind the ears, *YVT* the external jugular vein, *H* the division of the hollow vein (vena cava) near the throat; *FF* the azygos vein issuing from the right side of the vena cava and descending along the right side of the vertebrae as far as the second lumbar, *GG* the offshoots of the azygos vein, and θ the large vein stretching to the right kidney. A comparison with Vesalius's woodcut (b) shows that Platter indeed used the same lettering as Vesalius, but it also highlights the difficulty of locating the keys in Vesalius's woodcut, which was a complaint commonly expressed by his contemporaries. From Felix Platter, *De corporis humani structura et usu* (1583), table 31, detail, Wellcome Library, London; also from Andreas Vesalius, *De fabrica*, [368], detail, Cambridge University Library, K.7.3.

by dichotomies, which Platter argued to be the best form of instruction for "philosophical synthesis" (the first volume) and "anatomical analysis" (the second volume).[58] Though dichotomies were well known and used extensively in medical and legal literature before his time, it was Petrus Ramus (1515–1572) who endowed them with special philosophical significance.[59] Ramus sought to establish, through the reform of dialectics, a single method that would enable humans to master any art or branch of knowledge. This method would be underpinned by the belief that it corresponded to the structure of the world and to the capacity of the mind.[60] The key to acquiring this method was "exercise" (*usus* or *exercitio*), as principles of knowledge were proven correct through their successful use and application.[61] This exercise entailed "analysis" and "synthesis." "Analysis" was a process of breaking down through successive dichotomies what was already composed and constructed, so that sufficient knowledge of the parts could thus be obtained. Sufficient knowledge of the whole was acquired through reassembling the parts into a whole, which was "synthesis." Ramus visited Basel during 1568 and 1569, though the impact of his pedagogy in the university there was not felt until towards the end of the sixteenth century and the beginning of the seventeenth.[62] Platter had indeed come under Ramus's spell.[63]

Platter's first book fitted the idea of a "philosophical synthesis," as he set out to explain how the human body was made up of generic parts such as bones, muscles, viscera, vessels, cartilage, ligaments, membranes, skin, and fat.[64] In this part, Platter set up his dichotomies to proceed by function, which made them "philosophical" in the sense of explaining why the parts were designed in the particular ways that they were. The parts were first divided into primary parts, which made up the bulk of the body (bones, muscles, viscera), and secondary parts, which served the primary parts. The secondary parts were further divided into those that served the primary parts properly, by carrying something else (vessels) or completing them (cartilages and membranes), or improperly, by adding fat. Vessels were divided into those that served the whole body and those that served a particular part; the former were further divided into filled vessels, namely the nerves, and hollow vessels, namely the veins and arteries. Veins were viewed as serving either the whole body or specific parts, with two serving the whole body: the vena cava and vena porta. The vena cava was divided into parts that lay above and below the diaphragm (fig. 11.7): the vena cava above the diaphragm was further divided into parts below and above the clavicle, while the vena cava below the clavicle was divided into parts below and above the base of the heart. The azygos vein was described as issuing from the vena cava above the heart, running down the right of the body, and nourishing the thorax. At this point Platter referred the reader to the figures "F, F" in table 31 (fig. 11.6) and "o" in table 33, (fig. 11.8).[65]



112 DE VASIS.

SVPRA septum Vena caua existēs, Cùm Ta.31 à 3 sursum,

Infra Iugulū ad huc in thorace est, parte illic ipsius media à 3, ad H

Inferiore à septo ad cordis basim vsque, non minus ampla, ac sub septo ad sacrum os vsque exstitit. Atq; à 3, ad 2.

Septum in dextro latere & cordis inuolucrum vnà permeans, propagines duas profert, per Septum vniuersum distributas, & Cordis inuolucro, & Membranis intersepientibus surculos quoque offerentes. Ta.31 C.

Cordis basis dextrum latus accedit, obliquè nonnihil à dextro septi latere sursum deducta, & in sinistro ipsius latere

Orificio amplo, seu foramine in cordis dextrum ventriculū apertitur, atq; cordi, vti in Corde dictum est, continuatur. Ta.31 D.

Venam profert Coronariam dictam, ad orificij dicti posteriorem sedem (nonnunquam & aliam, sed minorem anteriore sede) quę Cordis basim coronę instar ambit, & per ipsius substantiam deorsum ramos ad mucronem ipsius, præcipuos tamen vbi crassior ipsius est substantia, dispēsans. Ta.31 E.

Supe riore à cordis basi ad Iugulū vsq;, multò gracilior q̄ sub corde. Atq; ab E, ad H.

Cordis inuolucrum rursum permeās, mox à dextro ipsius latere tātū (sinistro occupato magna arteria) venam profert, Sine pari ἄζυγον dictam, partib⁹ illic posteriorib⁹, eā à caua lōgi⁹ distarēt trāsmissam. Nā contorquet hæc ab exortu ad quartā vertebram vsque, atq; inde Ta.31 F F, & 33 O.

Deorsum secundum vertebratum dextrū latus, ad lumbos vsq; quoq;, infra septum defertur: vel simplex, vel nonnunquam in medio ipsius ductu aliam proferens venam, quæ transuersim ad sinistrum latus delata, deorsum vt in dextro, & sursum aliquousq; quandoq; defertur. Hæc siue simplex siue diuisa

Costarum nouem inferiorū radices perreptans, ramos toto ductu geniculatim ex posteriore ipsius sede, qui costarum interualla vtring; perreptant, diffundit: à quibus rursum soboles in Mēbranas intersepientes, & Vertebrarum corpora & medullam, Musculosq; vicinos deriuantur. Ta.31 G G.

Vena sine pari Vhictus.

Lumbos accedēs, continuatur in dextro latere ramo quodam ipsius cum emulgente Renis vena, in sinistro verò cum cruralibus (sicuti obseruatum fuit) Atq; transitus ille materiarū ex pectore per vrinas, & nonnunquam in pedes, per hasce vias, pulchra obseruatione, sic inuentus. Ta.31, iuxta θ.

Sursum aliquando ex hoc loco quoq; ramum mittit: qui superiorum illic trium Costarum interualla perreptans, ad Succingentem membranam quoq; pertingit.

Exilem venam ad Costarum trium superiorum interualla. Cuius vices sæpe gerit venæ sine pari ramus superior, vel alius à radice axillaris sæpe prodiens. Ta.31 K.

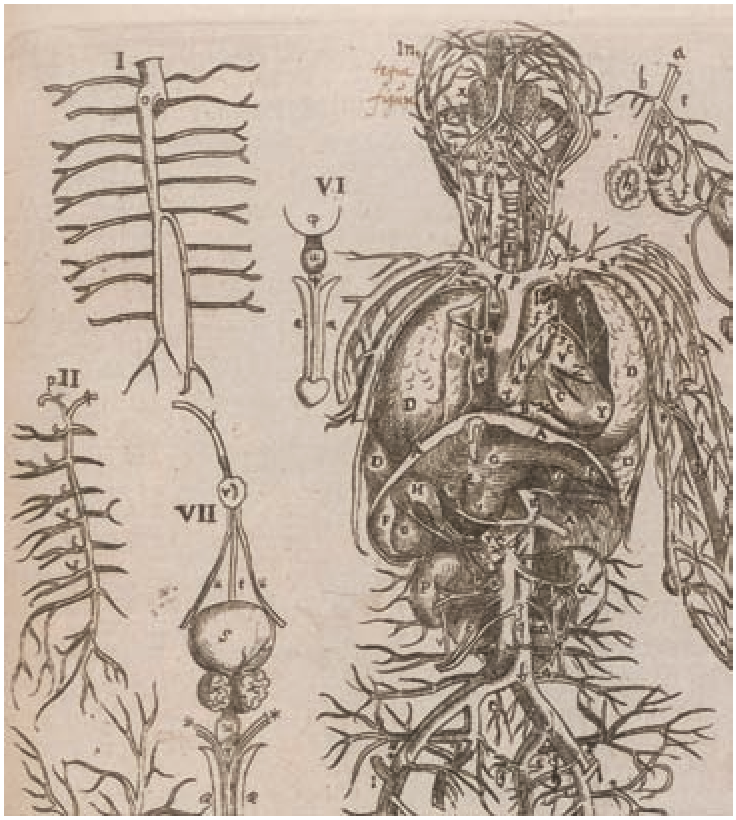
Iugulū accedit, postquā à cordis inuolucri basi sursum versus anteriora ad thoracis mediū processit: quo ductu inniti-

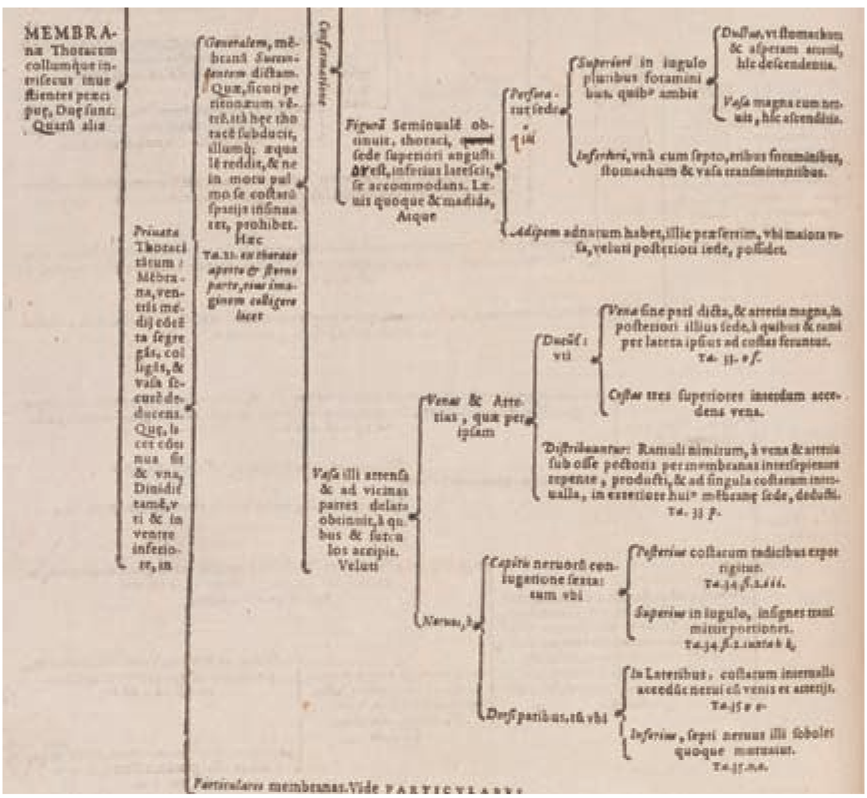
Pectoris ossis latera descendēs, in progres-

Fig. 11.7 "Philosophical synthesis." The description on this page starts with the vena cava above the diaphragm, which is then divided into segments below and above the clavicle (first division). The vena cava below the clavicle is then divided into segments below and above the base of the heart (second division), while the vena cava above the heart is divided into two parts, one of which reaches the clavicle while the other issues the azygos vein to the right of the vena cava (because the left side is occupied by the great artery). Here, in the third division, reference is made to table 31, *FF* (see fig. 11.6) and table 33, *o* (see fig. 11.8). The azygos vein is then described as being divided into one part of the vein running downward and the other sometimes branching upward, reaching the spaces between the superior three ribs. The part of the azygos vein tending downwards is even further divided (in the last division on the page) into separate parts that reach the roots of the nine intercostal veins (indicated at table 31, *GG*,) or the renal vein, at table 31, θ. From Felix Platter, *De corporis humani structura et usu* (1583), 1:112, detail. Wellcome Library, London.

Fig. 11.8 In the human figure on the right, *f* indicates the great artery and *o* is the origin of the azygos vein, which is also keyed in figure I at the upper left. The illustration is based closely on Vesalius's woodcuts. From Felix Platter, *De corporis humani structura et usu* (1583), table 33, detail. Wellcome Library, London.

Fig. 11.9 "Anatomical analysis." The azygos vein and the great artery are listed at the end of the dichotomies as the veins that run through the thorax, being vessels that serve the membrane covering the whole thorax. The keys refer to points *o*, for the azygos vein, and *f*, for the great artery, both in table 33 (see fig. 11.8). Detail from Felix Platter, *De corporis humani structura et usu* (1583), 2:168. Wellcome Library, London.





MEMBRANA Thoracem collumque intrinsecus inuestientes præcipue, Due sunt: Quarũ alia

Generalem, mẽbranã Succingentem dictam. Quæ, sicuti peritonæum vẽtri, ità hec thoracẽ subducit, illumq; æqualẽ reddit, & ne in motu pulmo se costarũ spatijs insinuaret, prohibet. Hæc Ta.21. ex thorace aperto & sterni parte, eius imaginem colligere licet

Conformatione

Figurã Seminualẽ obtinuit, thoraci, sede superiori angustior est, inferius latescit, se accommodans. Læuis quoque & madida, Atque

Perforatur sede

Superiori in iugulo pluribus foraminibus, quib^9 ambit

Ductus, vt stomachum & asperam arteriã, hic descendentia.

Vasa magna cum neruis, hic ascendentia.

Inferiori, vnà cum septo, tribus foraminibus, stomachum & vasa transmittentibus.

Adipem adnatum habet, illic præsertim, vbi maiora vasa, veluti posteriori sede, possidet.

Priuata Thoracicorum: Membrana, ventris mediũ cõcẽta segregãs, colligãs, & vasa secure deducens. Quæ, licet cõtinua sit & vna, Diuidit tamẽ, vti & in ventre inferiore, in

Vasa illi attensa & ad vicinas partes delata obtinuit, à quibus & surculos accipit. Veluti

Venas & Arterias, quæ per ipsam

Ducũ : vti

Vena sine pari dicta, & arteria magna, in posteriori illius sede, à quibus & rami per latera ipsius ad costas feruntur. Ta. 33. o f.

Costas tres superiores interdum accedens vena.

Distribuuntur: Ramuli nimirum, à vena & arteria sub osse pectoris per membranas intersepientes repentes, producti, & ad singula costarum interualla, in exteriore hui^9 mẽbranæ sede, deducti. Ta. 33 p.

Neruos, à

Capitis neruorũ coniugatione sexta: tum vbi

Posterius costarum radicibus exporrigitur. Ta.34 fi.2.i i i.

Superius in iugulo, insignes ramusculos portiones. Ta.34 fi.2.iuxta h k.

Dorsi partibus, tũ vbi

In Lateribus, costarum internalla accedũt nerui cũ venis et arterijs. Ta.35 x o.

Inferius, septi neruus illi soboles quoque mittuntur. Ta.35 n.a.

Particulares membranas. Vide PARTICVLARI

The second book dealt with the "composite" or specific parts of the body (such as the venters, thorax, head, chest, and limbs), which are made up of various different "simple" parts explained in the first book. In going through the specific parts of the body, the book followed the order of dissection.[66] Hence, in the second book the body was first divided into its surface and its inside, the inside being further divided into the body and the limbs. The body was then divided into the trunk and the head; the trunk was further divided into a lower part, the stomach, and an upper part, the thorax. The thorax was divided into organs contained inside it and other parts that make up the thorax itself; the thorax itself was divided into external and internal parts. The internal parts of the thorax were then divided into those that form the bulk, such as muscles and bones, and those that cover, namely membranes. The membranes were in turn described as covering either the whole thorax (namely veins and arteries) or specific parts of the thorax (namely nerves). The azygos and the costal veins are the two veins that cover and nourish the whole thorax (fig. 11.9), and Platter referred the reader to the figure in table 33, at "o." For Platter, the second book was thus about "anatomical analysis" because it proceeded from the surface to the inside, and from larger to smaller parts, in order to understand the parts of the body. This approach may appear analogous to that of Vesalius's *Epitome*, which used the nude figure as a starting point, but it is important to note that while the depth of the body was conveyed in the *Epitome* by the turning of pages or by a layered manikin, Platter's readers followed the order of dissections through tabular, textual divisions across a page until they reached a specific structure or organ, at which point they were directed to a part or detail in the figure.

The text was accompanied by a separate volume of images. As it was hard to conceive in the mind the parts of the human body explained in the text without inspecting the body itself, and as opportunities for dissecting the human body were fairly rare, Platter said that he offered etched images of the human body.[67] He thought it more appropriate to have a separate volume of images that could be consulted while reading the text, so that the reader would not have to turn pages so frequently. He also ensured that names and explanations to the keys were printed on the page facing each image, so that the reader would not have to turn the page when studying the image. This may well be a reaction to the way Vesalius had made his reader turn the pages back and forth in *De fabrica*. Platter's readers would have two books in front of them: one of images and another of text which proceeded through textual dichotomies. The images could be read in two different ways, to understand either how the body was composed or how it was to be dissected. The text pointed to parts or details of the images much less frequently than Vesalius's internal margins had done, and instead of turning pages back and forth, Platter's readers moved their eyes across the surfaces of the pages in two books.

Platter warned that his images, on first inspection, could be obscure, since certain things had been omitted. He hoped, however, that with "use and exercise" the obscure parts would become more familiar.[68] But the "use and exercise" required to understand the images could come only from following tabular divisions and then consulting images. Thus it was as directed a reading as that required by Vesalius, since Platter's reader had to proceed through tabular divisions to understand the location and function of a particular structure or organ. Although Platter had canonized Vesalius's images, Platter had set up a different kind of image-text relationship—one in which the images were read by way of two different sets of texts in tabular form, through both "analysis" and "synthesis," both of which were required for a full knowledge of the human body. In this way, Platter wanted his readers to understand the body in terms of both function and anatomical structure.

The reactions of Dubois, Eustachi, and Platter to Vesalius's depiction of the azygos vein helpfully illustrate the different reasons (history, dissection, authority) for accepting or rejecting an anatomical description, the different attitudes towards using images (i.e., no images, images of individual organs, or copies of Vesalius's images) and the different reading experiences (picture-less, grid-system, Ramist) offered by anatomical books. They suggest the different ways in which learned physicians of the sixteenth century could envisage the presentation of text, image, and body in a printed book.

In part 3 I have discussed how Vesalius used pictures in making general points about anatomical structures, first in response to a humanist controversy over bloodletting, and then in *De fabrica*. In this magnum opus, in which he sought to restore and establish pristine anatomical knowledge, Vesalius's pictures embodied the canonical body, the teleological method, and an adjudicating authority. Taken in tandem with the text, the pictures helped Vesalius create in the reader's experience the true (as he saw it) canonical structure of the human body, which could rarely be encountered in the dissection hall. The cases of the humanist physicians Dubois, Eustachi, and Platter are only three examples of the myriad of ways in which Vesalius's contemporaries reacted to the book that had shown what could be possible in a relationship between text, image and object.[69] Each of these authors had a different idea about the role of pictures in their book because they had different senses of the authority and method that mattered in establishing knowledge about human anatomy. As in the case of medical botany, the field of anatomy, which also demanded firsthand experience and observation, was a contested area of knowledge in which pictures played a multitude of roles.

At the end of the sixteenth century, André du Laurens summed up the state of anatomy well: there were two branches of anatomy, a "historical" one and a "scientific" one, both necessary for perfecting the art. "Historical" anatomy was characterised by *autopsia*, or firsthand inspection, either of the pictures or of bodies of dead humans and of dead or live animals. "Scientific" anatomy, characterized by "instruction" [*doctrina*], could be obtained through the writings of brilliant men or in person, *viva voce*.[70] Vesalius had cultivated in person the ocular faith of witnesses in the dissection hall through pictures; he advocated firsthand dissections; and through his book he sought to make the discipline "scientific." Just as sixteenth-century physicians understood the value of selective, insightful reporting (as Hippocrates had) as opposed to the recording of everything (as in Thucydides's report of the Athenian plague),[71] so too was more than simple *autopsia* required for anatomy to become "scientific"—and so did books have an important role to play in making the field of anatomy "scientific."

EPILOGUE

By the middle of the sixteenth century, about one hundred years after the advent of printing, the printed book had become ubiquitous in Europe. By then, it had become the basis of the academic study of medicine as well as the primary medium through which learned physicians made known their discoveries and arguments. This printed book, as a material product, did not come into being out of thin air to capture ideas. Its production was governed by technical, financial and other conditions that authors needed to negotiate and harness in order to have their views published. These were necessary, though not sufficient, conditions for pictures to be included in learned books about nature. Perhaps it is precisely because it took effort and money to place pictures in printed books that there needed to be strong epistemological, ontological, or intellectual reasons for wanting to use them in one's book. Beliefs in accidents, external forms, and a canonical body were powerful reasons that underpinned the Renaissance projects of Fuchs, Gessner, and Vesalius. Conversely, there were good intellectual reasons why similarly classical-minded physicians like Cornarius or Dubois did not see the point of using pictures in the recovery of ancient knowledge. But there also were other reasons why university-educated physicians did use pictures in their books: as a way to boost their authority, as in the case of Mattioli, or to criticize or canonize Vesalius, as Eustachi and Platter did respectively.

