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Natural Disciplines

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Epistemological Problems in Giovanni Mainardi's Commentary on Galen's *Ars parva*

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I

Galen's *Technē iatrikē* (*Ars medica*), generally known in the Latin Middle Ages as the *Ars parva* and subsequently, under the influence of medical humanism, by the more exact title of *Ars medicinalis,* was used for medical teaching from late antiquity and was a formal part of the curricula of university faculties of medicine from the Middle Ages until the eighteenth century.[1] The work thus had an extraordinarily long and uninterrupted life. Both its conciseness and the genuine obscurity of a number of passages—an obscurity certainly not lessened in the work's numerous translations—necessitated many interpretive expositions over the course of time. For centuries, the rich tradition of commentary that originated in this way provided material for methodological discussions that made use not only of the tools of logic but also of the theoretical positions supplied by natural philosophy and Aristotelian epistemology, the foundations of the systematization of medical culture in the West. Because of the nature of medicine as a discipline on the border of theory and practice, these commentaries provided the occasion for reflection on general concepts about the nature of scientific knowledge and, to a certain extent, the occasion for their modification. As far as medicine itself was specifically concerned, concepts of fundamental importance were developed and modified over the course of the centuries: these included notions of health, disease, and the neutral state, as well as the entire set of problems about the scope and the subject of the theoretical considerations and practical activities of the physician. In addition, the same context always gave rise to prolonged and lively discussions about the scientific status of medicine, a discipline that encompassed in its own proper sphere both theoretical considerations and practical applications.[2]

Within the curricula of the medieval faculties of medicine, the *Ars parva,* in addition to being read, explained, and commented on in the course of studies, was one of the canonical texts (along with the *Aphorisms* of Hippocrates) from which *puncta* were extracted for the *tentamen* and then for the

real graduation examination.[3] Hence, the commentaries on this work of Galen constituted a genuine and distinct literary genre, inserted into the heart of the academic institution. We still lack a complete census of commentaries. Nevertheless, the manuscript sources and printed editions so far available make it clear that the major figures in medical culture were profoundly grounded in this Galenic text; they also lead one to suppose that a significant proportion of all academic teachers of medicine felt themselves duty bound to produce something, in the form of a commentary or *quaestiones,* connected with the interpretive problems raised by the *Ars parva.*[4]

In the period of medical humanism, notwithstanding the renovation of medical culture at various levels resulting from the new methods promulgated by "philologist physicians," the faculties of medicine remained in general tied to medieval teaching and institutional tradition. As a result, the use made of the *Ars parva* in this period offers a privileged vantage point from which to investigate the interaction of the new tendencies of medical humanist culture with the methods and issues traditional in university culture and teaching.

Before we begin an examination of some of Giovanni Mainardi's proposed solutions to the problems posed by the *Ars parva,* it is perhaps appropriate briefly to characterize the movement of renovation that constituted medical humanism.[5] A sketch of some of the main features will enable us better to put the approaches and proposals of the Ferrarese physician in context and to evaluate their real significance. The new culture manifested itself in two ways: on the one hand, its proponents rejected and were bitterly critical of the *auctoritates* of medical scholasticism and vigorously promulgated a return to the pure sources of Greek medicine and botany; on the other, they brought the presentation of the classical texts of medieval medical scholasticism up to date by bringing them into line with the formal requirements of the new humanist culture.[6]

Humanism began to have significant effects on medical culture in the last decades of the fifteenth century. That was the time when generations educated in humanistic schools began to become culturally productive in the learned professions, into which, once they had completed their training with the technical instruction gained in the universities, they imported the fertile seeds of humanist method. At the same time, nonspecialists, too, were beginning to feel the need for access to the scientific as well as the literary patrimony of classical antiquity; it is sufficient here simply to mention the cases of Angelo Poliziano and Ermolao Barbaro. And it was precisely in the area of scientific culture that the awareness dawned that Greek and Latin culture had had different roles, a realization that made possible a more complex and

realistic evaluation of those two worlds, which up to that time were unconsciously confused in the vague idealization of classical antiquity. We find ourselves confronted for the first time with personages, of whom Leoniceno remains the classic example, in whom philological competence (acquired thanks to the *paideia* of humanist teachers) is united with the traditional and sophisticated philosophical medical culture imparted in the universities.[7] This union bore fruit in the work of exceptionally well-prepared scholars who could handle competently both the linguistic and the technical aspects of ancient scientific texts and thus could renovate scientific thought.[8]

The most significant change that humanists introduced into medical culture was not, in my opinion, the rejection of scholastic language in favor of a formal renewal of language and style following classical models, though that was one important aspect. Such linguistic rejection and renewal expressed a profound value, namely the recognition that the corpus of knowledge transmitted must be clearly and securely accessible to understanding. But of much greater importance was the recovery of Greek sources and their direct use, without mediation.

Direct contact with the "living and pure sources" of Greek scientific culture was made possible by the intense activity of numerous philologists who made available, in the original texts and in the new translations, the entire scientific corpus: the authors who wrote on philosophy, medicine, botany, mathematics, and astronomy. In some cases, as in that of Galen, which is directly relevant here, important texts were recovered that either had remained completely unknown during the Latin Middle Ages or had circulated in abbreviated form. Where medicine was concerned, broader and deeper knowledge of the classical authors provided a secure instrument for a critique of the organization and procedures of university teaching, a critique focusing on the need to free medical teaching from questions and issues that were substantially extraneous to the subject. The effort to render medicine independent of philosophy and thus make it an autonomous discipline—an intention that was one of the most pronounced aspects of the work of Mainardi but certainly not a common trait of all medical humanists—did not involve, however, a rejection of Aristotelianism *tout court*. The salient point was rather a sharp rejection of the scholastic systematization of medicine as the humanists set aside texts and teaching methods strongly influenced by philosophical issues, especially those filtered through the texts of Arab authors and their followers, the "moderns." Aristotelian natural philosophy and logic continued to provide the fundamental concepts that made possible the formulation of medical theories; but the Aristotelianism of humanist physicians was unquestionably an Aristotelianism in crisis. The direct comparison

of Aristotle and Galen both made ever more obvious the contrast between the two authors on some essential points and made ever more urgent the choice between loyalties.