It is important to note that even when there were strong intellectual reasons for using pictures, it did not commit an author like Fuchs to a single way of using them, just as he did not see his Latin commentary on a universal history of plants as the only form of knowledge, though perhaps for him it was the most significant. Through diminution, translation, and rearrangement, Fuchs's universal knowledge could be adjusted to more localized needs and markets, and that process transformed the function of his images. The copying practices of printers also meant that Fuchs's way of using pictures in *De historia stirpium* did not remain stable, as his pictures were copied into different books and projects. Vesalius's images were subject to an even more varied fate.[1]

In Latin books that embodied intellectual projects that were classically inspired, however, the pictures used by Fuchs, Gessner, and Vesalius reflected methods that the authors themselves had come to believe as being the most effective and reliable, forged out of contemporary debate and controversy. Such methods shared the feature of being expected to reach something essential about plants or the human body through investigation of their external features. To call these methods simply "observational" does not do justice to the ways in which they were framed—matching up accidents, tracing nature's hieroglyphics, or establishing canonical teleology. Pictures, furthermore, could be useful as an adjudicating authority on differences of opinion, both ancient and modern; and they were meant to persuade readers of the validity of each scholar's contribution to knowledge. Hence, pictures played a role much more fundamental and wide-ranging than that of possibly indicating observational attitudes.

Indeed, when Fuchs, Gessner, and Vesalius used pictures, despite their insistence on the importance of firsthand experience, the pictures were hardly ever precise depictions of the actual, individual specimens that were observed; these authors rarely used the strategy of truth claims made for contemporary "counterfeit" images of singular objects. Instead, individual blemishes were ignored and variations were merged into one plant; structures deemed useless were passed over in silence; and rare ossicles and impossible-to-see veins were made visible. The pictures embodied objects that were somehow general or ideal—something beyond the singular instances presented in nature and captured by the adjective *absolutus*. Even when Eustachi, another university-trained physician with a respect for Galen, chose to eschew such pictorial generalizations and insisted on depicting individual, particular organs, he regarded each as an embodiment of a more general law of nature, and the grid system allowed him to refer to features common across individual organs, as well as to variations. Such pictures were not frivolous or indulgent additions to texts that were the sole and self-sufficient bearers of arguments. Texts worked in tandem with pictures to produce a powerful form of argument—a visual argument, encompassing both demonstration and persuasion. Fuchs, Gessner, and Vesalius aspired to make their knowledge general and comprehensive by deploying these visual arguments. They were, I hope to have shown, making their knowledge "scientific" by their own learned standards, and pictures were an integral part of that process.

The fact that these physicians envisaged their knowledge being read in printed books affected the way they placed their text and images and the way they set up their arguments. Vesalius used the page's internal margins to guide readers between his text and the woodcuts, and thereby to direct their understanding of the human body. In other words, he used the book as a whole to form in the minds of his readers the proper and correct (so far as he was concerned) view of the human body. Platter copied Vesalius's pictures, but not the structure that bound text and images together. Instead, he separated the text and the images into different volumes and set up tabular divisions to guide his readers through the text, which then referred to discrete parts of the body in the etchings. By repeatedly reading through the divisions, readers formed an understanding of the body in their minds. Authors like Vesalius or Platter were not simply jotting down their thoughts on a page; they were also seeking to shape their readers' experience and understanding. The book also affected Gessner's method of study: the sheets of paper with drawings were "commonplaces" that made up a future book, and those sheets were covered with writings as he verbalized descriptions of plants over time and space, and answered research questions through other books. Such verbalizations allowed his pictures to be "read" like pages of a book. These points underscore the fact that these were intellectual projects in which the authors sought to form a full and correct understanding of plants or anatomy in the minds of their readers, and to exploit the format of the book to achieve their aims. One of the few authors who articulated how such an understanding might be obtained from images was Gessner, who believed that in order to grasp the "thing itself" or its form through an *ad vivum* image, the primacy of vision was required.

It is worth noting that sixteenth-century university-educated physicians whose works I have discussed in this study—including those who objected to using images—shared many cultural values, such as the importance of Latin and Greek, the authority of ancient authors, and hierarchies of knowledge. When disputes broke out over the use of pictures, it was obvious that more was at stake. In fact, the methods and assumptions about what the correct form of knowledge was were quickly called into question, and were hardly ever resolved at the level of pictures. Quarrels over matters of knowledge entailed questions of the character and moral probity of the individual, as we have seen in the disputes between Fuchs, Egenolff, and Cornarius, between Gessner and

Mattioli, and between Vesalius and Eustachi. This may be a roundabout way of acknowledging that learned humanist knowledge neither was inherently visual nor entailed a common visual regime. This was so for another, important factor: the reading habits of a learned scholar.[2]

Reading Books with Pictures

A learned physician in the sixteenth century such as Thomas Lorkyn (1528–1591) had access to many books besides the carefully crafted tomes by Fuchs and Vesalius. Lorkyn obtained his BA at Cambridge in 1552, proceeded to the MA degree in 1555, was awarded the MD in 1560, and in 1564 became the Professor of Physic at Cambridge, a position that his father-in-law, John Hatcher, had once held.[3] We know from Lorkyn's probate inventory that by the end of his life he possessed 588 titles, many of which have survived at Cambridge University Library, containing varying amounts of annotation by Lorkyn himself.[4] It appears that Lorkyn did not own Fuchs's *De historia stirpium* (1542) at the time of his death, but he may have kept a smaller edition inherited from Hatcher (valued at twelve pence at probate).[5] Lorkyn possessed a copy of the 1558 edition of Mat-

Fig. E.1 Thomas Lorkyn's drawing of the *lens palustris* with four petals in Pietro Andrea Mattioli's *Commentarii* (1558), 549, detail. Cambridge University Library, N*.7.5(B).

tioli's commentary on Dioscorides's *De materia medica*, which at probate was valued at 13 *s.* 4 *d.* (or one mark), the same value commanded by his copy of the revised 1555 edition of Vesalius's *De humani corporis fabrica*.[6]

Lorkyn's study of these medical texts suggests a certain amount of bookishness. He had compared and assimilated editions of Mattioli's commentaries from the 1560s into his own 1558 copy.[7] He also noted in that copy, on the page on the *petasites* (see fig. 6.1), that Mattioli believed Fuchs's *petasites* to be the *tussilago major* and made a note to that effect on the page of the *tussilago*.[8] Lorkyn's notes were not just confined to the text. For example, he added pictorial details of the *lens palustris* with four petals (fig. E.1) not shown by Mattioli. Such pictorial annotations were not unknown, as in the case of the careful read-

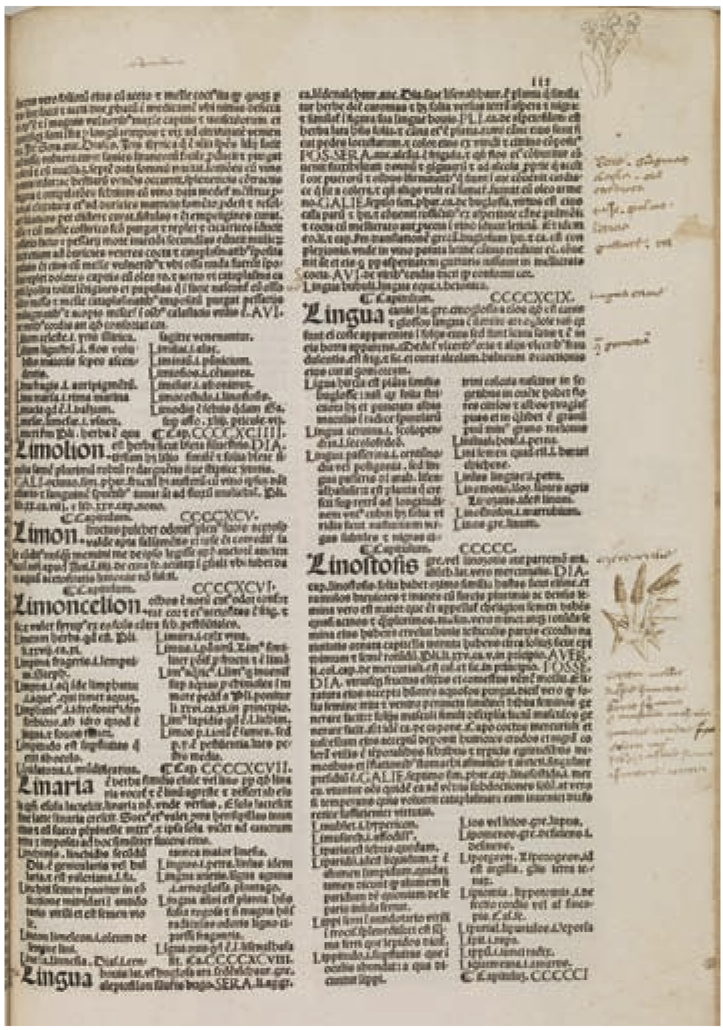


Fig. E.2 A drawing of a plant in the margin next to the text that discusses the plant "linostosis" (*mercurialis*). This copy of Silvaticus's book was owned by Thomas Lorkyn, but the marginal annotation (which summarizes the medicinal uses of *mercurialis* for softening the stomach and alleviating flatulence) is not by him. Matthaeus Silvaticus, *Pandectae medicinae* (1499), 112r. Cambridge University Library, inc.3.B.3.68 [1602].

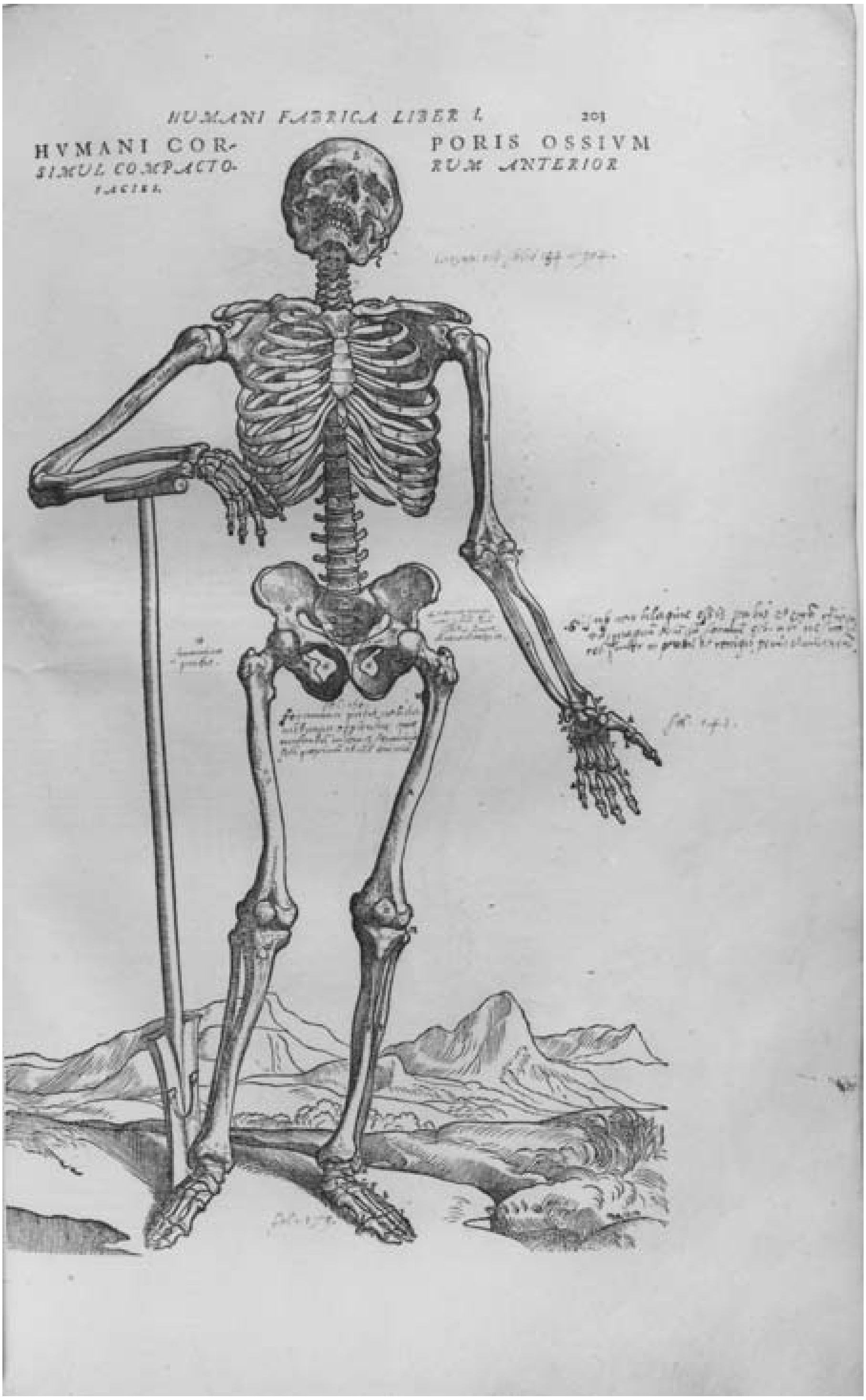


Fig. E.3 In his copy of the *De fabrica*, Lorkyn wrote his own cross-references to other images of individual body parts; Thus “fol. 184 and 304” written above the figure’s shoulder in this image refers to woodcuts of the cartilage and muscles of the larynx, while “fol. 141” and “fol. 173” refer to images of the bones of the hands and feet, respectively. From Andreas Vesalius, *De fabrica* (1555), 203. Cambridge University Library, N*.1.1(A).

er of Matthaeus Silvaticus's *Pandectae medicinae* (1499), who frequently added sketches in the margins, in addition to textual remarks and notes (fig. E.2). This is a copy which was also once owned by Lorkyn, and although the evidence here is probably a little too slight, it is worth noting the possibility that reading or marking habits might have been transmitted through books themselves.[9]

Lorkyn appears to have read through Vesalius's *De fabrica* (1555), as his copy abounds with notes and markings in the text as well as on the images and in the errata.[10] Having read the description of the five skulls, Lorkyn noted which one had the "natural" shape (see fig. 11.1), and numbered the other non-natural shapes in the order in which they were discussed. He also used the full-length figures as a reference point for images of smaller structures (fig. E.3). Lorkyn's note on the skulls and other annotations on the images incorporated the gist of the textual description, and functioned as summaries or reminders of the text. His folio references on the images were links that Vesalius had not supplied, and they suggest that Lorkyn was creating his own cross-reference system that went back and forth across the book. On another occasion (fig. E.4) we can almost see Lorykn thinking along with Vesalius's description of the inferior part of the cavity of the dorsal medulla (rhomboid fossa to us) as triangular with

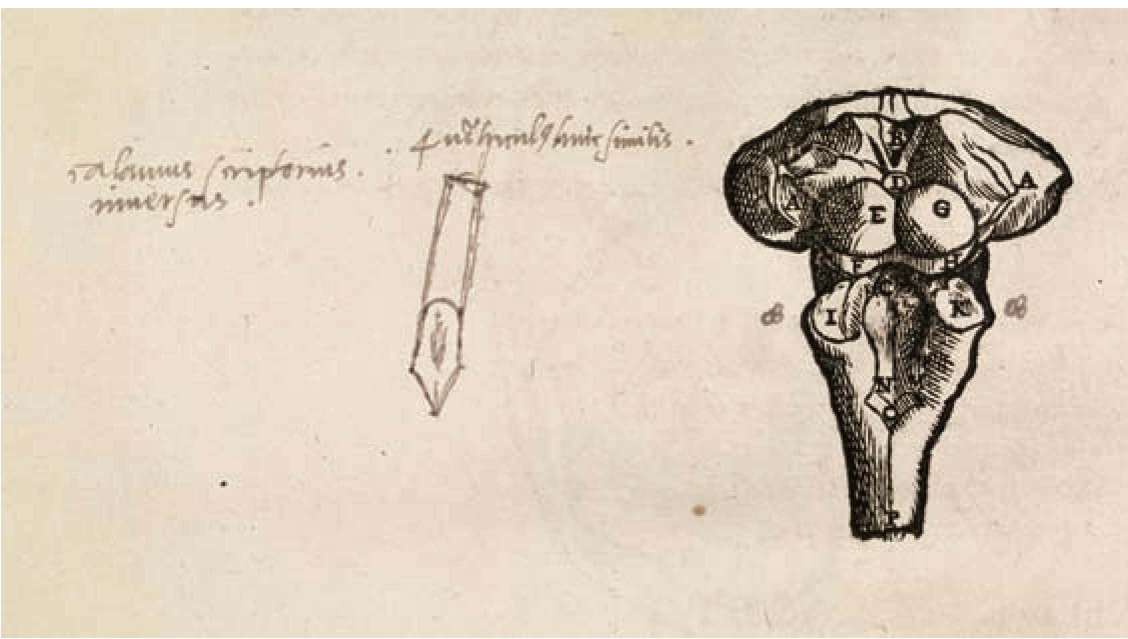


Fig. E.4 On this image Lorkyn drew a picture of the nib, in line with Vesalius's analogy about the form of the cavity of the dorsal medulla—an analogy which in fact goes back to Galen. From Andreas Vesalius, *De fabrica* (1555), 766. Cambridge University Library, N*.1.1(A).

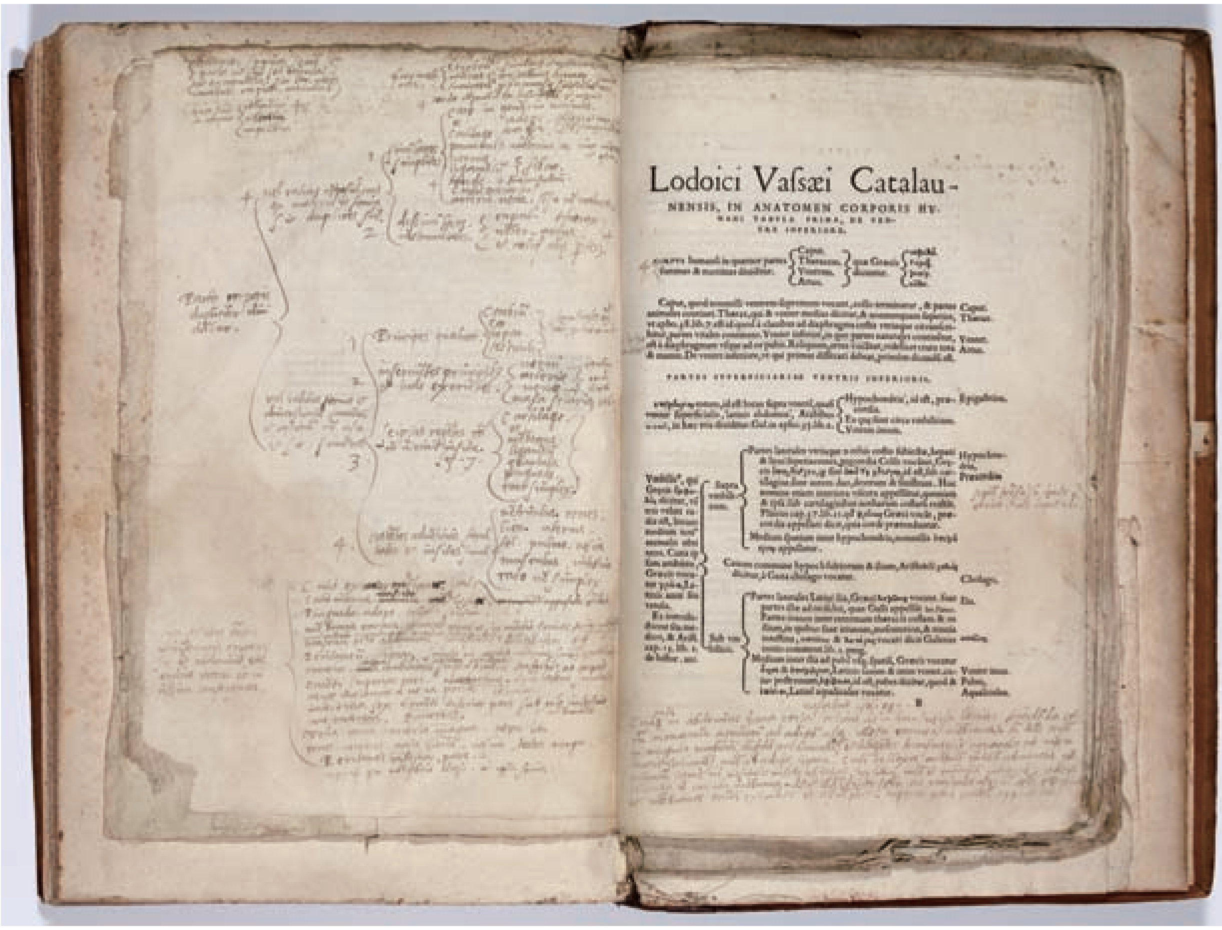


Fig. E.5 Lorkyn's use of tabulation for organizing his own anatomical knowledge alongside Vassé's tabulation. He first divided his approach to the body into two: the body understood as a combination of matter and form, and the body understood by its parts' functions, actions, and uses. From Loys Vassé, *In anatomen corporis humani, tabulae quatuor* (1541), A[iv]v and Br, page 29 x 19 cm. Cambridge University Library, N*.3.17(B).

its apex shaped like the tip of a reed pen (*calamus scriptorius*)—a feature also noted by Herophilus and Galen (*De anatomicis administrationibus*, 9.5). On the page, Lorkyn himself has drawn a picture of a nib.[11]

The book that Lorkyn annotated most extensively was a copy of Vassé's *In anatomen corporis humani, tabulae quatuor* (1541).[12] He appears to have acquired it for two schilling, but by the time of the probate it had depreciated to sixteen pence.[13] In the blank pages of this copy, Lorkyn made an extended comparison of the anatomical ideas between Vesalius and Dubois using tabulation. He also recorded the details of the two dissections he carried out in Cambridge in 1564/5 and 1566/7.[14] It is intriguing to see that Lorkyn also made extensive notes in his copy of Colombo's *De re anatomica* (1562), listing Colombo's criticisms of Vesalius as well as further differences between Vesalius and Dubois.[15] However, Lorkyn appears not to have made an effort to assimilate these notes into his copy of *De fabrica*, except for a few comments.[16]

Lorkyn's volumes of Mattioli and Vesalius, valued at his death at 1 mark each, were not the most expensive items in his library. The three-volume *Historia generalis plantarum* was valued at four marks (53*s.* 4 *d.*) and Galen's *Opera* at three pounds sterling.[17] In Lorkyn's probate list, six pence would have been ample for a copy (most probably secondhand), of one of the following titles: Hippocrates's *Aphorisms*, Dubois's *Methodus* or *De febribus*, Guy de Chauliac's *Chirurgia*, Celsus's *De re medica*, Actuarius's *De urinis*, Joubert's *Practica*, and Brasavola's *De medicamentis*.[18] Thus *De Fabrica* (1555) was valued at twenty-seven times what an average secondhand textbook in medicine would have cost in Cambridge around 1590, while Vassé's manual with generous margins was valued at only two and-a-half times that amount. Fuchs had once remarked that Vesalius's *De fabrica* was too prolix and sophisticated for students, and the *Epitome* too succinct compared to other textbooks (predictably, Fuchs went on to offer his own textbook for learning anatomy and dissection).[19] *De fabrica* was clearly not a student textbook, though Vesalius frequently addressed the novice reader in its pages, and hoped to edify as many people as he could.[20] Lorkyn certainly read through *De fabrica* carefully. The smaller books in Lorkyn's library, some of which he inherited rather than bought, have few or no reading marks in them, while the larger, and more expensive books evidently commanded more of his attention.

A sampling of the annotations in Lorkyn's books highlights the many different ways in which he read them: by assimilating or noting differences with what he had read elsewhere, by summarizing the gist of the text, by adding images, by creating his own cross-references, by drawing on the pages, by tabulating his own reading and knowledge (fig. E.5), and by recording his own dissections. He did not adhere to any single method of reading or studying a book, nor follow any single authority. His reading habits suggest how one book, however spectacular, would not change or normalize the way in which learned physician readers understood or accepted arguments, be they visual or not, from their books. These, of course, are traces of reading, not of emotional or other reactions to the images themselves.[21] It is perhaps not surprising that no consensus arose in the sixteenth century concerning the status or usefulness of images and visual arguments.

Thus there was a rich variety of positions that learned scholars could hold in this period concerning the use of images in investigating and understanding nature. Such a heterogeneity separates the sixteenth century from later periods in which it is possible to speak of a more or less collective need to train and calibrate the eyes of investigators of nature by means of "scientific atlases," and where the tendency to generalize beyond the observed particular was retained in a paradigm of "truth-to-nature," as Daston and Galison have recently shown.[22]

The examples I have discussed belong to a period before the introduction of sight-enhancing instruments such as the telescope and microscope. As Van Helden has pointed out, a new instrument like the telescope necessitated the creation of a new "visual language" for astronomy, and indeed the use of instruments to which readers did not routinely have access further intensified the need to persuade readers of the reliability of those instruments and the inferences made from using them.[23] But this does not mean that before the introduction of these instruments it was any easier or less necessary for sixteenth-century physicians to develop visual arguments since they knew that bodies for dissection or competent anatomists were not always available, and that some exotic plants were impossible for their readers to obtain or grow. My aim in this book has been to show the ingenious ways in which some of these sixteenth-century authors exploited the medium of the printed book to advance such arguments.

Soon, of course, Galileo would proclaim that the book of nature was written in the language of mathematics.[24] Many other models of the underlying structure of nature and the universe would also be advocated after him. Making that structure visible has remained one of the major tasks of the scientific enterprise, and one of the important moments in the history of that task can be located in the sixteenth-century book.[25] Fuchs, Gessner, and Vesalius were probably the first authors who tried to introduce this kind of visual, scientific argument into printed books of nature.

NOTES

Introduction

1. I am particularly indebted to Reeds 1991, Arber 1990, Palmer 1984 and 1985, Cunningham 1997; more recent and important studies are Park 2006 and Ogilvie 2006.

2. Findlen 2006.

3. The seminal paper that advocated taking images seriously within history of science was Rudwick 1976. See now Daston and Galison 2007, 55–113, Elkins 1995, Lefèvre et al. 2003, Kusukawa and Maclean 2006, Hashimoto 2008, Kuriyama 1995, Baldasso 2006, Lüthy and Smets 2009.

4. I have found especially useful Murdoch 1984, Wolf-Heidegger and Cetto 1967, Blunt and Stearn 2000. I have also consulted Roberts and Tomlinson 1992, Rutkow 1993, Nissen 1951, Saunders 1995.

5. Physicians who could draw well included Johannes Kentmann (see Kusukawa 2009), Gerardo Cibo (see Tongiorgi Tomasi 1989), and Johannes Moibanus (see Dioscorides 1565, biijr). Those who expressed objections to the use of pictures include Hieronymus Bock (Reeds 1976, 531n52) and Alessandro Benedetti (Ferrari 1996, 53–57). Cf. other humanist objections to images, Zorach 2008, 66.

6. Vesalius 1546 (partially translated in Farrington 1934), Fuchs 1551.

7. For the range of topics covered in learned medicine of this period, see Maclean 2001b.

8. For a helpful, historical contextualization of "observation," see Pomata 2011. I am grateful to Gianna Pomata for letting me see a draft of this paper.

9. This definition of naturalism is from Summers 1987, 3.

10. For studies on the origin and character of this Renaissance style, see Summers 1987, Snyder 1980, Edgerton 1991, Fowler 2003. For caution against "naturalism," see Kemp 1990; Harbison 1995, 25–61; Ackerman 1985a; Givens 2005, 5–36.

11. Clark and Pedretti 1968, 1:7–8.

12. Roberts and Tomlinson 1992, 120, 122.

13. Kemp 1981, 91–151.

14. As quoted and translated in Siraisi 1997, 110.

15. For Leonardo's mechanical interests and their context, see Galluzzi 1991; for the variety of uses of his drawings, see Kemp 2006.

16. For Leonardo's sketches as a means for producing knowledge rather than accurate descriptions, see Nova 2005; Veltman 1986, 113–42; Rosand 2002, 97–111.

17. Koreny 1988, 176–79.

18. Reeds 1990, 767.

19. For Leonardo's "hyperrealism," I follow Kemp 2004, 71.

20. "Das Lehrbuch der Malerei" in Dürer 1956–69, 2:109, as also noted in Anzelewsky 1983, 95. For an examination of Dürer's nature studies and their reception, see Koreny 1988.

21. Smith 2004, Peiffer 2004.

22. Indeed, the very idea of searching for past equivalents of photographic shots requires caution; see Cole forthcoming.

23. Danti 1567, 60, as translated in Ackerman 2002, 134.

24. Here I rely on Parshall 1993.

25. For instance, Quintilian, *Institutio oratoria* (8.3.63); Ginzburg 1985; Vickers 1983; Preston 2007.

26. For a study of single-sheet broadsides, see Honemann et al. 2000, Harms et al. 1985. For the impact of the singular and the preternatural on the study of nature, see Daston and Park 1998, Swan 1995.

27. Noted, for example, in Roberts and Tomlinson 1992, 44 (Hock); Blunt and Stearn 2000, 61–63 (Brunfels).

28. "Ein contrafact Anatomy der inneren glyderen des menschen durch den hochgelerten physicum und medicine doctorem Wendelinum hock von Brackenaw, zů Straszburg declariert, und eygentlich in beysein viler Scherer und Wundärtzt gründtlich durchsůcht." Gersdorff (1967), before a1r.

29. Hock is identified as a surgeon in Pagel 1958, 18. For his studies in Bologna, see Hock 1514, 1v, but his name does not appear in Knod 1899 or Friedländer and Malagola 1887. He obtained his *Burgerrecht* in Strasbourg in 1513 and joined the guild Zur Lutzerne, which was the main guild for barbers and surgeons; Wittmer and Meyer 1948–61, 2:611.

30. Pliny, *Natural History*, 26.1.2; for Hock's treatment of the French Disease, see Arrizabalaga et al. 1997, 259–60, 270.

31. For the stipulation of attending dissections, see Friedländer and Malagola 1887, 289.

32. A gymnasium was established at Strasbourg in 1538, which in 1566 became an academy, and in 1621 a university. For the limited schooling available in Strasbourg before 1538, see Schang and Livet 1988, 19–23.

33. The verses under the original broadside made the dissected man claim that he was a "mirror," revealed by the gifted physician for the public good and accurate teaching of the positions and characteristics of the internal organs, which in turn would make more reliable medicinal remedies and surgical treatment of wounds and boils.

34. The text reads: "Ein contrafacter Todt mit sein beinen fugen und glyderen, unnd gewerben, usz bevelh loblicher gedächtnüsz hertzog Albrechts bischoff zů Straszburg, durch meister Nicklaus bildhawer zů Zaberen worlich in stein abgehawen, und noch anzöig rechter gewisszer Anatomy mit sein latinischen namen verificiert." Gersdorff 1967, before a1r.

35. For Hagenauer's citizenship at Strasbourg, see Wittmer and Meyer 1948–61, 2:469; for the woodcarving for the Isenheim altar, see Baxandall 1980, 20–21, 280. Albrecht's tomb at the church of Notre Dame in Saverne appears not to have survived, Vöge 1931, 81–5.

36. For this broadside, see Parshall et al. 2005, 216–18, and Sudhoff 1908b, 58–61. For Helain, see Wickersheimer 1979, 701.

37. For more examples, see Parshall 1993, 556–62.

38. For the "dance of death," see Nigel Palmer 1993, Kiening 2003. I am grateful to Mark Chinca for advice on literature on the *Totentanz*.

39. "In this way my body (I say this to you in truth as a witness) has been drawn as a *contrafact* by Hans Wächtlin, accurately to the last hair, skilfully and well . . . . The lungs and heart are buried beneath the ribs, closed in by the diaphragm. Then the stomach, liver, spleen, gall bladder and more; two kidneys which are the same on both sides; the empty man who wants to put himself together must fit them all together in their places, because none works alone without the others, and gives the power of life, [and] is helpful and effective. Guido has explained this clearly and had it translated in the *Feldbuch*; you should be thankful to him." Gersdorff 1967, before a1r. Cf. the poem by Etienne Dolet for the corpse dissected by François Rabelais; Cunningham 1997, xii–xiii.

40. For Gersdorff, see *NDB* 6: 322–33. For the *Feldtbuch*, see Stannard 1999, chapter 11.

41. Gersdorff 1967; Gersdorff 1528 at the National Library of Medicine; Gersdorff 1517, [a6]v and [bi]r, British Library, C.31.c.12.

42. For a partial translation of this book, see now Cunningham and Kusukawa 2010.

43. ". . . a dextra [stomachus] habet epar: a quo apprehenditur, vero suis penulis: sicut manus, quod apprehendit et capit vero digitis." Mondino 1494 [bbijr], my interpolation.

44. "Augenschinlich anatomy zů erklerung der obgemelten capitem oder berschribungen fůglicher wyss hyenoch volgt."

45. "Solich anatomy ist in der jorzal Christi. M.CCCCC.xvij. in der loblichen statt Straßburg, in beysein ettlicher der gelerten und bewerten physicis, doctoribus, chirurgicis, und schereren noch art ersůcht und durchgründt, an eim erbetten todten man mit dem strang gericht. Künstlich declariert durch den erfarnen und hochgelerthen medicine doctorem Wendelinum Hock von Brackenaw, und als bald ab contrafact verzeychnet mit aller gestalt, farben, und worer anzoeige wie du es in nochgon der figuren findest." Gersdorff 1517, XIIIv.

46. Gersdorff 1517, XIIIIr, also repeated at LIVv.

47. For a reference to other painters and engravers, see Brunfels 1530–36 1:181, 217, Brunfels 1532, C[v]r; also noted in Sprague 1928. For Weiditz's output, see Landau and Parshall 1994, 252, and Séguenny et al. 2001, 197–227.

48. Arber 1990, 206; Ogilvie 2006, 193–94.

49. For the *Hortus sanitatis*, see Arber 1990, 28–37, 197–201; Blunt and Stearn 2000, 58–59.

50. Stannard 1978, 447; Ogilvie 2006, 70–75 (sixteenth-century herborizing trips); Reeds 1976, 538–39 (institutional trips).

51. Compare, for example, the faces on the leaves of the "Herba Torogas" in an alchemical herbal. Segre Rutz 2000, 10.

52. *Hortus sanitatis* (1.307), V3v. The text quotes verbatim from Isidore 2006, 350–51 (17.9).

53. *Hortus sanitatis* (1.233), P8r. For the use of striking mnemonic pictures, see Bolzoni 1989 and Yates 1992, 1–26.

54. Brunfels 1530–36, 1:A2v.

55. Ibid., 1:A3r (barbaric authors); 2:55, 59 (plants received from a painter); 1:68 (old women); also noted in Reeds 1991, 152–54.

56. Brunfels 1530–36, 1:217–18 (nuda herba), 2:60.

57. Ibid., 1:217.

58. Brunfels 1532, C[v]v. For the mismatch between picture and description, see Sprague 1928, 82.

59. The same point is made by Arber 1990, 52–55; Ganzinger 1959, 212; Landau and Parshall 1994, 252; Ogilvie 2006, 184.

60. *DSB* 2: 535–38 (Brunfels); *CoE* 3: 230–31 (Schott); Chrisman 1982, 29. See also the reference to Schott in Brunfels 1535, 2v.

61. Gombrich 1982 and 2000.

62. Fleck 1986, 134.

63. "Abrotoni herbae non speciem formamve scribere post tot tantosque viros oportet, nec particulares actiones, cur illi factitarunt, quas ut non definite distinctaeque saltem clare significarunt." *De simplicium medicamentum facultatibus* (6.1), Galen 1542, 5:154. For the reception of Galen's work during the Renaissance, see Durling 1961.

64. Pliny the Elder 1938–63, 7:140–41. Modern editions adopt the phrase *fors varia* (manifold hazards) instead of *sors varia* (manifold fortune), which is more common in sixteenth-century editions such as Pliny the Elder 1511 (clxxviiir) and 1539 (453). For the reception of the *Historia naturalis*, see Nauert 1980.

65. Isager 1991, 136–40. The relevant passages are translated and gathered conveniently in Jex-Blake and Sellers 1896.

66. As translated in Scarborough and Nutton 1982. For the reception of the *De materia medica*, see Riddle 1980.

67. Scarborough and Nutton 1982, 196; Dioscorides 1829–30, 1:3–7.

68. For example, Siraisi 2007, 102–5. For *autopsia* as the principal sense in history in Theodor Zwinger, see Blair 2005, 275.

69. Galen 1985, 4–5. *Autopsia* was translated as "careful examination" (*perspectio*) by Giorgio Valla in Galen 1518, 3v, and as "inspection" (*inspectio*) by Johannes Guinther von Andernach in Galen 1528, 50 (also giving the Greek, *autopsia*).

70. Nutton 2004a, 147–50, 231–32.

71. For the reception of classical ideas of experience and observation, see Pomata 2011.

72. For the common assumptions of learned medical knowledge, see Maclean 2001a, chapters 1, 3, and 7.

73. For background, see Weisheipl 1978.

74. *Metaphysics* (6.2), Aristotle 1984, 2:1622.

75. For a contrast between *scientia* and *historia*, I follow Pomata and Siraisi 2005.

76. Stannard 1999, McVaugh 2006.

77. Reeds 1980; Ogilvie 2006, 96–99; Siraisi 1990, 141–52.

78. Siraisi 1981, 110–14.

79. For a study of Gregory the Great's dicta, see Duggan 1989, Chazelle 1990, and, more generally, Camille 1985.

80. John Dee in Euclid 1570, 340r (mispaginated). For the printing of this work, see Evenden 2008,147–51.

81. Pliny the Elder 1938–63, 9:317–19 (35.36).

82. Bermingham 2000, especially 3–14.

83. Erasmus 1974, 26:398. For the connection between writing and drawing, see Rosand 2002, 139–44.

84. Wickram 1968, 15. Also summarized in Chrisman 1982, 209–13.

85. The works attributed to Finé in Johnson 1928 may be by the Master of François de Rohan; see Orth 1998, 82. For Finé drawing his own geometrical figures, see Bouelles 1542, aijr.

86. Edgerton 1984; Bredekamp 2007, 131–48, 217–82. Cf. Reeds 2004.

87. Daston and Galison 2007, 84–98.

88. For the complexity of analyzing image-text relationships in medicine, see Jones 2006 for the medieval period and Nutton 2001 for the later period. Cf. also the role of images in architectural prints, Zorach 2008.

Chapter 1

1. As also noted in Johns 1999, 475.

2. For early printed images, see now Parshall et al. 2005. Useful introductions to the history of woodcuts are Hind 1935 and Ott 1999. For intaglio, still helpful are Hind 1923 and Hofer 1934. For prints, see Landau and Parshall 1994, 260–358. Hellinga 1991 is a helpful introduction to incunabular illustrations.

3. Cennini 1960, 115–16 (chap. 173); Field 2005, 21. For textiles with printed patterns, King 1962 showed that many examples in Forrer 1898 were forgeries.

4. Parshall et al. 2005, 118–61, 212–14, 264–73, 298–302. See also the caveat in Schmidt 2005, 40–41. For the devotional practice of inscription, see Areford 2010, 69–70.

5. The "historically transitional form" of manuscript book with printed images continued well into the sixteenth century. See McKitterick 2003, 53–64; Schmidt 2003; Dicke and

Grubmüller 2003. The practice of stamping decorative initials to expedite the work of illuminators continued to about 1473, according to Lilian Armstrong 1991, 195–200. See also Alexander 1985; Goff 1962, Hindman and Farquhar 1977, 101–56; and Hirsch 1967, 27–28.

6. For decorative woodcuts stamped into Italian incunables, see Donati 1972–73 and 1978.

7. Having the woodcuts set in the margin would have made a compositor's work more straightforward.

8. Halley to Newton, 29 June 1686, and Newton 1959–77, 2:443, as noted in Cohen 1971, 134n20.

9. Gascoigne 1986, 9a. Parshall et al. 2005, 83–84.

10. Bowen and Imhof 2008, 192. For comparative costs of engraving and etching, see Bury 2001, 44. For the advantage of engraving over etching for maps, see Woodward 1996, 27–32.

11. The best comparative analysis of etching and engraving is Bowen and Imhof 2008, 191–207, 234–44 (on longevity). A much lower estimate of a maximum of two thousand and one thousand impressions for engraving and etching respectively is cited in Woodward 2007, 598.

12. Woodward 1996, 33.

13. Hind 1935, 1:175–97, and Dodgson 1937.

14. For the engraved volvelles by Götz, see Bradshaw 1889, 237–47; cf. Bury 2001, no. 20. Of the seven incunables that contain engraved illustrations, four are geographical titles; Fahy 1993, 91.

15. McKitterick 2003, 81–83, 88.

16. For an example of a decorative engraving pasted into a manuscript book, see Dackerman 2002, no. 4, 93. I thank David McKitterick for drawing my attention to this work. For examples of engravings as well as woodcut figures being pasted into manuscript or printed books, see also Erler 1992.

17. The engravings were by Nicolas Beatrizet, and the project was probably initiated by Salamanca, who had been publishing Spanish books. Witcombe 2004, 131–34. For Valverde's uses of Vesalius's images, see San Juan 2008 and Klestinec 2005.

18. According to Bury 2001, 41n3.

19. Voet 1969–72, 2:226, 384; Bowen and Imhof 2008, 47–49, 342–45.

20. For some of the technical difficulties of printed images, see McKitterick 2003, 87–88.

21. Bowen and Imhof 2003.

22. Landau and Parshall 1994, 260–368; Bowen and Imhof 2003.

23. For this work, see Barker 1994.

24. See Mandelbrote 2004 (the first part of Morison's *Historia plantarum* was never published).

25. For "nature prints," I follow Reeds 2006, Cave and Wakeman 1967, and now Cave 2010. For a decorative example, see Bartrum 1995, 287, no. 245.