II

Giovanni Mainardi of Ferrara (1462–1536) was certainly one of the most outstanding figures of medical humanism. Mainardi, who had been Leoniceno's pupil and was his successor in the chair of *medicina teorica* at Ferrara's Studium (1524), like his teacher brought forward a wide program of reformation of medical culture. But in his case, the proposed reformation had a stronger bias toward the practical aspects of medicine.[9] He enjoyed a rich and varied life, both personally and professionally: university teacher and successful doctor, personal physician at the court of Mirandola (1493–1502), royal physician at the Hungarian court (1513–1518), and physician of Alfonso d'Este at Ferrara (from 1518). He traveled extensively and was in contact with many personalities on the intellectual scene of his time. After the untimely death of Giovanni Pico della Mirandola in 1494, Mainardi edited (along with his pupil Gianfrancesco Pico—nephew of Giovanni Pico) the *Disputationes adversus astrologiam divinatricem,* one of the fundamental texts of the new Renaissance culture.

The wide range of his interests and the humanistic foundation of his approach to specific problems of medical culture are clearly revealed in the twenty books of his *Epistolae medicinales*. This best-selling work, whose complete edition, after several partial editions (the first in 1521), was published only after Mainardi's death (Basel, 1540), combines the traditional genre of *consilia* with humanistic and philological discussions on a variety of medical, botanical, and pharmacological themes: topics range from questions of terminology and identification of diseases and remedies to the taxonomy of skin diseases and the cure of the plague and supposedly new diseases such as syphilis, as well as treatments for gastric disorders and internal maladies. His strong interest in botany and pharmacology and his attempt to bring them back to their original purity are well represented in this work and are also behind his *Annotationes et censurae in Mesue Simplicia et Composita* (1535), a classic text of medieval medical tradition.

The specific character of his university teaching, with its scholastic approach to traditional themes of medical culture but with the novelty of the humanistic philological method, comes to the fore in his commentary on the first book of Galen's *Ars parva*. This work, first published in Rome in 1525,[10] is one of the first Renaissance expositions of Galen's text to appear after the

pioneering interpretation by Mainardi's former teacher Leoniceno of the three ordered doctrines of which Galen speaks in the proem of the *Ars parva*. Moreover, it and the commentary of Giovanni Battista da Monte are among the most important and widely disseminated commentaries produced under the influence of medical humanism. Mainardi's work bears witness to his endeavor to make a distinctive personal contribution to the convincing new interpretation of Galen's three ordered doctrines as simple "ordines docendi."[11] Without substantially modifying Leoniceno's revolutionary interpretation, Mainardi proposes a whole series of notable exegeses of specific points. His commentary, much more closely tied to university teaching than was Leoniceno's work, offers a valuable opportunity to investigate the extent to which medical humanism was able to make a breach in the scholastic medical system into which Galen's text had been integrated; it also allows us to see some of the differences of opinion within medical humanism, despite a common nucleus of important positions.[12] An analysis of the whole of Mainardi's commentary would far exceed the limits of this paper. I want simply to offer some examples of his method of proceeding taken both from his own introduction and from his commentary on Galen's proem. From these points one can easily identify his positions on the much-discussed problems connected with the structure of *Ars parva* and, what is more important, with the epistemological status of medicine, since he treats these subjects almost exclusively at the beginning of the work, following the usual scheme of the *accessus ad auctores*.

In form, Mainardi follows the tradition of the medieval commentators, but he always inserts innovations, both in interpreting the position of the cited authors and texts and in presenting his own opinions. The leitmotif of the whole work is supplied by the constant presence of Galen, who appears almost as a tutelary deity: "we who follow the opinion of Galen," "we who follow Galen do not hold the opinions of anyone else," "I defend myself with the shield of Galen"—these and other similar phrases are standard formulae that recur throughout the commentary.

There are a number of other noteworthy features in Mainardi's commentary that mark it as a work of startling modernity. Above all the endeavor, made necessary by the wider and deeper knowledge of Galen's thought, was to make medicine an autonomous discipline with respect to philosophy. Mainardi seeks to give medicine its own dignity and particular excellence, which in no way depend on participation in the epistemology of Aristotelian science. The effort is to eliminate, to the extent allowed by the text itself, any aspects particularly related to logic—that is, precisely those aspects on which the medieval commentators had particularly insisted. Mainardi is extremely

critical of his medieval predecessors, from Pietro d'Abano to Drusianus (Pietro de' Torrigiani, or Turisanus, the *Plusquam commentator*), from Gentile da Foligno to Jacopo da Forlì, not to mention Giovanni Sermoneta: he is even readier to recognize, at least in one case, the merits of the "Arab commentator on Galen" (Haly ibn Ridwan), though he offers many criticisms of him as well.[13]

His version of the polemic against Avicenna, the classic topos of medical humanism, is extreme: "No one should oppose to me here or elsewhere the authority of Avicenna; really I do not consider him among the medical authors but among the writers who have gathered the sayings of others." Aware of the temerity of this judgment, Mainardi adds that he discounts Avicenna's opinion only when "Galen's opinion, or invincible reason, or the evident truth of the thing itself" constrains him to dissent from the author of the Canon.[14] Generally, following Leoniceno's decisive recommendation—that Galen should be explained from Galen and not from the fantasies of commentators—Mainardi rests his own interpretation on Galen's authority, collected from statements of Galen in other works.[15] Besides Galen, the most frequently cited authors are the Greek commentators on Aristotle (Alexander of Aphrodisias, Themistius, Ammonius, Eustratius). It should be noted, however, that Leoniceno's range of authors cited is much richer than Mainardi's.