26. Cardano 1554, 517. I thank Ian Maclean for drawing my attention to this passage. See Marks 1998, 55, for panel stamping.

27. For "ichnographia," see Pinto 1976 and Bartoli 1978.

28. Cardano 1554, 517.

29. As noted in Siraisi 1997, 99. Cardano 1554, 609.

30. For Francis I's death mask by François Clouet, see Giesey 1960, 4. For the funeral rituals using these wax models, see Kantorowicz 1957.

31. For *ad vivum*, see further chapter 8.

32. Dated 10 September 1583. *Codex Kentmanus*, 210r.

33. For a study of the *Codex Kentmanus*, see Kusukawa 2009. For Kentmann, see further Helm 1971.

34. The collection was started in 1583, but evidently continued at least until 1604. *Codex Kentmanus*, 286r.

35. For the nature-print album at Blickling Hall as the model of the *Ekphrasis*, see Tognoni 2005. I am grateful to Mark Purcell for information on the rare books held at National Trust properties. For the limited use of the nature-print technique in the nineteenth century, see Daston and Galison 2007, 105, 109.

36. Bühler 1960, passim.

37. For the various uses of the Gutenberg Bible in this period, see Jensen 2003.

38. Hoffmann 1996, 6.

39. For a collation between the printed book and the manuscript, see Hunger 1935; for its illustrations, Blunt and Stearn 2000, 54–56.

40. Trithemius 1974, 34.

41. For Schedel's library, see Stauber 1969. For other cases, see also Elizabeth Armstrong 1979, 270; Reeve 1983.

42. For this practice, see Bühler 1960, 29–39; and Love 1993 for the seventeenth-century England.

43. Rodakiewicz 1940, Trapp 1999, Bühler 1952, with further examples at 182n29. For the case of copying pictures from Conrad Gessner's *Historia animalium* into a late-sixteenth-century manuscript of Pier Candido Decembrio (originally composed in 1450), see Pyle 1996.

44. Kaufmann 1976. See also the Schedel's example, Hernad 1990. This practice was by no means unusual; McKitterick 2003, 53–58.

45. See, for instance, the case of Andry le Musnier in Rouse and Rouse 2000, 1:303–27.

46. Lehmann-Haupt 1950, 40–45. For Bämler's decorations, see Klemperer 1927 and Edmunds 1993, 32–33.

47. Edmunds 1991; Bühler 1960, 44–45.

48. Hindman and Farquhar 1977, 101–56; Lilian Armstrong 1994, 38–41; Alexander 1985.

49. Hind 1935, 1:79–82; Field 2005, 23–24.

50. Dackerman 2002, 15–26. For a representation of the *Briefmaler*, see Schopper 1568, [C6]r. The precise tasks and the status of the *Briefmaler* are difficult to determine, however: see Schreiber 1932, Lange 1948, Sporhan-Krempel 1966, Adhémar 1954.

51. The figures are from Loose 1877, 98n2, 155n3; see also Rostenberg 1943, 25–28, for Tucher's expenditure on books. For Guldenmund's activities, see Landau and Parshall 1994, 223–31.

52. Peter Schott to Adolph Rusch (1489), Schott 1963–75, 1:150. See also a similar complaint by William Caxton about a shortage of craftsmen in Driver 2004, 8, and a comment in Mattioli 1558, β4r, on the shortage of good block cutters. For the improvment of English illustrations due to immigrant workers, see Evenden 2008, 16–18, 95–117.

53. Clough 1993, 196. For the genre of portrait books, see Pelc 2002.

54. Euclid 1482, [1v]. For Ratdolt, see Redgrave 1894 and Schwarz 1924.

55. Information from Paul Needham.

56. Wiegand 1952, 32–34, for the woodblocks.

57. Van der Stock 1998, 28–29.

58. Kirchhoff 1880, 96–106, cf. Grivel 1989.

59. Hindman 1983; Alexander 1992.

60. Hieronymus Andrea is known to have cut some of Dürer's designs, and Hans Lützelburger (d. 1526) cut the woodcuts of the *Pictures of Death* by Hans Holbein the Younger (1497–1543); Landau and Parshall 1994, 212–18. For Rubens's engraver, Cornelis Galle, see Judson and Van de Velde 1978, 1:34–36.

61. Witcombe 2004, 209, for the *Herbario nuovo*; for Diana Mantuana, see Lincoln 1997, and Kusukawa 2000, 32, 172–73. For other women artists in this period, see Sutherland Harris and Nochlin 1978, 102–24.

62. See the comparative costs of draftsmen, block cutters, and metal engravers in Voet 1969–72, 2:224. For metal engravers and designers, see Bury 2001, 45, and Woodward 1996, 26.

63. Depauw 1993, 49–50. Units used here are 1 florin (*fl.*) = 20 stuivers (*st.*). For van der Borcht's output, see Mielke, et al. 2004. For other craftsmen who worked for Plantin, see Bowen and Imhof 2008, appendix 1.

64. Units used here are 1 florin (*fl.*) = 250 pfennig (*d.*); 1 pfund (*lb.*) = 30 pfennig (*d.*).

65. For these craftsmen, see further chapter 2.

66. Baumann et al. 2001, 30–35.

67. Specklin obtained his citizenship in Strasbourg in 1530. Rott 1933–38, vol. 3 *Der*

Oberrhein. Quellen I, 276. Michael 1992, 37 (Zurich Bible). Veit Specklin had three sons, Daniel, Josias, and Zacharias, who developed careers in architecture, bookbinding, and engraving respectively. Thieme and Becker 1907–50, 31:345–46.

68. Baumann et al. 2001, 39.

69. Fuchs 1542, [α6]v–β[1]r. I have modified the translation in Ackerman 1985b, 113.

70. See Farrago 1992 (Leonardo), Panofsky 1956 (Galilei), Dundas 1990 (Michaelangelo), and Peter Hecht 1984 for further examples.

71. Erasmus's praise of Dürer is translated in Panofsky 1951; its context of replicability is stressed in Hayum 1985. See also chapter 8.

72. Fuchs 1544, a2r.

73. Fuchs 1544, a4v.

74. Baumann et al. 2001, 25.

75. This is probably why (in addition to the fact that drawings could be destroyed in the process of transference, and that the printed book represented the final product) Plantin's firm kept significantly more woodblocks and plates than drawings, Voet 1969–72, 2:228–29.

76. Witcombe 2004, 58.

77. Voet 1969–72, 2:381.

Chapter 2

1. Isengrin was a member of the gardeners' guild since 1530 and did not join the larger merchants' guild, zum Schlüssel, until 1554 (which implies that he possessed limited assets until then); Koelner 1953, 328. For Oporinus's economising policy with illustrations, Steinmann 1967, 42.

2. Febvre and Martin 1990, 114–25.

3. *CoE*, 3:215–16, and Grimm 1966, 1366–72.

4. *CoE*, 2:60–63 (Froben); 279–80 (Lachner). For the variety of financial sources for the early printed press, see Lowry 1992.

5. Lowry 1979, 180–207; idem 1991, 13–15.

6. Lowry 1979, 109–79.

7. For Regiomontanus, see Wingen-Trennhaus 1991 and Zinner 1990.

8. As translated in Pedersen 1978, 177.

9. See, for example, the accounts of Hieronymus Froben and Nicholas Episcopius in 1562; Rudolf Wackernagel 1881, 24–25.

10. Calculation from Francis Johnson 1950, 90.

11. Voet 1969–72, 2:382–84.

12. Ibid., 2:382, 384.

13. For Sambucus, see Siraisi 2007, 217–24.

14. The medium-quality paper for della Porta's book cost 1 *fl*. 1 *st*. per ream; the good-quality paper for the *Emblemata* cost 2 *fl*. per ream, and the very good quality of paper for the Valverde edition cost 3 *fl*. per ream; Voet 1969–72, 2:382, 384. The cost per sheet of paper in table 2.1 still exceeds the difference in the cost of paper.

15. For example, Hieronymus Froben paid the cutters a total of 52 *lb*. 17 *s*. for the woodcuts in two books (Galen's *Opera* and George Pachemere's *Epitome* of Aristotle) in 1560, but that was less than 10 percent of his half-year operational cost. Rudolf Wackernagel 1881, 18–19.

16. As pointed out in Clough 1993, 193. For Pierre Eskrich as the probable cutter of the figures, see Finney 1999. Cf. also Goltzius 1557, in which spaces for the portraits of Charlemagne (CXIII), Otto III (CXXVI), and Lothar III (CXXXIIII) are left empty. Such lacunae were common in portrait books of the period. Pelc 2002, 76.

17. For de Bèze's defence of the use of Protestant portraits, de Bèze 1580, *ijrf.

18. Here I have largely depended on Voet 1969–72; but see also now the analysis in Bowen and Imhof 2008, 67–84.

19. Mortimer 1974, 2:709–11.

20. The Latin text also drew on Grevin's edition of Vesalius's *Epitome*. Voet 1980–83, 5:2330. For the left/right inversion of Plantin's Valverde, see also Bowen and Imhof 2008, 80–81.

21. See Kusukawa 2007, 224–26.

22. Voet 1969–72, 2:384, revised in Voet 1980–83, 5:2331–33.

23. Figures from Voet 1969–72, 2:227, 467.

24. Verlinden 1959, 418. This is in line with the price comparison in Bowen and Imhof 2008, 79.

25. Voet 1969–72, 2:525.

26. Ibid., 2:459; de Roover 1968.

27. Voet 1969–72, 2:420. Cf. the strategy of diversification in Davis 1966, 77–86.

28. Voet 1969–72, 2:391.

29. Ibid., 2:442, 410. For the Frankfurt Book Fair, see Flood 2007.

30. Voet 1969–72, 2:422–25. For publishers' advertisements, see Pollard and Ehrman 1965; Richter 1965, 1974, 1985; Coppens 1992.

31. The 1498 Aldine catalogue printed *minimum* prices, Orlandi 1975, plate 9. For Colines' catalogues, see Fred Schreiber 1995, lxxii–lxxvi, 213–29. For a sense of a roughly fixed price of early printed books, see Davies 1997.

32. Rudolf Wackernagel 1881, 6–11.

33. Ibid., 6, 39, 57, 42 (as a comparsion, Episcopius and Froben often bought median paper at 8 *fl*. a bale). Units for these accounts are 1 pfund (*lb*.) = 20 schilling (*s*.); 1 florin (*fl*.) = 25 schilling (*s*.).

34. Erasmus 1974, 5:815; Erasmus 1992, 5:1482. For Erasmus's involvement in correcting texts for publication, Shaw 1986, 84–92, and Allen 1934, 109–37.

35. O'Malley 1964, 136–39.

36. Krieg 1953, 57–59.

37. Voet 1969–72, 2:288.

38. Steinmann 1967, 49. See further Krieg 1953, 39–59, for authors' pay.

39. This offer was probably refused, though the titles in question were published by Froben and Episcopius after his death; Hieronymus 1995, 101.

40. Elsas 1936–40, 2A:623.

41. Lötscher 1975, 523, 535. See chapter 11 for Platter's *De corporis humani structura*.

42. Erasmus to Lachner and Froben, 23 August 1517, no. 629, Erasmus 1974, 5:78; see also nos. 704A, 885, 1507.

43. Wattenberg 1967, 61. Cf. Tycho Brahe's *Epistolae astronomicae* (1596) and *Astronomiae instauratae mechanica* (1598) as gifts, Mosley 2007, 124–37.

44. Buchwald 1933, 97. Cornarius's dedication at Dioscorides 1557, α2r–β[1]r.

45. Kapp 1886–1923, 1:319. For Gessner's gaffe, see Nutton 1985, 96.

46. Schottenloher 1953, 197–208, Krieg 1953, 59–64, and Davis 1983. See Kyriss 1953 for gifts by incunabula publishers to religious houses.

47. Nutton 1997a, 162.

48. Pettas 1980, 137. This work cost 991 ducats to produce, and sold at 1.20 ducats a copy (ibid., 149), which meant that the Giunti needed to sell 825 copies to break even.

49. Oporinus to Kaspar Nidbruck, 13 April 1555, Steinmann 1969, 144.

50. Voet 1969–72, 1:171. Plantin's upper boundary for a single edition was normally 2,500 copies; Schottenloher 1920, 18–19 (Willer's order).

51. Gingerich 1986, 64–65. Hirsch 1948, 90. Lowry 1991, 25. For the problems with the Greek text of the 1525 edition, see Mani 1956.

52. Luther to Johannes Lang, 26 January 1520; Luther 1955–86, 48:150n8.

53. For publications with subscriptions, see Robinson and Wallis 1975.

54. Meyer et al. 1999, 1:669–70; Cushing 1943, 109–15; Fred Schreiber 1995, lxvii–lxix; Serrai and Cocetti 1990, 303–22. Boussuet's work as an "epitome" of Rondelet's *De piscibus marinis* is clarified in the privilege in Boussuet 1558, aijr, which was extended from Rondelet's 1554 privilege.

55. Voet 1980–83, 5:2335–36.

56. Oporinus's letter to Konrad Hubert, 12 August 1544; Steinmann 1969, 119.

57. "Animalium et historiam et icones habet Froschoverus Fracofurti (sic) et alba et coloribus illustrata; pretia ipse mihi sic annotavit.

In albis seu sine coloribus		Depictae coloribus
2 fl.	Gesnerus de animalibus	4 fl.
7 ß.	de oviparis	1 fl. 10 ß
1 fl. 10 ß	de avibus	6 fl.
3 fl.	de piscibus	7 fl. 10 ß
7 ß	Icones animalium	Depictarum pretia ex superioribus constant.
10ß	Avium	Solidos intelligit, quorum unus f. 3 cruciferos.
1 fl.	Piscium	

. . . Illam editionem historiae animalium dicit Gesnerus, a se non expectandam. Icones dicebat mihi bis editas esse; Et secundam editionem esse multo auctiorem et instructiorem prima. Die Illuminierten exemplaria sind schöhn, tam historiae quam iconum separatarum. Et fortassis vix alibi tam recte fieret, quam hi ubi ipse depingendi rationem monstravit." Ursinus to Crato von Krafftheim 27 July 1561; Becker 1892, 85. Also noted in Weber 1981, 22.

58. Cf. the phrase "white scarlet" in the terminology of medieval textiles, where "white" means "undyed." Munro 1983, 53.

59. The figures were measured from Gessner 1551–58, 3:510, 4:571.

60. For Gasser's correspondence with Gessner, see Burmeister 1970–75, 3:196–312.

61. To Gasser, 21 January 1564, Gessner 1577, 32r.

62. To Gasser, 19 March 1564, Gessner 1577, 34r–v.

63. To Gasser, 28 April 1564, Gessner 1577, 39v.

64. This may also have to do with the fact that Froschauer's painter used to color a dozen copies at a time. Gessner to John Caius, 29 August 1561; Gessner 1577, 135r.

65. To Gasser, 29 August 1564; Gessner 1577, 37r.

66. To Gasser, 6 November, 1564; Gessner 1577, 36r. Gessner probably sent them on 20 October, 1564; ibid., 35v–36r.

67. Recorded in Mazzini 1953, nos. 2670 and 2671.

68. Mazzini 1953, 2. For Gasser's library, see Burmeister 1970–75, 1:121–9. From Ursinus' letter of 1561, we also know that Froschauer charged 7 *s.* and 10 *s.* respectively for the uncolored copies of *Icones animalium* and *Icones avium,* both printed in 1560. So this would mean that Gasser had paid an additional 5 *fl.* 13 *s.* Gasser got a good deal, since *Icones animalium* and *Icones avium* together contained pictures of volumes 1 to 3 of the *Historia animalium*, which should have cost an extra 8 *fl.* 1 *s.*

69. This was 15 *fl.* a year. Meyer et al. 1999, 1:283–84.

70. Vesalius 1998, 1:lxii, explicitly states in the preface that the pictures were prepared at his own expense. Platter's comments (in 1583) also suggest that the woodcuts were owned by Vesalius's heirs, though Oporinus's will indicates that the printer thought he had some rights over them; Steinmann 1969, 200–201.

Chapter 3

1. An example in which the left/right placement mattered was the case of Vesalius's azygos vein. See Cushing 1943, 61 fig. 45.

2. Baumann et al. 2001, 66 (Fuchs); Cushing 1943, 119–531 (Vesalius); Sugita 1969.

3. Seelig 1995; Conway 1884, 197–319 (for which I thank David McKitterick); Driver 2004, 35–75; Schmidt 2005, 47–50. A good example of a printer who deployed all of these strategies is Johannes Grüninger, for whom see Kunze 1975, 1:401–9; Herrlinger 1970, 50–51; and Hug 1504, XLv, XLIr, XLIv.

4. For the extraordinarily complex story of this plate, see Layard 1922. For other examples, see idem 1907, 39, 46, plates XII, XVI.

5. Witcombe 2004, 17; Landau and Parshall 1994, 304–5.

6. Bowen and Imhof 2008, 196–205.

7. For an excellent accont of Grüninger's woodblocks, see Geeraedts 1980.

8. For Fuchs's woodblocks, Baumann et al. 2001, 162–65, and Schinz 1774, 7–8; for woodblocks of the *De fabrica*, see Cushing 1943, 97–109. The Vesalian woodblocks were destroyed in World War II. For the survival (and recent sale) of the blocks for Mattioli's herbal, see *The Mattioli Woodblocks*.

9. Figures compiled from the exceptionally helpful indexes of Mortimer 1964 and 1974.

10. Rothstein 1990, 111–17; Ott 1999, 192; Kathleen Scott 1989; Alexander 1992, 52–71, 121–49. For various functions of modelbooks, see Scheller 1995.

11. Martin Wackernagel 1981, 317, 335–36.

12. Giovanni 1556, 128–29, as noted in Mortimer 1974, 1:303.

13. Also noted in Rothstein 1990; Luborsky 1987.

14. "Du vindest auch ain yede person in ainer yeden figur. Wa si in disem bůch gebraucht wirt. glych ain mal als das annder. Vnd an ainem end als an dem anndern. mit gewand vnd gestalt. da mit ain yede person vnderschaidenlich aus den anndern erkennt mag werden." Terence 1970–72, 1:[avij]v. For Neidhart's role in directing the content of the images, see ibid., 2: 34–35.

15. Oporinus to Konrad Hubert 2 January 1545, Steinmann, 1969, 119–20. Cf. also the author's acknowledgement to Oporinus for the figures in Gerbelius 1545, A4r.

16. Vesalius 1543a, 23, 38 and 48; 24 and 48; 36 and 47; 14 and 67; 277 and 369.

17. Mattioli (1572), †4r. Cf. Rouillé's *Historia generalis plantarum*, usually attributed to Jacques Dalechamps, and the corrections made to the woodcuts there.

18. Such "credit-building" was not confined to pictorial matter; see the example of Erasmus and Froben in Pabel 2005.

19. Alexander 1992, 121–49; Lilli Fischel 1963, 52–62; Lehmann-Haupt 1929, 128–48.

20. Bath 2008, 69–112, 111 (the cat); for the circulation of Gessner's images, see further Acheson 2010. I thank Michael Hunter for drawing my attention to the latter.

21. Nevinson 1975. For the Continental prints as templates for decorations at Hardwick Hall, see Wells-Cole 1997, 247–96; I thank David McKitterick for drawing my attention to this work.

22. Griffiths 1998, 133–43; for medieval precedents, see Scheller 1995, 267–71.

23. For painted glass windows using patterns of the *Bibla pauperum*, see Henry 1987, 36–37, and from the *Hortulus animae*, Massing 1984, 232–33. See also fig. 7.7.

24. Landau and Parshall 1994, 120–46; Pon 2004, 86–94, 113–18; Riggs and Silver 1993, 1–45.

25. As noted in Church 1919, 238–39.

26. For the eclecticism of images in printed books, see McKitterick 2003, 53–66, and Kusukawa 2010.

27. Ivins 1953, 2. For a sustained attack on the idea that the printing press "fixed" the text, see Johns 1999.

28. Wendland 1980, 13–16.

29. Mortimer 1974, 1:247–48; the Mattioli copy is reported in Weiss 1959, 31, and in Seipel. 2006, 58–59.

30. Weiss 1959 and Hill 1995. I thank Liba Taub for drawing my attention to Hill's work.

31. For printing with red ink, see Scholderer 1958 and 1959.

32. Carter et al. 1982. Information on color copies from the ISTC: http://www.bl.uk/catalogues/istc/.

33. Dackerman 2002, 66–68; König 1991, 158. Early sixteenth-century Parisian use of stenciling in some copies of the *Cronica cronicarum* (1521) and the *Registre des ans* (1532) is noted in Levis 1917, 215.