The historical interest manifested by Mainardi on many occasions is another particularly interesting feature of his work. Not only did he begin his preface with a biography of Galen, but more than once he presents the reader with a historical reconstruction of the origin and development of problems before giving his own interpretation. This concern with putting things in historical perspective perhaps resulted from knowledge of the proem of Celsus' *De medicina,* recently rediscovered by humanists.[16] In any case, it seems that inserting the problems into a historical process contributes importantly (perhaps without Mainardi's fully realizing it) to a relativistic assessment of the various interpretations given over the course of time. In a cultural context in which the authorities of the past, including the recent past, were rarely questioned, Mainardi's historical approach gave him one more legitimate reason to propose his own interpretations.

Attention is also paid to issues connected with the organization and transmission of medical knowledge. Naturally, these issues were important for the medieval commentators as well, but the interest in them among humanists was of a very different kind.[17] In Mainardi's case, attention to organization of teaching involved referring to authors different from the traditional ones as well as deliberately deciding to avoid as far as possible the numerous

questions traditional in commentaries on the *Ars parva* that had more to do with dialectic than with medicine. According to Mainardi's curt judgment, such questions were a waste of time for the physician.

Mainardi's reflections about the methods and procedures of research and of what is now called scientific discovery seem open to innovation. He affirms that "someone who is discovering something in a certain way teaches himself." Nothing prevents him from subsequently teaching someone else "by the same procedures [lit., order] that he has taught himself."[18] This extremely felicitous and unusual image with which Mainardi defines the process of research not only breaks the rigid structure of the medieval relation between teaching and learning, between master and pupil, since in this case the learner is a pupil of a very particular kind; more important, it reveals an open and accepting attitude toward the possibilities offered to anyone who follows a line of "discovery" (invention) in an art or science. His remark becomes even more significant if it is linked to his negative judgment of the excessive obsequiousness toward the *auctoritates* among his predecessors. Such an attitude, according to Mainardi, had enormously damaged medicine, impeding new developments different from those recorded in the works of the past.[19]

Some solutions are proposed by Mainardi on the basis of his own translation of the Galenic text. Mainardi was convinced that many problems that were particularly difficult to solve had originated in misunderstanding of and consequent bad translations from the Greek text. He himself therefore translated afresh the pericopes of Galen's text to which he appended his commentary. This new translation was especially helpful in allowing him to handle concepts of health, sickness, and the neutral state. Mainardi in fact translated the first two of these as *saluber* and *insaluber,* suggesting also the suitability of *aegrotativus* (and *aegrotabilis*), instead of *sanus* and *aeger* (the medieval terms). By so doing, he stressed disease as a process, not an ontological entity—a conceptualization certainly more attuned with discussion of the latitude of qualities and of the passage from one qualitative state to another.[20]

III

Let us now examine in detail some points of the commentary. Mainardi proposes to abbreviate the treatment of arguments that had become classic topoi in the *accessus*. Therefore he does not follow the use of the "moderns," who write in the proem of every work a huge quantity of things, smuggling them in as Aristotelian when in reality they are entirely extraneous to Aristotle's thought and, in any case, "have more to do with dialectic than with medicine."[21] But he could not, obviously, completely free himself from the

constraints imposed by the traditional genre of commentary and by the audience of students he was addressing. Thus, he limits himself to information about the author, the title, and the subject of the work, and the order that the author had followed in the exposition. Following the biographical information with which Mainardi prefaced his commentary are brief notes about the title.[22] Cutting short the disquisitions of his predecessors on this subject (which he condemns as "puerile"), he confines himself to observing that in the Greek manuscripts we find the title *Ars medicinalis* and not *Ars parva.* A more interesting inquiry about the title, Mainardi remarks, would be why Galen had used the term *ars* only for this work.

Previously, Mainardi had held that the term *ars* referred to the teaching of medicine by the method of definition here used by Galen. But after more careful reflection, he concluded that the reason for this terminological choice was that all the main points of medicine were encompassed, as in a compendium, in this work. The other works of Galen take their titles from the part of medicine they cover. By contrast, the *Ars parva* deals with the essential elements of medicine, according to the very definition of medicine, which, since it is valid, encompasses the principles—that is, the essential elements—on which all the specific aspects of medicine rest: bodies, signs, and causes. The *Ars parva,* therefore, presents statements that are the results of demonstrations carried out elsewhere.[23] As for the subject of the work, Mainardi notes that the Greeks, when speaking of a single work, are concerned to designate not the "subject" but the *scopos* and *prothesis,* that is, the "goal" and the "intention," which have a wider scope than just the subject. The intention, expressed by Galen himself, is to teach medicine by the definitive doctrine: the subject, then, is that of the whole art, namely health.[24]

Mainardi does not agree with those who consider the text an epilogue, a summary, as it were, of Galen's entire output. Nor does he agree with those who consider it a handbook for beginners. The difficulty of the work and Galen's own statement oblige us to consider it an aid for the mnemonic recapitulation of the whole discipline rather than an introductory text. In Mainardi's view, once students have mastered this work with the help of a good teacher, they will be able to tackle the other works of Galen on their own. Conversely, a good exposition of this work seems the most efficacious and appropriate way for an excellent teacher to crown his didactic efforts.[25]

This last topic does not reflect an idle classificatory whim, as at first sight one might surmise, but is inscribed in the general framework of discussions about the best way of arranging in a rational order the prescribed books of the academic curriculum. The urge to reform the medical curriculum was typical of humanists; it gave Giovanni Battista da Monte the occasion, some

years later, to write his two prefatory letters "de ordine legendi Galeni opera" for the Giunta Galen of 1541 and 1550.[26]

The most interesting aspect of this introductory section, from the epistemological point of view, is Mainardi's treatment of problems concerning the subject of medicine. These problems are directly linked to the discussion about the scientific status of the discipline in the commentary on the first pericope of the book, which concerns the controversial definition of medicine that Galen places as an epigraph to the *Ars parva*. Right from this point, Mainardi anticipates the arguments that lead him to deny the status of *scientia* to medicine and proudly to claim it instead as an art—but an art of high epistemological profile to which all other liberal arts and philosophy itself must serve as propaedeutics.

As for the problem of establishing the real subject of medicine, Mainardi assails the belief of many of his predecessors that the human body was the primary subject of medicine. Such a position was unacceptable to Mainardi because it rendered medicine dangerously dependent on philosophical speculation about the elements. Following Galen, Mainardi denies that the body, the undoubted object of the operative part of medicine, is also the subject of medicine's theoretical consideration.[27] The true subject of medicine is health, and for the sake of health the physician develops his theoretical reflections, operates, and finally is acknowledged in his professional specialty with respect to other workers (*artifices*). Since medicine is a productive or, better, a restorative art, it is defined by what it restores, not by that on which its restorative action is conducted. Many restorative arts can deal with the same subject: for example, in restoring a house, different arts work on the roof, the walls, and the floor. These different arts are not distinguished from one another by theoretical consideration of the house itself as a unit, but by that which each of them repairs. Since medicine is obviously unable to produce human bodies, but can preserve or restore health, it must be distinguished from the other arts by health and not by the human body.[28]

To this discussion of the definition of the subject of medicine in Mainardi's preface we can add his comment on the definition of medicine given in the work itself. According to Galen, "Medicine is the science of things that are healthy, not healthy, and neutral. It does not change anything if someone says 'unhealthy.' What is important is to understand the term 'science' in the common sense."[29] This definition had been identified through the pseudo-Galenic *Introductio sive medicus* as that given by Herophilus, and Mainardi himself places great confidence in that attribution; indeed, in many cases he escapes apparently insoluble problems with the hypocritical

assertion, "in any case this definition is not by Galen." However, Galen's use of it was still perplexing. Galen's epistemological attitude is, in fact, rather ambiguous. It encompasses two different concepts of medicine, neither of which matches the definition of a science according to Aristotelian criteria. Galen's anatomical, physiological, exhortative, and polemical works transmit an iatrosophistic concept of Alexandrian origin. This position considers medicine as a *technē theōrētikē,* strictly linked to logico-mathematical knowledge and endowed with a high epistemological profile owing to the control of causes provided by anatomy. By contrast, the clinical works transmit the Hippocratic concept of medicine as a *technē poiētikē* which produces and maintains health. It would therefore be a productive art, like painting, sculpture, architecture, and shipbuilding. But it could also be seen as a *technē epanorthōtikē*—that is, similar to the techniques through which houses, shoes, and clothes are repaired. In either of the latter two forms, medicine is an empirical technique that occupies a very low place in the Aristotelian hierarchy of scientific knowledge.[30]

The Arabs received primarily the Alexandrian iatrosophistic concept of medicine. With the reception of Arab medicine and, contemporaneously, Aristotelian philosophy in the West, that concept was inserted into the Western tradition of empirical medicine.[31] Although Averroës' *Colliget* (1.1) speaks of medicine as "ars operativa," Avicenna's opinion (*Canon* 1.1) that medicine was a science, subordinate to natural philosophy, was the primary source of inspiration for the medieval commentators on the *Ars parva.* In the university context, the stress on the learned aspects of medicine, the strengthening of its ties to natural philosophy, and emphasis on its high epistemological profile were developments guaranteed to earn for physicians the dignity and the honors of a learned profession endowed with great social prestige, on the model offered by the faculties of law.[32] As we can see from commentaries by Taddeo Alderotti, Pietro d'Abano, Torrigiano de' Torrigiani, Jacopo da Forlì, and Ugo Benzi, the question of whether medicine should be defined as science or as art was discussed interminably. While some commentators tried to deal with the unequal epistemological level of theoretical and practical medicine by claiming, as Taddeo Alderotti does, the status of science for the theory of medicine and that of art for its practice, others, such as Bartolomeo da Varignana and Dino del Garbo, declared medicine an art, stressing its practical aim and reclaiming its independence from natural philosophy. Mainardi, like the rest of his predecessors (except perhaps for Leoniceno, who was aware of the eclecticism of Galen's thought),[33] does not seem to have been aware of the flexible meanings that the terms *epistēmē* and *technē* were acquiring in Galen's day, at the very time that philosophy was losing the con-

notation of profound knowledge of causes and taking on the sense of a theoretical *technē*. In that environment—largely thanks to Galen's own efforts—medicine was rising to the status of a theoretical *technē,* as the ruling scientific discipline in the cultural panorama of the period.[34]