34. Woodward 2007, 594, and pl. 15 for further examples of Schott's *Geographia*.

35. Bialler 1992, 30–34; Dackerman 2002, 68–72; Pelc 2002, 73–75, no. 77; Bowen and Imhof 2008, 193; Voet 1969–72, 2, plates 45–47. One of Hubertus's cousin's sons was Hendrick Goltzius, for whom, see Leeflang et al. 2003. I thank David McKitterick for drawing my attention to this work.

36. Gascoigne 1997, 21–73. For later developments see Rodari 1996.

37. For examples, see Winn 1997.

38. See the examples in Alexander 1994, 163–208. For lists of books printed on vellum, see Alston and Hill 1996 and Praet 1822–28.

39. Hook and Norman 1991, 1:208–14, for the dedication copy to Charles V.

40. For Holle's financial demise, see Tedeschi 1991.

41. Mortimer 1974, 2:434. I have not seen the 1585 edition myself.

42. Lilian Armstrong 1991, 200–201.

43. Winn 2009.

44. Voet 1980–83, 3:1415–16.

45. Nave and Imhof 1993, 122; Voet 1969–72, 2:243. Colored copies of L'Obel's *Kruydtboeck* survive at the Plantin Moretus Museum; Nave and Imhof 1993, 64–65. Cf. a colored copy of *Hortus Eystettensis* (1613) cost five hundred florins, in comparison to an uncolored copy for thirty-eight or forty-eight florins, though it is unclear whether the colored copies were bespoke. Barker 1994, 17.

46. See chapter 2. This rate tallies with what we know about Schedel's *Liber Cornicarum*: of the 595 copies that remained unsold, fourteen were colored and bound, these being valued at least at six gulden each; an uncolored one, also bound, was about three gulden, while the binding cost about one guilden. Wilson 1976, 237.

47. For "hierarchies" of decorations, see Lilian Armstrong 1991, 180–89, and Winn 1997, 31–32. For Feyerabend's Bible, see Pallmann 1884, 7, 17–31.

48. Gessner 1551–58, 1:γ1 v. See also a similar offer for his book on gems and minerals in Gessner 1565, Aa7v.

49. Gessner 1577, 135r.

50. The original watercolors by Hans Weiditz, also forming part of Platter's herbarium, may well have been the copy after which the coloring was applied in the copy of Otto Brunfels's *Herbarum vivae eicones* (1530) at the Library of the Royal Botanic Gardens at Kew. Sprague 1928, 36, and Sprague's letter (to Agnes Arber) attached to the copy of Brunfels at Kew, Pre-Linn-B. Cf. Arber 1990, 317–18.

51. Gessner to Johannes Crato a Crafftheim, 26 March 1564. Gessner 1577, 22r.

52. Cf. hand-coloring of some early prints may have been trade-organized. McKitterick 2003, 63.

53. It is unclear whether Mijncken herself had done the coloring; Voet 1969–72, 2:242. For the print publishing business of the Liefrinck family, see Landau and Parshall 1994, 220–23.

54. Arber 1990, 317–18.

55. Szépe 1998.

56. Lilian Armstrong 1994, 38–41.

57. König 1983, and for the usefulness of this approach in general, König 1987. For recent findings using spectroscopy, see Chaplin et al. 2005.

58. Rosenthal 1928 and 1930.

59. Loose 1877, 155n3. For Springinklee's images for the *Hortulus animae*, see Oldenbourg 1972, 121–29.

60. Fridolin 1491, hiiir, also noted in Kunze 1975, 1:367. I thank Kristian Jensen for his advice on colored copies of the *Schatzbehalter*.

61. Kunze 1993, 1:128. I have consulted the 1533 edition in the British Library, 1506/670, Bergbuchlein, 25v–26r (coloring instructions).

62. Dackerman 2002, 87–89. Field 2005, 21.

63. Bühler 1960, 74; Klemperer 1927, tab. 1.

64. For early woodcuts in simple outlines as intended for coloring, see Parshall et al. 2005, 20.

65. Plumier 1693, ãiij v.

66. Bradley 2009, 130–37.

67. The problematic nature of a historical and cultural understanding of color is argued conclusively in Gage 1993.

68. See in particular Hall 1992 for Renaissance paintings.

69. Meyer et al. 1999, 1:120, 633.

70. Cf. Banks's colored copy (British Library, 450.h.2) of Fuchs's *Neu Kreutterbuch* (1543). For the later coloring of the *Hortus eystettensis*, see Barker 1994, 43–48. Dating of coloring may be helped by scientific pigment analysis.

71. For a partially colored copy of Mattioli 1558, see Cambridge University Library, N*.7.5 (B); McKitterick 2003, 68.

72. I follow here Gage 1993, 29–36, 79–96. For how little agreement there was regarding which colors German color terms referred to in the vernacular versions of the works of Brunfels, Bock, and Fuchs, see Seidensticker 2010. I thank Christine Salazar for drawing my attention to this work.

73. Fuchs 1542, β3r–β4v, translated in Meyer et al. 1999, 1:220–59. Fuchs's terms for colors were fairly standard: for example, *rubrus*, *purpureus*, *puniceus*, *rosaceus*, *croceus*, *luteus*, *caeruleus*, *albus*, *candidus*, *virides*.

74. Gage 1993, 80. Familiarity with Aulus Gellius's *Attic nights* (2.26) may also have helped Renaissance readers. For this text, see Bradley 2009, 229–33.

75. Bradley 2009, 132.

76. Willich 1582, 8.

77. Ibid., 104.

78. Ibid., 103.

79. Gage 1993, 80–82. For the convention of representing colour by engraved lines, see Petrasancta 1634, 313–14. This convention is not present in Guillim, *A Display of Heraldrie*, until its 1679 edition.

80. Dodart 1676, 7.

81. Landau and Parshall 1994, 310–15.

82. Hahn et al. 2004.

83. Vesalius 1998–, 2:22.

Chapter 4

1. Meyer et al. 1999, 1:665.

2. "Cum Caesareae Maiest. Galliarum Regis, ac Senatus Veneti gratia et privilegio ut in diplomatis eorundem continetur." Vesalius 1543a, title page.

3. For this chapter I have benefited from Elizabeth Armstrong 1990, Witcombe 2004, and Richardson 1999.

4. For Maximilian's interest in printing, see Kunze 1993, 1:224–44, and Tennant 1989; for Leo X, see Elizabeth Armstrong 1990, 12. For a list of papal privileges before 1527, see Blasio 1988, 79–98.

5. Elizabeth Armstrong 1990, 27–28.

6. For Crato, see Evans 1975, 22–23, Louthan 1994.

7. Witcombe 1991.

8. Gessner 1577, 18v. For Seld's intellectual interests, see Georg Vogel 1933, 63–66.

9. For further examples, see Schottenloher 1953, 197–208.

10. As described in Schottenloher 1933, 92. Cf. Kirchhoff 1880, 93–95.

11. "Ex parte sanctissimi domini nostri domini Leonis divina providentia papae decimi, et de eiusdem mandato mihi B. episcopo sabinensi cardinali sanctae crucis vivae vocis oraculo facto, notificatur omnibus et singulis, ac *sub poena excommunicationis* latae sententiae, et ducentorum ducatorum aureorum irremissibiliter exigendorum et camerae apostolicae de facto applicandorum praecipitur, quod nemo audeat vel praesumat imprimere, sive imprimi facere, aut impraessum vendere hoc breve vel compendium de correctione calendarii, sine licentia reverendi patris domini Pauli episcopi forosemproniensis, et domini Iacobi Sadoleti eiusdem sanctissimi domini nostri secretarii." Paul of Middelburg 1514/15, [div]r (my emphasis). For other books with penalty clauses of excommunication, see Blasio 1988, 88–97.

12. Martin Vogel 1978, 33. For the definition of "new" texts, see Elizabeth Armstrong 1990, 92–99.

13. Meyer et al. 1999, 1:802.

14. Hirsch 1967, 84–85. Woodward 1996, 68–69.

15. Witcombe 2004, 22–23, 80, 245–51; Hirsch 1967, 86; Woodward 1996, 67–69.

16. Witcombe 2004, 58.

17. Koerner 1993, 213; Hindman and Farquhar 1977, 189.

18. The first privilege is followed by the second in Fuchs 1545d, A2r–A3r. The plagiarism by Egenolff and Ryff is mentioned at A4r. This case is noted in Schottenloher 1933, 101.

19. Bury 2001, 128, 175–77.

20. Elizabeth Armstrong 1990, 205.

21. Valverde 1556, verso of title page.

22. Schottenloher 1933. For Basel's link with France, see Bietenholz 1971, especially 25–54. For early papal privileges, see Blasio 1988.

23. Mattioli 1565, **6r–**7v.

24. Cf. some of Froben's title pages for Erasmus in Pabel 2005.

25. For an example of a printed paraph, see Elizabeth Armstrong 1990, 41.

26. These figures were used in Arnoullet's edition of Fuchs's *Plantarum effigies* (1551) and Dioscorides's *De materia medica* (1552). Baudrier 1895–1921, 10:102–3; Mortimer 1964, 1:289; Meyer et al. 1999, 1:698–700. For other instances of images being copied promptly after the expiry of their privilege, see Elizabeth Armstrong 1990, 199–202.

27. Elizabeth Armstrong 1990, 194–99; Witcombe 2004, 81–86.

28. Vesalius 1998–, 1:lx–lxi.

29. "Every supplicant for copyright may be identified as a publisher." Witcombe 2004, 27.

30. The original documents are transcribed in Altona 1892, and are summarized in Grotefend 1881. This case has also been discussed by Parshall 1993, 568–70, Landau and Parhsall 1994, 253, and Koerner 1993, 215–18.

31. This was the *Kreuterbuch* attributed to Johannes von Cube, followed by the *Herbarum imagines vivae*.

32. Altona 1892, 899–900.

33. Grotefend 1881, 16–17.

34. Cube died around 1504; see *NDB* 3: 435–36.

35. Altona 1892, 901.

36. Ibid. "Jacob Meller" is identified as Barbari in Parshall 1993, 569.

37. Egenolff 1544, b4v.

38. Fuchs 1545a, D1r.

39. Grotefend 1881, 22.

40. For universities as censoring authorities, Hirsch 1955, 101–3; for the Sorbonne, Higman 1979. For the Holy Roman Empire, see Eisenhardt 1970, 24–34.

41. Hirsch 1955, 103.

42. Monfasani 1988.

43. Fredericq 1899–1903, 4:56; Kapp 1886–1923, 1:536–38.

44. Grivel 1989, 15.

45. Hirsch 1967, 96 (see also the pro-evangelical censorship in Augsburg, Costa 1916, 16–17); Clark 1984.

46. Scribner 1981, Edwards 1994, Köhler 1981. See also Williams 2010 for the Protestant printer John Day's self-censorship of images.

47. Grendler 1977, 147–48.

48. Bujanda et al. 1990, 758, 771.

49. Shelfmark KB1555. F8T. Cf. a similar treatment of Melanchthon's name in books, Pantin 1987.

50. Grendler 1977, 99, 297.

51. Bujanda et al. 1994, 929.

52. For the passages to be corrected, see Gingerich 2002, 367–68.

53. Gingerich 1981.

54. Pettas 1995, 19.

55. Grendler 1977, 119n150, 290.

56. Christian Hecht 1997, 178–86.

57. See Molanus 1570, 14v, chap. 2, entitled “Quod in libris prohibetur, prohibendum etiam esse in picturis, quae sunt idiotarum libri.” This is a reference to Gregory the Great’s dictum, for which see Chazelle 1990.

58. Bury 2001, 129.

59. Bury 2001, 131. For Thomassin’s activities in Rome, see further Witcombe 2004, 200–206.

60. For the sources and reception of Holbein’s pictures, see Michael 1992. Jean Vauzelles is identified as the probable author of the French prose of the Bible (1538) and Gilles Corrozet of the Latin text of the Bible (1539).

61. Bible (1542).

62. I follow here the findings of Davis 1956.

63. Luther to Georg Spalatin, 15 August 1521. Luther 1955–86, 48:296; cf. also 54:141. For Luther’s relationship with his printers, see Richard Cole 1984.

64. To Melchior Guilandino Borussus, 27 May; Gessner 1577, 139v. Of more than 900 titles printed by Froschauer, 560 were on religion, and 35 on medicine and science. Leemann-van Elck 1952, 128–30. The predominance of theological titles in Froschauer’s output is reflected in his advertisement of 1555; Richter 1965, plate 19.

65. To J. Bauhin, 5 November 1562. Bauhin 1591, 111.

66. Westman 1980.

67. Nave and Imhof 1993, 112.

68. To J. Bauhin, 5 November 1562; Bauhin 1591, 117. Gessner to John Caius, 29 August 1561; Gessner 1577, 135v. Also noted in Reeds 1983, 266–67.

69. See the numerous variants in additions, changes, and cancel slips as a result of his precarious finances in Salviani 1554. See Mortimer 1974, 2:628–29. For Salviani, see further Pinon 2002.

70. An exception would be Ulysse Aldrovandi and his production of *Ornithologiae*, for which we await the authoritative study by Laurent Pinon; see also Pinon 2003.

71. But note, for example, that only 25 percent of copies of the first edition of *De revolutionibus* contained the (incomplete) errata sheet. Gingerich 2002, 362–66.

72. Fuchs 1542, 898 (my interpolation). Two other corrections of names in images are given. Vesalius 1543a [664], correction for p. 181. Cf. paste-overs of the *text* accompanying pictures: see Salviani 1554, 112v, 130r, 156v, 192v in Cambridge University Library shelfmark: M.13.5.

73. L’Obel and Pena 1571 have several additional slips of corrected woodcuts pasted onto the page or inserted between pages. See Voet 1980–83, 3:1407–8.

74. Fred Schreiber 1995, lxvii–lxix; Kellett 1957; Herrlinger 1967; Roberts and Tomlinson 1992, 168–87.

75. Some of the figures were based on erotic Italian prints. Kellett 1957.

76. Concasty 1964, 304.

77. Fred Schreiber 1995, lxvii–viii.

78. Concasty 1964, lxxxiii, 500.

79. “Very little anatomy” is a verdict by Roberts and Tomlinson 1992, 182.

80. For Vesalius’s supervision of the printing of *De fabrica*, see O’Malley 1964, 129, 136.

81. Vesalius 1998–, 3:210. For authors and privileges, see further Richardson 1999, 69–76.

Chapter 5

1. See the contributions in Wear et al. 1985.

2. For Fuchs’s biography, see Meyer et al. 1999, 1:16–44. This chapter and the next expand on Kusukawa 1997.

3. See Fuchs’s Latin translations of the sixth book of Hippocrates’s *Epidemics* (1532) and also of the same author’s *Aphorisms* (1537).

4. See Fuchs 1539, 1542, 1551.

5. Fuchs 1530, Xv–XIv.

6. For Leoniceno, see Nutton 1997b, 1–8, and Ogilvie 2006, 126–33. Here I summarize Leoniceno 1529, 239–42.

7. Dioscorides 1543, 344; Pliny the Elder 1532, 490.

8. Leoniceno 1529, 241.

9. This paragraph is indebted to Godman 1998, 88–104.

10. For the "School of Ferrara," see Nutton 1997b.

11. See Meyer et al. 1999, 1:658, 660, 799–800. Other physicians who challenged Fuchs's work included Symphorien Champier (1472–1537) and Michael Servetus (1511–1553); Meyer et al. 1999, 1:798–816.

12. Monteux 1537, 42–43.

13. Fuchs 1535, 9v.

14. Monteux 1537, 44.

15. Ibid., 45.

16. Porphyry 1994, 1–11.

17. Aristotle, *Metaphysics*, 6.2.

18. Porphyry 1994, 11.

19. Ibid., 19.

20. *Commentary on the Isagoge* in Boethius 1847, col. 133.

21. For an assessment of Boethius's commentary on the *Isagoge*, Marenbon 2003, 23–31.

22. For background, see Maclean 2001b, 228–35.

23. Cf. Aristotle, *Rhetoric*, 3.6.

24. Monteux 1533, vr.

25. For reference to Agricola's *nativa adiacentia*, see Fuchs 1540, 95. For editions of Agricola's *De dialectica*, see Huisman 1985, 17–87; for their diffusion, see Mack 1993, 257–79.

26. Agricola 1515, Biii r.

27. Ibid., Biii r–v.

28. "Nativa adiacentia sunt, quae intrinsecus ex ipsa oriuntur, velutique innata sunt." Agricola 1538, 103.

29. Fuchs 1540, 94–95.

30. Agricola 1515, A5v; also noted in Mack 1883, 153.

31. See Melanchthon's praise of Fuchs in Melanchthon 1977–, no.1430, T6:79–81.

32. To Fuchs, 1537. Melanchthon 1834–60, 3:411.

33. Melanchthon 1531, E2v.

34. *Erotemata dialectices* (1547) in Melanchthon 1834–60, 13:522.

35. Ibid., 528–29.

36. "Modus namque humanae cognitionis ferme ex multis accidentibus unam quandam substantiae imaginem colligit, quemadmodum Homerus fecit, ubi si strabis oculis, acuminato capite, gibbosis humeris, garrulitate scurruli Thersiten fuisse scribit. Denique cur argumenta ducta a definitione, ex genere et accidentibus, inefficacia essent, cum fere ubique differentias rerum per accidentia circumloquamur? Neque enim multa propria nomina differentiarum extant." Fuchs 1535, 9v–10r.

37. Monteux 1533, vv.

38. Fuchs 1535, 10r.

39. Ibid. Cf. Boethius's likening of rhetorical description with depiction in colors, noted in Maclean 2005b, 169n11.

40. "Leonardi Fuchsii annotationes aliquot herbarum et simplicium, a medicis hactenus non recte intellectorum." Brunfels 1530–36, 2:129–55; Leoniceno's *De falsa quarundam herbarum inscriptione a Plino* and Collenuccio's *Adversus Nic. Leonicenum Pliniomastigen defensio* were also included. For Brunfels's role in disseminating these Italian ideas, see Dilg 1975, 247–49.

41. E.g., Brunfels 1530–36, 2:20 (*foeniculum*) and 3:174 (*antheum*). For further examples, see Sprague 1928, 80.

42. Monteux's objections are entitled "Quod picturae simplicium medicamentorum sint fallaces, et inde ducta argumenta sint fallacia" in Monteux 1533, vr.

43. Rott 1933–38, vol.1 *Bodenseegebiet Text*, 160; vol. 1 *Bodenseegebiet—Quellen*, 167; vol. 2 *Alt-Schwaben und die Reichsstädte*, LVI.

44. Meyer et al. 1999, 1:48. See also Melanchthon to Fuchs, 12 November 1538. Melanchthon 1977–, no. 2117, T8:251.

45. Fichtner 1968, 78.

46. His salary was 160 florins for 1535 and 1537, with an additional 15 florins for "publishing his own books" and yet another 15 florins for "living quarters." In 1540 his salary was 200 florins, which included 5 florins for housing. Meyer et al. 1999, 1:283–84.

47. For a helpful survey of author portraits for this period, see Mortimer 1996.

48. The identification of the *plant* is in Baumann et al. 2001, 143.

49. Meyer et al. 1999, 1:204 (translation modified). The Greek word is used in the original preface; Fuchs 1542, α4r.

50. Meyer et al. 1999, 1:125 (Margrave George), 211 (Schaller).

51. Joachim II's grandfather, Johann Cicero of Brandenburg, and Georg's father, Friedrich V of Ansbach, were brothers.

52. "De industria vero et data opera cavimus ne umbris, alijsque minus necessarijs, quibus interdum artis gloriam affectant pictores, nativa herbarum forma obliteraretur; neque passi sumus ut sic libidini suae indulgerent artifices, ut minus subinde veritati pictura respondet." Fuchs 1542, [α6]v.

53. Ogilvie 2006, 196.

54. For this annotating device, see William Sherman 2005.

55. Fuchs 1542, [α3v]–α4r. Fully translated in Meyer et al. 1999, 1:198–219. For the topos of "old wives," see Reeves 1999 and the literature cited there.

56. Fuchs 1542, α4r.

57. Ibid., [α5]v.

58. Ibid., 604.

59. Ibid., 731, 735.

60. Sections on these five plants are translated in Meyer et al. 1999, 1:614–25.

61. Fuchs 1542, 532; Meyer et al. 1999, 1:76 (translation modified).

62. For the foolhardy who eat *verangenes* (aubergine), see Harrison 1968, 264.

63. Fuchs 1542, [α6]v.

64. Ibid.

65. Ibid.

66. Ibid.

67. Ibid.

68. Fuchs 1542, [α6]r; Meyer et al. 1999, 1:210 (translation modified).

69. Cf. the jar of aloe in Dorsten 1540, 25r.

70. For this theme, see Nordenfolk 1985.

71. "Quis quaeso sanae mentis picturam contemneret, quam constat res multo clarius exprimere, quam verbis ullis, etiam eloquentissimorum, deliniari queant. Et quidem natura sic comparatum est, ut pictura omnes capiamur: adeoque altius animo insident quae in tabulis aut charta oculis exposita sunt et depicta, quam quae nudis verbis describuntur. Hinc multas esse stirpes constat, quae cum nullis verbis ita describi possint ut cognoscantur, pictura tamen sic ob oculos ponuntur, ut primo statim aspectu deprehendantur." Fuchs 1542, β[1]r.