But for Mainardi, as for most previous Latin commentators, the contrast between science and art was a very sharp one, so that he felt obliged to try to solve the problem of positioning medicine as one or the other. After noting, following Leoniceno, that even though Galen uses the definition put forward by Herophilus, he does not seem entirely to approve it, Mainardi emphasizes how important it is to understand the term *scientia* not in the strict sense but in the common sense, broadening its meaning to include productive arts such as medicine.[35] Mainardi realized that the problem of whether or not medicine could be allocated the status of *scientia* was a very old one. He provided his readers with a historical reconstruction of the various solutions proposed, taking as his starting point the pseudo-Galenic *Introductio sive medicus*. The Methodists held that all of medicine should be considered a science; Erasistratus thought instead that the part of medicine that dealt with causes and matter belonged to science, whereas the curative and prognostic part was conjectural. Galen always held it to be a productive art, like those of architecture, shipbuilding, and other similar things, which no one thought should be considered sciences. Ammonius, Eustratius, and Averroës were of the same opinion. However, Avicenna followed the opinion of the Methodists and considered as science both the part of medicine that reflects on principles, which came to be called theory, and the part that teaches how to operate, which came to be called practice. Most of the moderns follow Avicenna and think that medicine can be called both science and art, believing that these two definitions are not contradictory, provided neither is understood in the strict sense.[36]

Mainardi supports his own opinion with the authority of Galen: "We who adhere to the opinion of Galen do not deny that in a certain way [medicine] can be called a science; however, we hold that in the proper and absolute sense it is an art, because it has an operative *habitus* and reaches its goal—health—not by necessary but by contingent means. Moreover, it has to do not with being but with generation and the things that can be produced by us. All these characteristics, according to Aristotle, are distinctive traits distinguishing art from science."[37] Mainardi decisively rejects the solution put forward by Pietro d'Abano, who proposed an ontological distinction between the moment of discovery and what some historians might call a period of "normal science."[38] Pietro wanted in this way to distinguish a period of the art, which would correspond to the moment of finding out and establishing

the discipline, and a period of science, when the discipline was already perfected. Mainardi thought this a ridiculous idea.[39]

As we have already noted, the problem of the relations between medicine and philosophy is closely connected with that of the scientific status of medicine. Galen, in harmony with the culture of his time, was relatively uninterested in metaphysical problems and therefore made natural philosophy, ethics, and logic propaedeutic to medicine in his system.[40] Avicenna, on the contrary, subordinated medicine to natural philosophy, and the medievals for the most part followed him.[41] Mainardi firmly denies that medicine could be referred to any part of philosophy, not even to natural philosophy. He cites as support for his opinion the Aristotelian topos according to which the activity of the physician begins where that of the natural philosopher leaves off.[42] He specifies that the physician and the philosopher could both deal with disease and health, but from very different points of view. The physician considers the things that lead to operation, while the philosopher is concerned with speculation for own sake.[43]

Mainardi held that at this point it was useful to put the problem in historical context. As Celsus informs us, the ancients considered medicine to be a part of "wisdom," since its first founders were philosophers. Hippocrates subsequently separated medicine from philosophy, but because he himself was a philosopher, he left some philosophical elements within it. Later, many of his successors—above all those who belonged to the sect of the rationalists, who were more philosophers than physicians—introduced many additional philosophical and dialectical elements. These elements made medicine more prestigious but also more distanced from its proper end; they made physicians worthy of admiration but not actually better, since their ability to discuss improved more than did their ability to cure. For this reason, Galen reproached them.[44]

Mainardi underlines the cultural comprehensiveness as well as the specific character of medicine. The former idea, which was certainly not foreign to the medieval commentators, took on a very different meaning in his work. For him, medicine, although requiring full cultural preparation in the liberal arts and philosophy itself, remained confined within the epistemological framework of an art. Medicine was assigned—mistakenly, in his view—the status of a science because anyone who wanted to learn it as it had been transmitted must be an expert in all the liberal arts and all philosophy, even though medicine itself was an art and should not be called a science in the proper sense.[45] Mainardi stresses that the structure of medicine is directed toward operation, a focus not characteristic of a science. If it were allowed that medi-

cine has the status of science, we would be obliged to admit that all the artisanal and vile crafts could be considered sciences too and that they too made use of true demonstrations, since they prove many things through cause and effect. For this reason, if the people who work in these crafts were philosophers and logicians, as are those who practice medicine, they too would have imported into their crafts many of the same philosophical aspects found in medicine.[46] Mainardi goes on:

> Someone might think that the fact that medicine is directed toward operation does not mean that it cannot be a science . . . ; to this I will reply that it is impossible for any of the arts to be a science because, in addition to possessing a *habitus* that is productive and aimed toward external operation, the intentions that lead to their goals are reached in a contingent way. Moreover, if one affirms that there are many aspects in medicine that are not directed toward operation and can therefore be shown by demonstration, I will absolutely admit that there are such real demonstrations. However, precisely because they are demonstrations, they no longer belong to medicine—that is, to an art—but instead become part of natural philosophy.[47]

In this way Mainardi dismissed the endeavor of Drusianus (Turisanus) to claim medicine as a science by restricting the definition of art to the curative part and stating that all of medicine was speculative, but not for the sake of speculation alone.[48]

Mainardi's deeper knowledge of Galen also allowed him to take a definitive position on the problem of the division of medicine into theory and practice. This division, probably of late Alexandrian origin and patterned on the division of philosophy, was firmly established by the Avicennian systematization of medicine and fitted well into the organization of university studies through the separation of chairs.[49] Though Drusianus was aware that Galen had not mentioned the theory/practice division, he did not seem to find the omission important.[50] But for Mainardi, Galen's silence on this issue, and the fact that he always spoke of medicine as a productive art, was sufficient reason to condemn the division into theory and practice as artificial and illegitimate.[51]

Finally, Mainardi's epistemological views led him to take a noteworthy position on the already long-standing *disputa delle arti*.[52] For him, as we have seen, it was not possible to include medicine among the sciences in the strict Aristotelian sense of the term. To do so, in his view, would completely misconstrue medicine's specific character and goals. By contrast, he was fully ready

to follow the alternate route of underlining the great cultural and professional dignity of the arts:

> I would not want to be accused of doing medicine damage by including it among the company of arts in which pettifogging lawyers are accustomed to degrade us, as if it was something vile to profess an art and be called masters of it, something that they despise. The term "*art*" in fact designates something so noble that even the imperial dignity, than which there is nothing greater on earth, is defined, according to Quintilian, with the name of art. Nor does the name of art abrogate the dignity of medicine because medicine shares it with humbler arts. Indeed the name of man does not take dignity away from kings even though they share it with commoners. Furthermore art represents something noble because those who possess an art are always considered superior to those who lack it. We say not only that medicine is an art, but that it is the noblest of the arts, which Galen himself, in *De constitutione artis medicinalis,* holds as superior even to rhetoric. As far as the term "master" is concerned, it is given not only to those who practice medicine but also to those who are ready to learn it, since, as Pietro d'Abano says, those who are future physicians must be already masters of other disciplines. The excellence attached to the term master is shown by expressions such as "Roman magistrate" and "master of the knights" and "great master," used at the court of the king of France; and what is most important of all, Christ, king of kings, does not refuse the name of master. Let us leave, however, the lawyers with their quibbles. We do not blush to be called masters of the noblest of arts.[53]

Mainardi proudly claims for medicine and the profession of the physician the dignity of a special cultural and professional position, different from that of either the philosopher or the lawyer, in a period in which those two figures still enjoyed hegemony in the cultural scene. He thereby signals indisputably that his world was consciously undergoing great cultural and social changes. Mainardi recognizes that these changes are affecting the discipline of medicine, which is now in effect inserted into a cultural system in evolution. His awareness appears in his call for a continuing openness in scientific research:

> One must think that there are many more things still to be investigated than those that have so far been discovered by human ingenuity, so much so that even today the saying of Aristotle is true that the enormous number of things we know is only the least part of the things we do not know. Therefore, because many things remain to be investigated in all the sciences, for a long time our predecessors have been wrong. They based themselves on things that had already been discovered and treated what-

> ever their predecessors wrote as an oracle, and therefore they added nothing to the arts. This failure, especially in the field of medicine, was a great sin and did much damage.[54]

The manifold aspects of Renaissance relationships between natural philosophy and the various disciplines that emerge in the articles in this volume give us a picture of a complex situation. Within the field of medicine, patterns of approach to new trends in culture and practice are varied and diverse, as Vivian Nutton's vivid portrayal of learned medicine in Tudor England also shows. Mainardi's critical view was the product of a very different cultural background. He practiced religiously Leoniceno's recommendation to elucidate Galen by Galen himself and not by means of alien philosophical lucubrations. Leoniceno's insistence on this point combined perfectly with Mainardi's striving to depict medicine as an independent discipline, free from heavy philosophical debts. His positions are even more significant, given the context in which they are formulated: commentary on a standard text in the university medical curriculum, that is, one of the *loci naturales* where the effects of the marriage between medicine and philosophy were most evident.

Despite the criticisms by many medical humanists of the excessive penetration of medicine by Aristotelian logic, epistemology, and natural philosophy, medical theory remained deeply embedded in a general foundation of Aristotelian philosophy. Although humanist physicians were generally inclined to side with Galen against Aristotle, the pull of a complete, well-structured, sophisticated tradition was very difficult to resist. Mainardi's position is therefore especially noteworthy. Indeed, some years after the publication of his commentary, another of Leoniceno's pupils, Giovanni Battista da Monte, in his highly successful Paduan university teaching, constantly stressed the need for medicine to maintain strong links with philosophy as the only way to attain a methodical and rational practice.

NOTES

Many thanks to Nancy Siraisi for her kindness—not least for the translation of the text read at the seminar's session, which I have not substantially altered for the printed version.

1. The text of *Ars parva* is printed in Claudius Galenus, *Opera omnia,* ed. C. G. Kühn (Leipzig: Off. Libr. C. Cnoblochii, 1821–1833; facsimile reprint, Hildesheim; Olms, 1964–1965), 1:305–412.

2. On the relationship of medicine and logic, especially in the *Ars parva,* see Jole Agrimi and Chiara Crisciani, "Medicina e logica in Maestri bolognesi tra Due e Trecento: Problemi e temi di ricerca," in *L'insegnamento della logica a Bologna nel XVI secolo,* ed. Dino

Buzzetti, Maurizio Ferriani, and Andrea Tabarroni, Studi e memorie per la storia dell' Università di Bologna, n.s., 8 (Bologna: Istituto per la Storia dell'Università di Bologna, 1992), pp. 188–239. On the relationship of medicine and philosophy, see Paul Oskar Kristeller, "Philosophy and Medicine in Medieval and Renaissance Italy," in *Organism, Medicine, and Metaphysic,* ed. E. F. Spicker (Dordrecht: Reidel, 1978), pp. 29–40; Graziella Federici Vescovini, "Medicina e filosofia a Padova fra XIV e XV secolo: Jacopo da Forlì e Ugo Benzi da Siena (1380–1430)," in her *"Arti" e filosofia nel secolo XIV: Studi sulla tradizione aristotelica e i "moderni"* (Florence: Enrico Vallecchi, 1983), pp. 231–278; and Charles B. Schmitt, "Aristotle among the Physicians," in *The Medical Renaissance of the Sixteenth Century,* ed. Andrew Wear, Roger K. French, and Ian M. Lonie (Cambridge: Cambridge University Press, 1985), pp. 1–15.