72. Ibid., β[1]r.

73. Ibid.

74. See chapter 4.

75. Fuchs 1542, [α5]v–[α6]r; cf. the repeated images in Dorsten 1540, 106r and 108v, 35r and 189v, 16r, 120r, and 140r.

76. Fuchs 1542, [α5]r.

77. Ibid., [α6]r.

78. "Quod ad picturas ipsas attinet, quae certe singulae ad vivarum stirpium lineamenta et effigies expressae sunt, unice curavimus ut essent *absolutissimae*, atque adeo ut quaevis

stirps suis pingeretur radicibus, caulibus, folijs, floribus, seminibus ac fructibus, summam adhibuimus diligentiam." Fuchs, ibid., [α6]v (my emphasis).

79. "Perfectus, ad finem perductus, nulla re indigens." *Thesaurus Linguae Latinae*, 1:178. The *loci classici* for this word include [Cicero] 1968, *Ad Herennium* (1.14.24), and Pliny the Younger 1969 (5.15.1).

80. For the sense of the English word "absolute" as used by Sir Thomas Smith and William Shakespeare, see Daly 1978, 228–31.

81. I have followed Oberman 1963, 30–56, for *potentia Dei*. For discussions of absolute monarchical power, see Daly 1978 and Miller 1990.

82. Blunt and Stearn 2000, 67–71; Ogilvie 2006, 196.

83. For example, Fuchs 1542, 352, 469, 825.

84. Fuchs 1542, 468.

85. Blunt and Stearn 2000, 71. For a list of these "composite" images, see Meyer et al. 1999, 1:121–22.

86. Gessner 1551–58, 1:865–66 (cf. 851 and 852).

87. As translated in Meyer et al. 1999, 1:624.

88. As noted in Blunt and Stearn 2000, 67; Ganzinger 1959, 215.

89. Fuchs 1542, 643. Cf. Dioscorides's description of the *petasites*: "It is a shoot, taller than a cubit and thick as a thumb, bearing large, hat-shaped leaves, as if they were mushrooms, and which are good for malignant and cancerous ulcers when applied ground." Dioscorides 2005, 292–93.

90. "Pediculus est cubito major, crassitudine pollicis, in quo petasi figura folium magnum, ut fungus dependet. Ex qua sane descriptione satis perspicuus fit, herbam cuius picturam damus esse Petasiten." Fuchs 1542, 643.

91. Ibid.

92. Ibid.

93. Ibid.

94. Ibid.

95. Ibid.

96. Riddle 1985, 171–72.

97. Fuchs 1542, 645..

98. Ibid.

99. Ibid. Fuchs added that it was helpful for pains in the uterus, for getting rid of intestinal worms, for inducing urine and menstruation, and for treating wet wounds.

100. Stannard 1978, 443–49.

101. "Plinius secus quam Dioscorides hortens serpyllum nequaquam, sylvestre vero humi serpere asserit, adeo ut subesse in hoc mendam versimile sit: res enim ipsa et vivae herbarum imagines satis testantur, Dioscoridis sententiam esse veriorem." Fuchs 1542, 250 (De Erpyllo). Cf. Pliny the Elder, *Historia naturalis* (20.90), and Dioscorides, *De materia medica* (3.38).

102. Fuchs 1542, 135 ("De agrosti").

103. Rondelet 1554, 1:3. For the resemblance of this book to contemporary herbals, see Reeds 1991, 63–64. For the later development of the status of accidental definitions, see Maclean 2005b.

Chapter 6

1. Meyer et al. 1999, 1:803. Fuchs 1545a, A2r.

2. Stübler 1928, 103–4.

3. Meyer et al. 1999, 1:809.

4. Ibid., 1:812.

5. This is an exaggeration, since the measurement suggests that Fuchs's book was printed on demy paper, which is smaller than royal paper; Gaskell 1995, 86.

6. Dioscorides 1557, α3r.

7. Ibid.

8. “Nos non oculos pascere, sed animos alere, et iudicia excitare, et excavere voluimus, eorum qui haec nostra amore capti, non livore acti legent.” Ibid., α3v.

9. Ibid., α2v.

10. Miedema 1968, 236.

11. The pictures of Alciati’s *Emblemata* were inserted by the publishers. For Alciati’s use of the term as epigrammatic, see Miedema 1968. Cf. Cornarius 1529, which included epigrams translated by Alciati; Alison Saunders 1982, 3.

12. E.g. “anthenidis pictura & vires,” “buglossi pictura et vis;” Dioscorides 1557, a2r and a3v.

13. “Petasites. pediculus est *maior cubito, digiti magni* crassitudine, in quo folium petasi *sive galeri modo* magnum, *incumbens velut* fungus. Facit hoc ad maligna et phagedaenica ulcera, *tritum impositum*.” Ibid., 353. I have italicized the parts that differ from Fuchs’s Latin quotation of the same passage of Dioscorides.

14. Ibid., 354.

15. Ibid.

16. Clemen 1912, 40, 44–45.

17. “Ex illo porro tempore reprobatis ac reiectis medicis illis barbaris, quos per totos novem annos sequutus eram, totum me ad graecam medicinam contuli Graecisque medicis me totum addixi, quos et sequor et ad quorum imitationem medicinam exerceo, et iam per viginti sex annos Germaniae nostrae persuadere persevero hos esse veros medicos et rectos artis medicinae autores, ipsorum maxime lingua legendos ac sequendos. Et ut non esset quod querentur aliqui vel de Graecae linguae ignorantia, aut horum authorum difficultate, conatus sum Graecos illos medicos facere Latinos, non obscura et perplexa, sed lucida et explicata usus illorum in Latinam linguam translatione.” Preface dated 1 April 1555 to Michael Meienburg, in Paul of Aegina, *Totius rei medicae libri*; reprinted in Cornarius 1567, qiiir.

18. For Cornarius’s output, see Clemen 1912.

19. Cf. humanist suspicion against the use of images in the study of monuments; Zorach 2008, 66.

20. See also the assessment that Fuchs was a less skilled philologist than Cornarius in Durling 1989, 42–47.

21. For Mattioli’s commentaries, see Stannard 1969.

22. Mattioli 1558, β4v.

23. Ibid.

24. Ibid.

25. Ibid.

26. Ibid.

27. Mattioli 1558, [α6]v.

28. Findlen 2000, 380–90. For Fuchs’s criticism of Mattioli, see Ogilvie 2006, 59.

29. Mattioli 1558, β4r.

30. Meyer et al. 1999, 1:674–77.

31. Fuchs 1545d, A2r.

32. Ibid., A3r.

33. Its full title translates as “”The New Plantbook, in which not only the whole history, that is, name, form, place and season of growth, nature, power and effects of the plants growing in Germany and other lands is described with the best industry, but also their root, stem, leaves, flower, juice, fruit and the entire form, are skilfully pictured and copied, as has never before seen the light of day.” See Meyer et al. 1999, 1:134, for the six new figures added to the book.

34. Fuchs 1543b, 2r–3r.

35. “Ich derhalben mein Kreüterbůch hette woellen inn die Teütschen spraach bringen, damit auch der gemein mann kündte ihm selbert in der not artzney geben und allerley kranckheyt heylen.” Ibid., 2v.

36. For attention to the indigenous in natural history as a result of New World discoveries, see Cooper 2007.

37. "On translating," Luther 1955–86, 35:189, for the reference to the "common man."

38. Blickle 1996, 386. Cf. Roper 1987.

39. These constituted about 20 percent of the population, after the top 10 percent of nobility and well-off citizens who had the ability to participate in political power in one way or another. Schenda 1988.

40. Schenda 1988.

41. Fuchs 1543b, 2v.

42. Ibid.

43. Arber 1990, 153; Meyer et al. 1999, 1:134.

44. Fuchs 1543b, Vv2r (Turkish corn), [Mm5]v (chili pepper).

45. "La court veu la Requeste a elle presentee par vivant Gaultherot, Jacques Gazeau, et Jacques Bogard, Libraries en L'Universite de Paris, avec la certification des Docteurs en la faculte de Medecine, en L'Universite de Paris . . . Faict le vingtseptiesme iour de Janvier, 1542." Fuchs 1543a, verso of title page. The privilege is fully translated in Meyer et al. 1999, 1:668.

46. Meyer et al. 1999, 1:667–68. Also reprinted in 1546 and 1547; 683, 687–88.

47. Fuchs 1543a, AAiijr.

48. Ibid., 78v (balsam), 275v (strycnon), 207v (myrice), 248r (polygonum mas).

49. Fuchs 1545b, [d4]r. Meyer et al. 1999, 1:37.

50. For the foundation at Pisa, see Garbari and Tongiorgi Tomasi 1991.

51. Fuchs 1550, [ãvij]v.

52. "Sentiebam etiam simul mihi datam esse occasionem sane optimam, ut me cur minus tuis postulates gratificari potuerim, honestissime excusarem, et ut *optimi et charissimi amici D. Andreae Vesalij, viri optimis quibusque disciplinis instructissimi, ac linguae utriusque, Graecae et Latinae, medicinaeque, eius potissimum partes quam anatomen appellamus* (*in qua, ut ingénue quod res est fatear, Galenum ipsum longe superavit*) *peritissimi*, fidem apud te liberarem. Nihil enim virum hunc in officio suo deliquisse aut cessasse, sed mandata tua diligenter et fideliter esse executum, tibi plane persuasum habeas." Fuchs 1550, a7v (my italics).

53. ". . . Andreas Vesalius, anatomes peritissimus illustrator, qui eas quoque quarum sic pictas icones damus radices, amicitiae ergo mihi dono dedit." Fuchs, *Codex* 11 123, 3(1):338. See Foust 1992, 3–17, for the identity of the rhubarb in this period.

Chapter 7

1. For Gessner as the "father of bibliography," Wellisch 1975, 151. For Gessner's *Historia animalium*, see Pinon 2005. For *De rerum fossilium*, see Rudwick 1976b, 1–35.

2. For Gessner's notes on these pictures, see also Ogilvie 2006, 174–80.

3. Gessner 1751–51, on which see also Serrai and Cochetti 1990, 348–52. The modern editions are Gessner 1972–80 (*HP* hereafter) and Gessner 1987–91. This chapter is heavily indebted to the work of the editors of those editions. I use the term "Historia plantarum" to refer to the collection of the original drawings at Erlangen, Universitätsbibliothek, Ms 2386.

4. For Gessner's bio-bibliography, I follow Wellisch 1975.

5. For his time at Lausanne, see Olivier 1951.

6. Wellisch 1975, 158, 163.

7. For Gessner's publications, see Serrai and Cochetti 1990.

8. To Kentmann, 16 March 1555; Gessner 1584, A3v.

9. For the *Historia animalium*, see Pinon 2005, Kusukawa 2010.

10. To Fuchs, 18 October 1556, in Heller and Meyer 1983, 67, 69 (translation modified). Cf. the proposal by Caspar Wolf (1532–1601) to complete Gessner's *Historia plantarum* with the same eight-heading structure used in the *Historia animalium*, in his *hyposchesis* added to Simler 1566, 45v–47r.

11. We appear not to have Fuchs's response, but in 1565 he still fumed at such an idea: "Let him arrange his own things as he will, I will not permit him to arrange mine otherwise than I have done myself!" Fichtner 1968, 80n78; Heller and Meyer 1983, 75 (translation modified).

12. Gessner 1584, A3v. Gessner was referring to Fuchs 1542, Bock 1552, Dodoens 1554, Turner 1551, Belon 1553, and Lonicer 1551. For some reason, Gessner omitted from his list Brunfels's *Vivae eicones*, which he had certainly read and admired by then, as noted in Ogilvie 2003, 143.

13. To Kentmann, 27 February 1559; Gessner 1584, B4v-Cir. Cf. "Historia plantarum," 9r, Gessner's desiderata of plants.

14. Gessner called Aldrovandi "quo nemo diligentior, nemo copiosior in totius naturae rerum variarum possessione vivit"; Bauhin 1591, 112.

15. For a full list of those who contributed plants or pictures of plants, see Steiger 1968, 42–43. For an analysis of Gessner's correspondence network, see Delisle 2008 and 2009.

16. To Wolf, 1557; Gessner 1577, 122v.

17. Gessner 1577, 10r–11r; Bauhin 1591, 114. For some of these catalogues, see Gessner, *De hortis Germaniae*, in Cordus 1561, 243r–v.

18. To Zwinger, 7 April 1564; Gessner 1577, 107r–v.

19. To J. Bauhin, 20 April 1561; Bauhin 1591, 101. For Sebald Hauwenreuter, see Adam 1620, 311–14.

20. To Adolf Occo, 8 July 1565; Gessner 1577, 64v. For Herold, see "Historia plantarum," 228r, 229r, 229v, 230r; Cordus 1561, 85r–v.

21. To Joachim Camerarius the Younger, 27 August 1565; Rath 1950, 164. One plappart = 1 *s.* = 12 *d.*, Erasmus 1974–, 11:25n2.

22. To J. Bauhin, 1 August 1563; Bauhin 1591, 123–24.

23. To Johannes Fabricius Montanus, 19 July 1560; Gessner 1577, 89r. See also an earlier letter to Fabricius, 12 July 1560; ibid., 88v–89r.

24. To Fabricius Montanus, 20 March 1561; ibid., 89v.

25. To Aretius, 4 February 1565; ibid., 120v.

26. To Camerarius the Younger, 17 June 1564; Rath 1950, 152.

27. "Herba inventa primum a M. Iacobo Baumanno." *HP* 3:tab. 23.

28. Cf. the exchange of favors among the nobility. Neuschel 1989, 69–78. I thank Nick Jardine for drawing my attention to this work.

29. For the cinnamon branch, *HP* 8:tabs 21–22. For Calzolari's pictures of the *daphne Cneorum*, see *HP* 1:83. For plants sent by Calzolari to Gessner, see Salzmann 1959.

30. Nissen 1966, 58–59, which supercedes Leemann van Elck 1935, 19–25.

31. E.g., *HP* 5:tab. 9; 2:tabs 12, 17, 19; 3:tab. 3.

32. For Murer, see *NDB* 18:607–8; Anderes 1981, 18; Dürst 1997.

33. *HP* 4:tab. 3.

34. *HP* 6:tab. 10.

35. Simler 1566, 15r.

36. Kusukawa 2007, 226n29. I also thank Lorraine Daston for making available her notes from the Bibliothèque Centrale du Muséum National d'Histoire Naturelle, Salle des Réserves, MS450, containing instructions to artists and assistants working on "*histoire des plantes*" for the Académie Royale des Sciences. See further Daston and Galison 2007, 84–95.

37. To Kentmann, 4 March 1562; Gessner 1584, C3v.

38. To J. Bauhin, 1 August 1563; Bauhin 1591, 123. To Crato, 1 August 1563; Gessner 1577, 13r. Also noted in Hanhart 1824, 214.

39. To J. Bauhin, 1 August 1563 and 9 August 1563; Bauhin 1591, 122.

40. To J. Bauhin, 12 December 1563, and 1564; ibid., 135, 141.

41. To J. Bauhin, 11 July 1563; ibid., 117. Also noted in Reeds 1983, 266–67.

42. To J. Bauhin, 1563; Bauhin 1591, 126.

43. To Camerarius the Younger, 22 September 1565; Rath 1950, 195. To J. Bauhin, 11 and 29 October 1565; Bauhin 1591, 157.

44. *HP* 6:99–105.

45. To Zwinger, 22 March 1563; Gessner 1577, 111r.

46. Dürer believed that both the block cutter and the glass painter needed clear directions for outlines and shading; Butts 2003, 342. For Murer's glass paintings at Wettingen, see Hoegger 1998.

47. To Occo 26 September 1565; Gessner 1577, 65r.

48. Ibid.

49. 1 August 1563; Bauhin 1591, 123. Cortuso later became prefect of the garden in Padua; see Trevisan 1995, 70.

50. *HP* 4:tab. 23.

51. Except in cases of a nature print such as the one of the *citria* (sent by Wolfgang Meurer); "Historia Plantarum," 327r.

52. To Kentmann, 27 February 1559; Gessner 1584, B4r. Kreich is also mentioned in *HP* 1:tab. 27.

53. For plants from the Fugger gardens, see *HP* 6:tabs 3–8.

54. *HP* 7:tab. 15.

55. *HP* 5:tab. 1. Baumann originally worked in Nuremberg, and is better known for his German rendering of Vesalius's *De fabrica* (1551). For his public dissections at Nuremberg, see Ebstein 1909.

56. To Fuchs, 18 October 1558; Gessner 1577, 137v; Durling 1980, 105.

57. Hanhart 1824, 141, 211.

58. To Dydimus Obrecht, 18 March 1560; Gessner 1577, 115r; Fretz 1948, 61–76.

59. For a reference to locations in Gessner's gardens see, for example, *HP* 7:tab.19.

60. Gessner, *De hortis Germaniae*, in Cordus 1561, 243v. Cf. a similar description of his own garden: to Cosmus Holtzach, 6 September 1554; Gessner 1577, 81v.

61. For Gessner's views of the mountains, see Gessner 1937. For the route of Gessner's trip in 1561, see Steiger 1978.

62. E.g. *HP* 5:tab. 9.

63. *HP* 3:tab. 11.

64. For references to Gessner's wife, "Historia plantarum," 206v, 434v, *HP* 4:tab. 7; 6:tab. 4; cf. *HP* 1:tab. 22 (Frau Wellenberg); 8:tab. 18 (Imcker Schaerer).

65. Simler 1566, 14v.

66. Gessner's *herbarium* appears not to have survived. For herbaria, see further Ogilvie 2006, 165–74.

67. *HP* 6:tab. 22; 5:tab. 15; 7:tab. 10.

68. *HP* 4:tab.18. For litmus blue, see Harley 2001, 63.

69. "Herba mihi ignota, 1554 ex semine misso nescio an Gallia vel Italia." *HP* 1:tab.17.

70. "Folia lapathi mollia, succosa, acria admodum—et pungentia sicut Noli me tangere fere, ut forte venenati aliquid habeat. Primus quidem gustus subacetosum aliquid refert—(vide an zinziber caninum), laevia. Caulis fere rotundus est, non sine eminentibus quibusdam angulis, viridis, modice hirsutus, pinguis (ut calices florum, ita digiti fere propter lentorem adhaereant), cubitalis aut maior, solidus, sed medulla intus fungosa. Flores pallidi sunt vel lutei coloris diluti, (aut similes Arthriticae floribus figura et divisione), intra calyces virides pulchre coronantes media fere parte inclusi exemptiles, qui cum deciderint, vascula seminum subnascuntur subrotunda instar avellanae, in quibus semina etc." Ibid.

71. "Florebat Julio in hortulo meo. Augusto sem[xxx]. Radix inutilis, paucis fibris albis haeret. Herba tota mollis et flaccida est, sine odore fere, nisi quod circa florum calyces nescio quid genus obscure olet. In pinguiore solo ad tres cubitos excrescit." Ibid.

72. "Semina nihil plane caloris, cum saepe et diu manderem, mihi repraesentarunt." Ibid.

73. "Quae propter vascula vocetur ficto nomine a nobis Lapathum Apocynon." Ibid.

74. "Priapeia Rondeletio." Ibid.

75. For Rondelet's teaching, see Lewis 2007, 70–94, and Reeds 1991, 55–72.

76. "An Petun Theveti cognata herba?" *HP* 1:tab.17.

77. Thévet 1558, [59]r. On Thévet, see Lestringant 1994.

78. Gessner owned the Paris and Antwerp editions of Thévet's *Les singularitez*; only the Antwerp copy survives. See Leu et al. 2008, nos. 361–62, and Leu 1992, 286.

79. Thévet 1558, [59]v.

80. Marginal annotations in Thévet 1558, [59]v; Basel University Library, Hx VI 30. Cf. To Occo, 5 November, 1565; Gessner 1577, 79v.

81. “Habet etiam Dodonaeus.” *HP* 1:tab. 17. For Gessner’s copies of Dodoens’s herbal, see Leu et al. 2008, nos. 115–16.

82. “Priapeia aliorum . . . Bummanus dicebat Augustae etiam Lunariam vocari.” The *hyoscyamus luteus* was already depicted in Dodoens 1554, ccccIxxxj, as pointed out in Ockenden 1939, 273–74. The comparison between the tobacco plant and henbane goes back to Oviedo (1535); Brooks 1937–52, 1:204.

83. Cordus 1561, 241r. For Coudenberghe’s role in distributing plants, see further Egmond 2008.

84. Cordus 1561, 262r.

85. Meyer et al. 1999, 1:631, Baumann et al. 2001, 122 for Albrecht Meyer’s dates working on the Vienna Codex.

86. Meyer et al. 1999, 1:631.

87. The term *priapeia* was also used by Gohory. See Ockenden 1939, 276.

88. “Such imm Matthiolo 460b.” *HP* 1:tab. 17.