3. On the curriculum and examination procedures at the University of Ferrara, where Giovanni Mainardi taught, see Vincenzo Caputo and Riccardo Caputo, *L'università degli scolari di Medicina ed Arti dello Studio Ferrarese (sec. XV–XVIII)* (Ferrara: Tipografia artigiana, 1990); for the *Ars parva,* see Statuto 57, 127–128; pp. 8, 44. See also Vincenzo Caputo, *I collegi dottorali e l'esame di dottorato nello Studio Ferrarese: Gli Statuti del Collegio ferrarese dei dottori di Medicina ed Arti (sec. XV–XVII)* (Ferrara: Università degli Studi di Ferrara, 1962), pp. 51–55, 114–118.

4. There is a partial census of commentaries on *Ars parva* in Justus Niedling, *Die mittelalterlichen und frühneuzeitlichen Kommentare zur "Techne" des Galenos,* inaugural dissertation (Paderborn: Druck der Bonifacius-Druckerei, 1924). On the medieval commentaries on *Ars parva,* see Per-Gunnar Ottosson, *Scholastic Medicine and Philosophy: A Study of Commentaries on Galen's Tegni (ca. 1300–1450),* 2nd ed. (Naples: Bibliopolis, 1984).

5. On medical humanism, see Walter Pagel, "Medical Humanism—A Historical Necessity in the Era of the Renaissance," in *Essays on the Life and Work of Thomas Linacre, ca. 1460–1524,* ed. Francis Maddison, Margaret Pelling, and Charles Webster (Oxford: Clarendon, 1977), pp. 375–386; Richard J. Durling, "Linacre and Medical Humanism," in ibid., pp. 77–106; Jerome J. Bylebyl, "The School of Padua. Humanistic Medicine in the Sixteenth Century," in *Health, Medicine, and Mortality in the Sixteenth Century,* ed. Charles Webster (Cambridge: Cambridge University Press, 1979), pp. 335–370; idem, "Medicine, Philosophy, and Humanism in Renaissance Italy," in *Science and the Arts in the Renaissance,* ed. John W. Shirley and F. David Hoeniger (Washington, D.C.; Folger Shakespeare Library, 1985), pp. 27–49; *Humanismus und Medizin,* ed. Rudolf Schmitz and Gundolf Keil, Mitteilung II der Kommission für Humanismusforschung (Weinheim: Acta Humaniora, 1984); Vivian Nutton, *John Caius and the Manuscripts of Galen,* supplementary vol. 13 ([Cambridge]: Cambridge Philological Society, 1987); idem, "Greek Science in the Sixteenth-Century Renaissance," in *Renaissance and Revolution: Humanists, Scholars, Craftsmen, and Natural Philosophers in Early Modern Europe,* ed. J. V. Field and Frank A. J. L. James (Cambridge: Cambridge University Press, 1993), pp. 15–28; and idem, "The Rise of Medical Humanism: Ferrara, 1464–1555," *Renaissance Studies* 11 (1997): 2–19.

6. On the adaptation of a medieval standard text—Avicenna's Canon—to the humanist trend, see Nancy G. Siraisi, *Avicenna in Renaissance Italy: The "Canon" and Medical Teaching in Italian Universities after 1500* (Princeton: Princeton University Press, 1987).

7. On Nicolò Leoniceno, see Dominico Vitaliani, *Della vita e delle opere di Nicolò Leoniceno vicentino* (Verona: Tipolitografia Sordomuti, 1892); Daniela Mugnai Carrara, "Profilo

di Nicolò Leoniceno," *Interpres* 2 (1979): 169–212; and eadem, *La biblioteca di Nicolò Leoniceno Tra Aristotele e Galeno: Cultura e libri di un medico umanista,* Accademia Toscana di Scienze e Lettere "La Colombaria" 118 (Florence: Olschki, 1991).

8. For the role played by humanism in scientific thought, see Eugenio Garin, "Gli umanisti e la scienza," *Rivista di Filosofia* 3 (1961): 259–278; Marie Boas, *The Scientific Renaissance, 1450–1630* (London: Collins, 1962); and Paola Zambelli, "Rinnovamento umanistico, progresso tecnologico e teorie filosofiche alle origini della rivoluzione scientifica," *Studi Storici* 3 (1965): 507–546. See also Eugenio Garin, "Rinascimento e Rivoluzione scientifica," in his *Rinascite e rivoluzioni: Movimenti culturali dal XIV al XVIII secolo,* 2nd ed. (Bari: Laterza, 1976), pp. 297–326.

9. On Giovanni Mainardi (known also as G. Manardo and G. Manardi), see *Atti del convegno internazionale per le celebrazioni del V centenario della nascita di G. Manardo* (Ferrara: Università degli Studi di Ferrara, 1963); Paola Zambelli, "Giovanni Mainardi e la polemica sull'astrologia," in *L'opera e il pensiero di Giovanni Pico della Mirandola nella storia dell' umanesimo* (Florence: Sansoni, 1965), 2:205–279; and Vaclaw Urban, "Consulti inediti di medici italiani (Giovanni Manardo, Francesco Frigimelica) per il vescovo di Cracovia Pietro Tomicki (1515–1532)," *Quaderni per la Storia dell'Università di Padova* 21 (1988): 75–103.