89. *HP* 1:89. Gessner’s copy of this edition appears to be lost. See Leu et al. 2008, A41.

90. Cf. Brooks 1937–52, 1:271–74, for a translation of passages from Gessner’s letters relating to his chewing the leaves of what was probably the *Nicotiana tabacum*.

91. *HP* 3: tab. 6; *HP* 2: tab. 10; *HP* 6: tab. 14.

92. Not all of his library has survived, but see Leu et al. 2008; for instance, nos.115–16, 241, 294, 322, and 359–60.

93. Ibid., nos. 116, 241.

94. Leu et al. 2008, no. 115.

95. Pomata and Siraisi, introduction, 17. For an estimate that Gessner identified at least fifty plants unknown to the ancients, see Simler 1566, 15r.

96. Salzmann 1959, 102.

97. Leemann van Elck 1935, 24.

98. “De indicibus librorum”; Gessner 1548/9, 19v–20v. Translated in Wellisch, 1981, 12.

99. As translated in Wellisch 1981, 12.

100. Gessner 1548/9, [23]r. For Erasmus, see Moss 1996, 111–15.

101. For the implications of commonplace books for Renaissance thought, see the seminal work Moss 1996; for natural philosophy in particular, see Blair 1992; and for commonplace notebooks and practices, see Siegel 2009, 33–47. I thank Christoph Lüthy for drawing my attention to Siegel’s work.

102. For Gessner’s commonplacing method, I have benefited from Delisle 2009, chapter 6. See also Braun 1990, 12.

103. *HP* 4:tab. 18.

104. For example, see “Historia plantarum,” 40r (from Ruell’s edition of Dioscorides), 123r, 124r (from Turner 1551), 305r, 305v, 311r, and 311v (from Thévet 1558).

105. Cordus 1561, 213v–216v. See the commentary at: *HP* 1:90, 96 (commentary on *HP* 1:tab. 26).

106. See Pinon 2003. For a comparison between Gessner and Aldrovandi, see Fischel 2009.

107. I thank Paula Findlen for first suggesting to me the idea of “pictorial commonplace.”

108. Gessner 1551–58, 1:β3r.

Chapter 8

1. Gessner 1577, 74r–v. The episode over the identity of the *doronicum* is summarized in Palmer 1985, 155–56. 1 drachm = 3.65 grams, Engel 1965, 6.

2. “Nolim autem te putare, me ita vel temerarium vel imperitum esse, ut ea velim experiri in me, quae praesens periculum affere queant.” To Occo, 18 April 1565; Gessner 1577, 74v.

3. Palmer 1985, 155.

4. Paré 1951, 199–200.

5. As noted in Durling 1980, 106–7, and Simler 1566, 14v.

6. The following is my summary of his letter to Occo, 28 September 1565; Gessner 1577, 78r.

7. Dodoens 1557, 581–84. Mattioli was one of the many others who took this view; Palmer 1985, 155–56.

8. Dioscorides 2005, 282.

9. "Aconitum. Arabice Realgal: vulgo Tora." Gessner 1542, 2v.

10. Fuchs 1542, 86.

11. Mattioli 1544, 327–29. For an assessment of this commentary, see Nutton, "Mattioli."

12. Mattioli describes the controlled experiment performed by his master, the surgeon Gregorio Caravita, before Pope Clement VII, in which an antidote to the *napellum* was administered to two condemned assassins. Mattioli 1544, 328, as noted in Nutton 2004b, 140.

13. Gessner 1551–58, 1:735–50, at 748.

14. Mattioli 1558, 479–82.

15. Gessner 1555, 38.

16. Ibid. Cf. the original picture from Peyer in *HP* 2:tab.5.

17. Gessner 1555, 39–40.

18. Ibid. Cf. Kentmann's entry: "Aconiton pardaleanches quod hic depingitur reperitur in Monte Baldo inter Pataviam et Veronam, Aloisius Romanus verum Aconiton esse affirmavit." *Codex Kentmanus*, 135r.

19. Gessner 1555, 40. For Gratarolo's views, see further Maclean 2005a, 17–19.

20.Gessner 1555, 40. Cf. a similar comment by Pietro Antonio Michiel on Mattioli's pictures: Palmer 1985, 153.

21. Gessner 1555, 40.

22. For a list of names recorded by Gessner, see Steiger 1968, 42–43.

23. Mattioli 1558, 541.

24. Ibid.

25. Mattioli 1558, β1r. In his copy (DrM 438, Zentralbibliothek Zurich), Gessner added the page numbers 475, 541, 566, and 568.

26. To Kentmann, 25 August 1558; Gessner 1584, B3r. To Camerarius the Younger, 27 August 1565; Rath 1950, 163. For decorum of conduct in this dispute, see Delisle 2004.

27. To Kentmann, 27 August 1563; Gessner 1584, D2r. For similar suspicions against Mattioli's images by Dodoens and Guilandinus, see Reeds 1991, 161, 164.

28. For Mattioli's strategy of exclusion and inclusion, see Findlen 2000. For the differences of Mattioli's editions, see Stannard 1969.

29. The sale of thirty-two thousand copies is mentioned in Palmer 1985, 152.

30. To Camerarius the Younger, 27 January 1565; Rath 1950, 159.

31. To Camerarius the Younger, 27 August, 1565; Rath 1950, 163.

32. To Crato, 9 August 1563; Gessner 1577, 14v.

33. To Camerarius the Younger, 27 August, 1565; Rath 1950, 163–64. To Occo, 18 February 1565; Gessner 1577, 68r.

34. To Adolf Occo, 22 January 1564; Gessner 1577, 50r–v. To Crato, 9 August 1563 and 6 February 1564; Gessner 1577, 14v, 20v. Cf. *HP* 7: tabs 11–12 (379r–v).

35. Delisle 2004.

36. For Donzellini's points, I am indebted to Delisle 2004, 166–68. This was not the only plant for which Mattioli's woodcut matched the text of Dioscorides rather than an actual plant; Reeds 1991, 156.

37. Mattioli 1558, 393, Zentralbibliothek, Zurich, DrM 438; Dodoens 1557, 157, Zentralbibliothek, Zurich, 16.17.

38. This was probably Valetin Graff, who frequently served as *Ratsherr* in Freiberg between 1540 and 1554; Herrmann 1965, 150. For Gessner's dedication, dated 3 February 1554, to Gravius, see Gessner 1551–58, 2:*2r–v. I have discussed this letter in more detail elsewhere in Kusukawa, forthcoming. For Fabricius, see *ADB* 6:510–14.

39. Hanhart, *Gessner*, 309–10. For the meaning of the word "*fossilia*," see Rudwick 1976b, 1.

40. This is dated as having taken place in 1554 in Gessner 1751–71, 2:XVIII.

41. For the *Handstein*, I have followed Streider 1967.

42. I thank Pamela Smith for help with Jamnitzer's work. For Jamnitzer's works, see the

exhibition catalog Bott et al. 1985.

43. I thank Tara Nummedal for her help on mining matters in this period. The mining towns of the Erzgebirge were significant producers of European silver during the 1520s and 1530s, and Freiberg in particular was experiencing an upturn in production during the 1540s and 1550s. Soetbeer 1879, 17; cf. Nef 1941.

44. For Jamnitzer's *Handstein*, see Streider 1967, 1412, and Schönherr 1888, 291. Smith 2004, 74–80.

45. Daston and Park 1998, 279–80; Distelberger 1985, 273–74; Scheicher 1985, 33.

46. I offer a full translation of this letter in Kusukawa, forthcoming.

47. Gessner 1565, Aa8r–2v; cf. translation in Fischel 2010, 155.

48. "Ars vero illa, quaecunque est, quae tam proprias rerum icones effingit, quales in Gravij muneribus intueor, non tam similes rerum imagines quam res ipsas repraesentare mihi videtur, et ut Platonice dicam *auto to auto*. Ita ut nisi materia foret diversa, differentia plane nulla perciperetur." To Georgius Fabricius, 22 June 1554; Gessner 1577, 131r–v.

49. I am indebted to Nick Denyer for the identification and explanation of this passage, for which see his commentary in Plato 2001, 211–12.

50. Plato 2001, 217.

51. "Forma vero sua cuique est, ut interior et essentialis, quae ratione sola cognoscitur. . . ." Gessner 1565, Aa8 v.

52. Discussed in Isager 1991, 138; cf. Mitchell 1994, 329–44.

53. For this process, see Smith 2004, 74–75.

54. For a selection of works of this period that use the Medusa motif, see Garber and Vickers 2003, 51–71.

55. Isager 1991, 136–40.

56. Pliny 1938–63, 9:331. Cf. Kaufmann 2009, 202–4, for this story in relation to Giuseppe Arcimboldo.

57. Isager 1991, 139.

58. "Atqui hic summus est gradus, ad quem usque ingenium artificis progredi potest, ita aemulari naturam, ut *quae non sint, esse videantur*. Non laedit araneus, simillimus tamen laesuro et minanti[:] non salit locusta, sed iam iam salitura videtur. Non fragrant fraga, non redolet liliastrum, non grave spirat ruta, nil sapit bellis, non acre est millefolium, si sensus consulas quibus haec dijudicantur. Iidem si cohibeantur, et solis habeatur (ut plerunque solemus) oculis fides, odorem saporemque haec omnia pollicentur, invitant, alliciunt." Gessner 1577, 131v (my emphasis and interpolation in brackets).

59. Panofsky 1951. For Dürer's reputation among his contemporaries, see Białostocki 1986 and Kaufmann 1989 (on Hoefnagel's assessment). Cf. also Joannes Sapidus's praise of Hans Weiditz as Apelles, Reeds 1976, 530.

60. It is unlikely here that Gessner is alluding to a Platonic recollection of forms (for which, see Dominic Scott 1995, 15–85) when he mentions how the senses of smell or taste could be triggered by the sight of an *ad vivum* image.

61. For example, Holbein 1538; Lonicerus 1573; Gombrich 2000, 78–83.

62. Wood 2008, 61–107, especially in relation to print. A similar point about *ad vivum* in cartography is made by Nuti 1994, 108n18. The phrase *ad vivum* was increasingly used by scholars and students of nature later in the sixteenth century and early seventeenth century to underpin the reliability and value of images depicting singular events, even though some of the images were copies. For a helpful review of the nuances of *ad vivum*, see Kaufmann 2009, 158–61. I thank Renaldo Migaldi for drawing my attention to this work. See also Swan 1995 for further developments.

63. Gessner 1565, Aa3r, Aa7v. For Gessner's study of the morphology of gems and fossils, see now Fischel 2010.

64. "Pictura certe ars homini propria et liberalis, admiratione simul et oblectatione plerunque spectantes afficere solet: A natura vero rebus impressae imagines ac figurae, ceu revera quaedam hieroglyphicae notae, verius quidem quam illae Aegyptiorum sacrificis celebratae, maiestatis etiam aliquid prae se ferunt: praesertim quae non fortuitae fuerint, sed plane

naturales et (ut ita dicam) specificae, ac generi alicui semper ceu propriae inhaerere videntur, ut in Stirpium genere ac Fossilium." Gessner 1565, Aa4v.

65. For the Renaissance passion for hieroglyphics, I follow Iversen 1993, 57–87, and Wittkower 1977, 113–28.

66. Gessner 1560, 7. For Gessner's copy of Horapollo's *Hieroglyphica*, see Leu et al. 2008, no. 373.

67. Also pointed out in Rudwick 1976b, 26.

68. For the religious underpinning of Gessner's focus on morphology, see also Fischel 2010, 157–63.

69. Gessner 1551–58, 1:α4r.

70. *HP* 8:97. For the importance of understanding Gessner's faith and study of nature in tandem, see Zimmermann 1981, 40. For Gessner's theology, see Leu 1990.

71. For periodization of Renaissance natural history, see Ogilvie 2006, 30–49; esp. 324–27 for "phytographers."

Chapter 9

1. Jones 1998, 29–42, cf. Sudhoff, 1908a.

2. For a full list, see Talbot 1967, 130–31.

3. Getz 1998, 9.

4. For Brissot, see *CoE*, 1:203; Moreau 1622, 104; Vesalius 1948, 15–18.

5. Moreau 1622, 99.

6. *CoE*, 2:355.

7. For these ideas, see Brain 1986, 129–30, and Gil-Sotres 1994.

8. Identified as Dionysius, the *archiater* to King Emanuel, by Moreau 1622, 100.

9. Brissot 1525, [dviir].

10. Ibid., diiijv.

11. It should be noted, however, that the gift appears to have been a partial settlement of a debt. See Concasty 1964, 106, 119, 128.

12. Manardo 1535, 269–74; Corti 1532 and 1538; Fuchs 1534; Fuchs 1535, 64–70; Fuchs 1539, 59r–v. A fuller list of those involved in the controversy can be found in Moreau 1622, 30–31.

13. Hippocrates 1539, 38–39.

14. Ibid., 39.

15. Thurini 1528, Dryvere 1532, Vettori 1536. For Dryvere, see Vocht 1951–55, 2:531–42.

16. Thurini 1533, XXIIIIr. Cardano was also accused of "heresy" for his medical views; Siraisi 1997, 27. For heterodoxical views in medicine, see further Maclean 2005a.

17. Standardized or agreed positions were beginning to emerge among tracts on the French Disease, incidences of which were regarded as declining by the middle of the sixteenth century. Arrizabalaga et al. 1998, 252–77.

18. Margolin 1998; Vocht 1951–55, 3:322–33, for Vesalius's attendance.

19. See Kellet 1961; and for Guinther, see Vocht 1951–55, 2:529–30. Cf. a slightly later enthusiasm for Hippocratic medicine in Lonie 1985.

20. Durling 1961, 255–59, 297.

21. For other translations of these works, see Durling 1961, 284–92.

22. Dubois 1539b, 12.

23. Ibid., 12–13. For Benedetti, see Ferrari 1996.

24. Dubois 1539b, 12–13.

25. Dubois 1539a, [av]v.

26. Guinther 1536, 32–33, as noted in Cushing 1943, 44–45.

27. The images are reproduced in Saunders and O'Malley 1983, 233–47; a translation, with detailed commentary, is available in Singer and Rabin 1949.

28. The inscription in the cartouche standing against a tree trunk reads: "Imprimebat Venetijs B. Vitalis Venetus sumptibus Ioannis Stephanus Calcarensis. Prostrant vero in officina D. Bernardi. A. 1538." Saunders and O'Malley 1983, 247.

29. Data from Württembergische Landesbibliothek, Stuttgart. I have not seen this edition.

30. Rosand and Muraro 1976, 211–35.

31. "Furthermore, since many have attempted vainly to copy these figures, I have committed them to the press, and to these plates I have added others in which Jan Stefan, an outstanding artist of our time, has most appropriately depicted in three positions my *skeleton* recently constructed for the benefit of my students." As translated in Saunders and O'Malley 1983, 233–34.

32. Ibid. (translation modified).

33. For *kat'ixin*, cf. Galen, *De ratione curandi per venae sectionem* (15), translated in Brain 1986, 89–90.

34. For this topos, see Yates 1992 and Carruthers 1990.

35. For Lazarus de Frigeis, see Piovan 1988 and Carpi 1998.

36. Singer and Rabin 1949, lxix–lxxi.

37. Guinther first used the term "azygos" in the 1536 edition of his *Institutiones.* Singer and Rabin 1949, 9.

38. Translation modified from Singer and Rabin 1949, 9 (their interpolation).

39. *De victus ratione in morbis acutis*, book II, aphorism X, in Galen 1542, 4:443.

40. The confusion is reflected in Guinther, who appears also to have had in mind the description from Galen's *De venarum arteriarumque dissectione* (for which, see below), Guinther 1536, 64–65; cf. the changes in Guinther 1539, 58.

41. The melancholic juice, referred to in the title, was related to the problem of *dolor lateralis* because Hippocrates had stated that those who suffer haemorrhoids were not attacked by *dolor lateralis* or inflammation of the lungs. Singer and Rabin 1949, 84n189; Nutton 1983.

42. Vesalius 1948, 79–80.

43. Cf. Brain 1986, 129–30.

44. Vesalius 1948, 51–52.

45. Cf. Galen 1551b, 286–87.

46. Vesalius 1948, 55–62.

47. Ibid., 63–64.

48. Ibid., 64 (translation modified).

49. Justinian 1978 (3.6), 180: "Sed cum magis veritas oculata fide quam per aures animis hominum infigitur, ideo necessarium duximus, post narrationem graduum etiam eos praesenti libro inscribi." This is translated by J. A. C. Thomas as: "Since the truth imprints itself more on the minds of men when it is seen than when it is heard, we held it necessary, after expounding the degrees of kindred, to record them in the present book so that the young, by both seeing and hearing, might completely comprehend the doctrine thereof."

50. As translated in Vesalius 1948, 71. "Verum et negocium dilucidius paulo ob oculos collocem, venas thoracis obiter delineabo, quo mathematicorum more rem aggrediamur." Vesalius 1539, 40.

51. Vesalius 1948, 73–74 (translation modified).

52. For an analysis of the status of diagrams in the context of Greek mathematics, see Netz 1999.

53. For an inverted figure, see Cushing 1943, fig. 45, as noted in chapter 3 n1. For other uses in medical literature of geometric figures, see Maclean 2001a, 171–81, and Maclean 2006.

54. For this genre see, for example, Büttner et al. 2003, Camerota 2004, Dupré 2006.

55. Vesalius 1539, 42.

56. Cf. the essays in Léfevre 2004.

57. Belon 1551, 9–10.

58. Heseler 1959, 85.

59. Ibid., 85–87.

60. For the presence of nobility, bourgoisie, young girls, and monks at public dissections, see Platter 1961, 47. For children as fetchers in a dissection at Montpellier in 1527, see Dannenfeldt 1999, 24.

61. Heseler 1959, 47

62. Ibid., 306n1.

63. Ibid., 236–37 (translation modified).

64. A point also made in Kemp 1996, 49.

65. Singer and Rabin 1949, lvi–vii.

66. E.g., Heseler 1959, 137 (charcoal), 219 (Dryander), 253 (*tabulae*).

67. O'Malley 1958, fig. 2; Roth 1892, 454–57.

68. I thank Lorraine Daston for pointing out the significance of looking, pointing, and reading.

69. The messiness of dissection is also noted by Kemp 2000b, 23. See also Heseler 1959, 157, 221. Cf. the discipline in the anatomical theater in Fabricius's time; see Klestinec 2004.

70. *De venarum arteriarumque dissectione* in Galen 1542, 1:183, as also pointed out in Singer and Rabin 1949, 63n153.

71. Vesalius 1948, 90.

Chapter 10

1. Vesalius to Johannes Gast, August 1542; translated in Rudolf 1943, 116.

2. Ibid.

3. Cushing 1943, 80, 112.

4. Vesalius 1998–, 1:lv; also noted in O'Malley 1964, 184.

5. Rudolf 1943, 118. This roughly tallies with Bullinger's copy, which was recorded at the price of ten pfunds (= five florins), Leu et al. 2004, 167. One florin = fifteen batzen.

6. To Franciscus Dryander, 6 February 1547, Wolf-Heidegger 1943, 210.

7. Three schilling = thirty-six pfennig; two batzen = forty pfennig. The figures are from Burckhardt 1945, 447–49.

8. Wolf-Heidegger and Cetto 1967, 214–18; Cunningham 1997, 121–28; Carlino 1999a, 39–53; Park 2006, 207–59. For frontispieces in general, see Remmert 2005.

9. Vesalius 1998–, 1:xlviii–xlix.

10. Ibid., 1:li.

11. Bylebyl 1990; Wolf-Heidegger and Cetto 1967, 116–22, figs. 43–65.

12. Vesalius 1543a, 548. For cases of condemned women falsely claiming pregnancy, see Schmidt 1928, 122, 123, and 187.

13. Saunders and O'Malley 1983, 41. This chapter happens to be one of the lengthiest and original chapters in the *De fabrica*. Siraisi 1997b, 4–10.

14. Vesalius 1998–, 2:330–31, as also noted in Kemp 2000a, 24–25.

15. Heckshser 1958, 67–75; cf. Schupbach 1982, 16–20.

16. Vesalius 1998–, 1:l. Kemp 2000a, 24–25.

17. Saunders and O'Malley 1983, 41.

18. The earliest edition I have seen of Theophilus's *De corporis humani fabrica* is from 1537.

19. Arrizabalaga 1998.

20. Theophilus 1556, aijv.

21. Ibid., aiv–aiir.

22. Theophilus 1537, 9.

23. Guinther 1539, 127–227; Guinther rearranged the order of some of the chapters in book 1.

24. Vesalius 1998–, 1:liii.

25. Rosand and Muraro 1976, 220.

26. See last quotation, previous chapter. For Marcolini, Britt, and Porta as possible woodcutters for *De fabrica*, see Guerra 1969. I thank Iain Donaldson for drawing my attention to this paper.

27. For a decisive argument that Titian was unlikely to have been involved with *De fabrica*, see Simons and Kornel 2008. For references to Titian see Bonaveri 1670; Tortebat 1667; Vesalius 1706; and Cushing 1943, 99–100,134, 144–46.

28. These drawings are conveniently reproduced in Saunders and O'Malley 1983, 248–51, and Cushing 1943, 81–83. Cf. Poseq 2002.

29. For this portrait I follow Habert 1999 and Ausserhofer 1992.

30. Habert 1999, 79. Ausserhofer 1992, 41–43.

31. Habert 1999, 80.

32. For a study of this pose see Spicer 1991, and for other portraits with similar gestures, see Habert 1999, 78–80. For sleeves see Welch 2000.

33. From twenty-five, the age of majority, men were expected to wear black in Venice, according to Rogers 2000, 123.

34. For copies of the Brauweiler portrait, see Ausserhofer 1992, 44–60.

35. The use of red chalk for drawings became prominent in the sixteenth century. Ames-Lewis 2000, 56.

36. Kaufmann 2004, 17–20; Breazeale et al. 2010, 58–60 (entry by Stacey Sell). Cf. a pen drawing attributed to Calcar: Laclotte et al. 2005.

37. Kaufmann 2004, 19.

38. See, for example, Vesalius 1998–, 1:89 (canine skull), 2:50 (transverse septum).

39. Kemp 1970.

40. Serlio 1996–2001, 1:xi–xvi; for Serlio's use of the printed book was signaling the rise of an image-based architectural method, see Carpo 2001, 46–56.

41. Serlio 1996–2001, 1:83; Carlino 1999a, 46; Long 2002, 74–79. The similarity of approaches to structures between Serlio and Vesalius is further pursued in Burioni 2005.

42. Serlio 1996–2001 (4.8), 1:340, based on Vitruvius, *De architectura* (4.1). Alberti 1988 (9.7), 309.

43. Serlio 1996–2001 (4.6), 1:283.

44. Ibid., 1:286–87.

45. Kemp 1970, 285–86. For the suggestion that the landscape may be of the Euganean Hills, see Wiegand 1952, 40–41. For landscape drawings by Domenico Campagnola, see Laclotte et al. 2005.

46. For small illustrations see, for example, Vesalius 1543a, 94, 99, 125, 143, and 250. For the size of the *Epitome*, see Cushing 1943, 112.

47. Repeats of pictures occur at Vesalius 1543a, 23, 38 and 48; 24 and 48; 36 and 47; 14 and 67; 277 and 369. Cf. ibid., 93.

48. E.g., Vesalius 1543a, 93, 258, 296–97, 307–8, 323, 643, 646.

49. Lambert 1952. These were called, perhaps anachronistically, "pictorial footnotes" in O'Malley 1964, 149. Cf. the the history of the footnote; see Grafton 1997. For these initial letters as a means of rendering dissection more palatable, see Carlino 1999a, 216–21.

50. Sherman 1995, 37–44, and Valls 1996.

51. For the ingenuity of this myological series, see Kemp 1970, 281–82. For the background landscape, see Cavanagh 1983.

52. Vesalius 1998–, 2:1–2.

53. Vesalius 1998-, 1:50. Cf. 2:68 (for pictures filling vacant space).

54. Vesalius 1969, xxxi–ii. O'Malley 1964, 184–85.

55. For layered cutouts, see Sten Lindberg 1979; for anatomical sheets with paste-ins, see Carlino 1999b.

56. Dubois 1539b, 12–13. See chapter 9 above.

57. Vesalius 1998–, 1:lvi.

58. Ibid.

59. Vesalius 1543a, *4r. I have modified the translation at Vesalius 1998–, 1:lvi.

60. "Scripta quidem loquuntur; icones, quamvis mutae, res singulas ita ferunt ob oculos, ut nullum praeterea sermonem desyderent." Estienne 1545, 8.

61. "Were the Athenians more famous in war or in wisdom?" 3, Plutarch 1927–76, 4:501 (347A).

62. See for instance, Baxandall 1980, 98–101.

63. Vesalius 1998–, 1:lvi.

64. On repulsion associated with dissections, see Carlino 1999a, 213–25.

65. Gessner 1551–58, 1:γ1v.

66. Vesalius 1543a, 547. Siraisi 1997b, 5–7. Cf. The order of Vesalius's actual dissections in Heseler 1959.

67. "*Corpus itaque publicae sectioni adhiberi convenit, in suo sexu quam temperatissimum, et aetatis mediae, ut ad hoc tanquam ad Policleti statuam alia corpora possis conferre.* In privatis autem sectionibus, quae crebrius accidunt, utile erit quodvis aggredi, ut cuiusmodi id quoque sit expendas, corporumque differentiam, veramque multorum morborum naturam assequaris." Vesalius 1543a, 548 (my emphasis); also noted in Harcourt 1987, 42. See further Pigeaud 1990, 413–18.

68. For sources on Policleitus, see Overbeck 1868, 166–75.

69. Galen 1534, 63. For the Renaissance rediscovery and reception of this work, see Nutton 1986.

70. See *The Best Constitution of Our Bodies*, 3, Galen 1997, 294.

71. Stewart 1978, 125n23 and 131.

72. *On Mixtures* (1.9) and *The Art of Medicine* (14) in Galen 1997, 228–29, 362. Cf. Stewart 1978, 125n22 and Galen, *De temperamentis*, 32r–v.

73. *The Best Constitution of our Bodies*, 3; *On Mixtures*, 1.9; Galen 1997, 293, 228–29.

74. For the status of the body of the criminal in dissections, see Park 1994.

75. Vesalius 1543a, 280*; my translation based on Siraisi 1994, 68, with my interpolation. Cf. Straus and Temkin 1943, 611, as well as Vesalius 1998–, 3:57–58.

76. "Do not prejudge my work until you yourself have seen, as I have, the phenomenon in many examples." Galen 1999, 30.

77. The importance of classical sculpture is helpfully analyzed in Harcourt 1987 and San Juan 2008. For works attributed to Policleitus in this period, see Bober and Rubinstein 1987, 90 (no. 52A) and 155–57 (no. 123). There was some difficulty in identifying the "canon" with the statue of Doryphoros, due to a defect in the manuscript of Pliny the Elder, see Bober 1995, 326n27. Haskell and Penny 1981, 118, date the discovery of the Doryphorous to 1863.

78. The torso was in the Belvedere gardens in the Vatican by the 1530s. Brummer 1970, 142–52; Bober and Rubinstein 1987, 166–68. For the Torso's significance in this period, see Schwinn 1973. For the dating of the Trinity sketch, see Michaelis 1892, 92–94. Cf. sketches of the Torso from the same period, Leeflang et al. 2003, 130–31; *Fiamminghi a Roma*, 169.

79. Boissard 1597, 1:11; Aldrovandi 1556, 12 (no written verdict by Michelangelo on the Torso seems to survive; Schwinn 1973, 34). For the Sistine Chapel, see De Tolnay 1969, vol. 2, figs. 359 and 360.

80. Strehlke 2004, 130–33.

81. For figures and sketches "completing" the Torso, see Brummer 1970, 143, 148–49. Cf. the idea of restoration in San Juan 2008.

82. Here I follow the very helpful analysis in Pigeaud 1990.

83. Pigeaud 1990, 405. Vesalius 1543a, 317 and 650, for "scopus naturae."

84. Pigeaud 1990, 412; Vesalius 1543a, 510–11. For the relatively late emergence of the idea of scientific "laws," see Ruby 1986; and for the terms used to describe such regularities, see Maclean 2008.

85. Pliny the Elder 1938–63, 9:168–69 (translation modified).

86. Vesalius 1998–, 1:47, Vesalius 1543a, 19; Siraisi 1994, 85–88; also noted in Pigeaud 1990, 407–9.

87. For an extensive discussion of the historical contexts of these categories, see Daston and Park 1998. For learned physicians' concepts of nature and its correlative terms, see further Maclean 2001a, 234–75.

88. Galen, *De differentiis morborum*, chap. 8.

89. Vesalius also claimed that he did not affirm things that he had seen only once or twice in his dissections. Roth 1892, 108.

90. Vesalius 1998–, 1:172; 1543a, 72.

91. Cf. Galen 1535, 28. On the *De ossibus*, see Durling 1961, 288.

92. "Sed superesse rarius quam desse invenitur." Galen 1535, 28; this is unchanged in the 1548 translation, which takes into account the Greek text printed in 1543. Galen 1548, 12; Singer 1952, 772.

93. Vesalius 1998–, 1:172.
94. Ibid., 1:107.
95. Ibid., 1:166, 114.
96. Ibid., 1:61.
97. Henry of Mondeville 1892, 29; Berengario 1959, 160.
98. Vesalius 1998–, 1:377–78; cf. ibid., 1:215 and 195.
99. Mayor 1971, figs. 55 and 394 (no pagination). For a further reference to the Cemetery of the Innocents, see Vesalius 1546, 94.
100. Vesalius 1998–, 1:87, 232; 2:320.
101. For example, Heseler 1959, 109, 265.
102. Straus and Temkin 1943, 630.
103. Vesalius 1998–, 1:279; *De fabrica*, 119.
104. See for example, Galen 1968, 1:195 (3.13).
105. Siraisi 1997b; Straus and Temkin 1943.
106. O'Malley 1964, 294. Canani, *Musculorum humani corporis picturata dissectio*, as translated in Lind 1975, 309–16, at 315 (palmaris brevis). For Canani, see further Roberts and Tomlison 1992, 92–95.
107. The Vesalian figures present "normative description of human structure in general" rather than any particular object, Harcourt 1987, 39.
108. "*Anatomy is an important part of natural philosophy*; to it, since it embraces the study of man and must properly be regarded as the prime foundation of the whole art of medicine and the source of everything that constitutes it." Vesalius 1998–, 1:1 (my emphasis); 1543a, ii.
109. Cunningham 1997, 116–18.
110. Siraisi 1997b.
111. Carlino 1999a, 199–201.
112. Vesalius 1998–, 1:89; the figure is repeated at 116.
113. Vesalius 1998–, 1:102–3. In 1540, Vesalius used six dogs alongside three humans; Heseler 1959.
114. Vesalius 1998–, 2:37; 1543a, 185.
115. Ibid., 2:43.
116. Ibid., 2:285.
117. For another case, see Vesalius 1998–, 2:37–8, 270–71.
118. Vesalius 1998–, 1:250; 1543a, 107. Vesalius is here referring to Erasmus's colloquy, "Knucklebones, or the Game of Tali," in which it is explained that humans do not have the *talus*, following Aristotle and other sources (for which Erasmus was probably indebted to Leoniceno). Erasmus 1974–, 40:891–904. I am grateful to Andrew Taylor for identifying this work for me.
119. For example, *History of Animals* (1.16), Aristotle 1984, 1:788.
120. Berengario 1521, CXLXIr-CLXXIIr.
121. Saunders and O'Malley 1983, 174.

Chapter 11

1. See the essays in Kessler and Maclean 2002.
2. Also noted in Harcourt 1987, 39.
3. Vesalius 1998–, 1:lx.
4. Ibid., 1:lix, 1543a, *5r.
5. Siraisi 1994, 64.
6. Jones 2006, 15 and 1987.
7. Vesalius 1998–, 1:lx–lxi. For this passage, see Kemp 1993, 97.
8. Siraisi 1997b, 30.
9. Vesalius 1998–, 1:lvii.
10. Vesalius 1543a, 650–51.

11. Vesalius 1998–, 1:377. Game-playing among students to master technical knowledge is well known; see, for instance, Moyer 2001.

12. Vesalius 1998–, 1:382–83. I thank Christine Salazar for drawing my attention to the passage in Galen.

13. Vesalius 1543a, 538–39. This also may have had to do with the shortage of female cadavers. O'Malley 1964, 113.

14. Vesalius 1998–, 2:148–53. For the representation of instruments in surgical manuscripts, see Jones 1998, 87–89, and Brunschwig 1497, XIXr.

15. Von Staden 1995. Cf. also Vickers 1983. For Vesalius's familiarity with contemporary rhetorical discussions, I have benefited from discussion with Andrea Carlino. For the importance of taking Vesalius's rhetorical and other textual strategies seriously, see Siraisi 1997b.

16. Vesalius 1998–, 1:lxii, states explicitly in the preface that the pictures were prepared at his own expense.

17. For the tripartite division of labor in public dissections after Vesalius, see Bylebyl 1979, 361. See Kemp 1993, 103 for eighteenth-century anatomical works.

18. Dubois 1555b, 73; Cunningham 1997, 132; Carlino 1999b, 207–11.

19. See chapter 10.

20. Dubois 1556, 3–4.

21. Ibid.

22. Fail 1585, 114r, as noted in Kellet 1961, 103–4. For the date, see Nutton and Nutton 2004, 367.

23. For Vassé, see Crummer and Saunders 1939.

24. Vassé 1541, Aiiir. I have used the third issue of the first edition (1541); Crummer and Saunders 1939, 354.

25. Vassé 1541, Aiiir.

26. Ibid. For the theme of anatomy as self-knowledge, see Carlino 1995 and Schupbach 1982.

27. Dubois 1555a, 1r–4v.

28. For *lusus naturae* in this period, see Findlen 1990.

29. Dubois 1555a, 3r.

30. Ibid., 27r.

31. Siraisi 2007, 25–62.

32. Vassé's editions after 1543 add that the position of the azygos vein is affected by the shortening of the thorax in humans (e.g. Vassé 1553, 17r).

33. Dubois 1555a, 57r.

34. Ibid.

35. Dubois 1555a, 57v.

36. Ibid., 60r–65v.

37. Ibid., 58r.

38. Kellet 1961, 112 (Dubois 1555a, 58r). See also the reed among Vesalius's instruments in fig. 11.2, "R." The injection of blood vessels with colored fluids and the use of wax to preserve soft tissues were later practiced by Jan Swammerdam and Frederick Ruysch; see Cook 2002, 229–43.

39. Belloni 1969, 72.

40. Eustachi 1564, *2r–v. Carlino 1999b, 211–12. The plates had been bequeathed to Pini, from whom Pope Clement XI purchased them for six hundred scudi. Clement then presented them to his physician, Eustachi's successor at the Sapienza, Giovanni Maria Lancisi. Lancisi supplied his own text for the 1714 edition to the plates. *DSB* 4:486–87. For the text, see Belloni 1981.

41. *DSB* 4:486–88.

42. Eustachi 1564, 265.

43. Ibid.

44. Eustachi 1564, 276.

45. Ibid., 267. This description is anatomically correct.

46. Eustachi 1564, 1. Note that Eustachi was given a proportional compass by Commandino, Belloni 1969.

47. Eustachi 1564, 13. For "÷" denoting a half, see Cappelli 1999, 407, 415.

48. Eustachi 1564, 13.

49. Ibid.

50. "Diversae renum formae in his tabulis depictae sunt, non quia omnes sint monstruosae, sed quia hominis natura in eis conformandis admodum inconstans ac varia est." Eustachi 1564, 1.

51. Ibid., 261–311.

52. For example, Eustachi 1564, 51.

53. Cf. the difference between "typical" specimens and "type specimens." Daston and Galison 2007, 111–13.

54. Platter 1583, 3:[2]r.

55. Ibid.

56. Ibid.

57. For an improved view of the keys to the 1555 Vesalian woodcuts, see Cushing 1943, fig. 64.

58. Platter 1583, 1:α2v.

59. Maclean 2001b; for Ramist tables, see Siegel 2009, 64–73.

60. Here I follow Goulding 2006, 63–68; also Bruyère 1984, 219–22.

61. Ong 2004, 264.

62. For Ramus's stay in Basel, see Bietenholz 1971, 153–63, and Meerhoff 2004, 100–103; for his later impact at the University of Basel, see Rother 2001, 25–32; for his influence more generally, see Freedman 1993 and now Hotson 2007.

63. As did Theodor Zwinger the Elder; see Blair 2005 and Siegel 2009, 69–82.

64. Platter 1583, 1:1.

65. Ibid., 1:112.

66. Ibid., 2:141.

67. Ibid., 3:1r.

68. Ibid.

69. For critiques of Vesalius by John Caius and Cornarius, see Nutton 1988, 118–20.

70. "Anatomicam artem duobus modis comparari posse existimo, *autopsia*, seu inspectione et doctrina. Uterque modus ad artis perfectionem est necessarius, sed prior certior, posterior nobilior: ille *historicus*, hic *epistemonikos*, id est, *scientificus* dici potest. Inspectio vel est figurarum tantum, quae in chartis pingi solent, vel corporum, tum hominis, tum brutorum, hominis mortui tantum, brutorum et extinctorum, et viventium ad internos partium motus observandos. Doctrinam duobus modis, scriptis scilicet clarissimorum virorum et viva voce assequimur." Du Laurens 1600, 14. This passage is also discussed in Wear 1983, 227–28. For the importance of oral communication in learning, see further Waquet 2003.

71. Siraisi 2007, 64.

Epilogue

1. Cushing 1943, 117–51, cf. a "shrine of death" in ivory after a Vesalian skeleton, Seipel 2006, 133–40.

2. Jardine and Grafton 1990; Sherman 1995.

3. For his biography, I follow Archbold 2004.

4. For the probate list, see Leedham-Green 1986, 1:492–509; and for identification of copies, see Sayle 1921.

5. Leedham-Green 1986, no. 258, 1:501, which has not been located.

6. Leedham-Green 1986, nos. 3 and 20, 1: 495. Cambridge University Library, N*.7.5 (B) (Mattioli) and N*.1.1 (A) (Vesalius). The probate value appears to have been calculated roughly: the Vesalius and the Mattioli are both folio tomes of 824 and 826 pages respectively, published within three years of each other; but in terms of physical size, the Mattioli volume

possibly uses one-third less paper than *De fabrica* (1555). For the difference between the 1555 and 1543 editions of *De fabrica*, see Siraisi 1997b; see also O'Malley 1964, 269–82.

7. Cambridge University Library, N*.7.5 (B). Next to the year 1554, Lorkyn added the dates 1565 and 1569.

8. Mattioli 1558, 444, Cambridge University Library, N*.7.5 (B).

9. Cf. the copying of marginal annotations to Copernicus's *De revolutionibus* of Erasmus Reinhold and of Jofrancus Offusius in Gingerich 2002, XIX–XXI.

10. Another copy of the 1555 edition that was read very carefully, including its index, belonged to Johann Thal (author of *Sylva Hercynia*, for which see Cooper 2007, 55), and is now in a private collection. Thal added book and chapter numbers at the top of each page, which would have enabled him to follow more readily the instructions in the internal margins to consult other images.

11. Vesalius 1555, 766. Cf. also the figure in Galen 1999, fig. 26. For Lorkyn's other sketches, see Vesalius 1555, 43, 69.

12. For another heavily annotated copy of this work by a medical student at Basel, see Kolb 1951, 18–19.

13. Leedham-Green 1986, no. 89, 1: 497.

14. Jones 1988.

15. Cambridge University Library, P*.6.15(E), with the price of 2 *s*., but valued at 8 *d*. at probate. Leedham-Green 1986, no. 561, 1: 507.

16. For instance, the comment that Colombo regarded larynges as bones rather than cartilage is noted in Vesalius 1555, 185. Cambridge University Library, N*.1.1(A).

17. Leedham-Green 1986, no. 82, 1: 497 and no. 4, 1: 495. Lorkyn's copy of the *Historia generalis plantarum* has not been located; his copy of Galen, *Opera* (1542) is at Cambridge University Library, N*.1.25–29(B), with annotations.

18. Leedham-Green 1986, 1:492–508; 6 *d*. tallies with the evaluation of old copies of textbooks in Reignold Bridges, who died a little earlier than Lorkyn. Leedham-Green 1986, 1:485–92.

19. Fuchs 1551, 8–9.

20. Vesalius 1998-, 1:lvi.

21. Freedberg 1989 sets out to understand emotional responses to images. This aspect is little studied for images in printed books, but see the discussion of the defacement of printed images in Driver 2004, 185–214.

22. Daston and Galison 2007, 17–27.

23. Van Helden 1996. See also Feldhay 1995. For the microscope, see Catherine Wilson 1995 and Dennis 1989; Shapin 1984 is the seminal work that highlighted the importance of persuasion for experiments with the air pump.

24. "Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics . . . ." Galileo, *Assayer* (1623) as translated in Drake 1957, 237–38.

25. For a rare attempt to analyze the use of images in modern scientific disciplines that deal with the invisible, see Elkins 2008.

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CoE Bietenholz, Peter G. ed., *Contemporaries of Erasmus: A Biographical Register of the Renaissance and Reformation*. 3 vols. Toronto: University of Toronto Press, 1985–87.

DSB Gillispie, Charles Coulston, ed. *Dictionary of Scientific Biography*. 16 vols. New York: Scribner's, 1970–80.

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