10. On later editions, see J. Hill Cotton in *Dictionary of Scientific Biography,* ed. C. C. Gillespie (New York: Scribner and Sons, 1981), s.v. "Manardo, Giovanni."

11. Nicolò Leoniceno, *De tribus doctrinis ordinatis secundum Galeni sententiam* and *Antisophista medici Romani,* in his *Opuscula, per A. Lemnium adnotata* (Basel, 1532), 62A–83A, 146C–174C. On these works, see Daniela Mugnai Carrara, "Una polemica umanistico-scolastica circa l'interpretazione delle tre dottrine ordinate di Galeno," *Annali dell'Istituto e Museo di Storia della Scienza di Firenze* 8 (1983): 31–57.

12. On the different opinion of another leading medical humanist, Giovanni Battista da Monte, on the crucial issue of the independence of medicine from philosophy, see Schmitt, "Aristotle among the Physicians," p. 12.

13. See Giovanni Mainardi, *In artem Galeni medicinalem commentarius,* in Claudius Galenus, *Artis medicae liber primus a Iohanne Manardo commentariis illustratus, cui Nicolai Leoniceni Quaestio de tribus doctrinis praefixa est* (Padua, 1564), fols. 22v–24r. All subsequent citations of Mainardi's commentary are from this edition.

14. Ibid., fol. 34v: "Nemo autem neque hic, neque alibi in hac mea commentatione Avicennae autoritatem mihi opponat, eum enim in auctorum medicinae catalogo minime me habere profiteor, sed scriptorum qui aliorum dicta collegerunt, ut alias quandoque scripsi, et aliquando, deo optimo maximo aspirante, latius explicaturus sum. Quod temeritati nemo bonus mihi adscribet, maxime ubi de Galeni agitur opinione, non enim ab Avicenna secedo, nisi quando vel Galeni sententia, vel invincibilis ratio, vel ipsa rei aperta veritas me cogit dissentire."

15. Using this Alexandrian hermeneutic criterion, Leoniceno reverses the then-standard approach to the text. For the medieval commentators it was quite usual to explain difficult passages of Galen's text with the support of other philosophical and medical authorities. Cf. Leoniceno, *Antisophista medici Romani,* 151C: "Galenus siquidem ex Galeno est

intelligendus. Caetera omnia sunt nugae et falsae latinorum expositorum qui Arabes in plerisque sunt imitati imaginatione." On this point, see Daniela Mugnai Carrara, "Nicolò Leoniceno e Giovanni Mainardi: aspetti epistemologici dell'umanesimo medico," in *Alla corte degli Estensi: Filosofia, arte e cultura a Ferrara nei secoli XV e XVI,* ed. Marco Bertozzî, Atti del Convegno internazionale di Studi, Ferrara, 5–7 March 1992 (Ferrara: Università degli Studi, 1994), pp. 19–40.

16. For the use by Renaissance scholars of Celsus' proem to *De medicina,* but also of Galen's *De sectis* and the pseudo-Galenic *Introductio sive medicus* (works also used by Mainardi) on the many opinions of ancient medical schools, see Nancy G. Siraisi, "Giovanni Argenterio and Sixteenth-Century Medical Innovation: Between Princely Patronage and Academic Controversy," in *Renaissance Medical Learning: Evolution of a Tradition,* eds. Michael R. McVaugh and Nancy G. Siraisi, Osiris, 2nd ser. 6 (Philadelphia: History of Science Society, 1990), p. 173.

17. On the organization of medieval medical education, see Nancy G. Siraisi, *Arts and Sciences at Padua: The Studium of Padua before 1350* (Toronto: Pontifical Institute of Mediaeval Studies, 1973); eadem, *Taddeo Alderotti and His Pupils: Two Generations of Italian Medical Learning* (Princeton: Princeton University Press, 1981); Jole Agrimi and Chiara Crisciani, *Edocere medicos: Medicina scolastica nei secoli XIII–XV* (Naples: Guernini, 1988); and Nancy G. Siraisi, *Medieval and Early Renaissance Medicine: An Introduction to Knowledge and Practice* (Chicago: University of Chicago Press, 1990).

18. Mainardi, *In artem Galeni,* fol. 27v: "Sunt quidam . . . quibus ego minime assentiendum duco, qui enim invenit, quodammodo seipsum docet. Nihil autem vetat quo minus eo quo semet docuit ordine alium docere valeat."

19. See below, note 54.

20. Leoniceno's translation was "Medicina est scientia salubrium et insalubrium et neutrorum. Nihil vero differt et si quis loco insalubrium aegrorum dixerit." Lorenzano translated the same passage: "Medicina est sanabilium scientia, aegrotabilium et neutrorum. Nec interest si dixeris valetudinariorum." On the editions of these new humanistic translations of *Ars parva,* see Richard J. Durling, "Chronological Census of Renaissance Editions and Translations of Galen," *Journal of the Warburg and Courtauld Institutes* 24 (1961): 251. On the concepts of health, disease, and neutral state in some medieval commentaries on *Ars parva,* see Ottosson, *Scholastic Medicine and Philosophy,* pp. 126–194. For Mainardi's translation, see note 29 below.

21. Mainardi, *In artem Galeni,* fol. 3r: "De subiecto ad fastidium in cuiuslibet libri exordio scribunt recentiores, multa perperam quasi Aristotelica confingentes, ab Aristotelis mente penitus aliena. Quae cum sint alio loco a nobis declarata, ad dialecticamque potius quam ad medicinam spectent, ab eis in praesentia supersedere satius duxi."

22. Mainardi (ibid., fols. 1r–2r) draws biographical information from other works of Galen: *Methodus medendi, De anatomicis adgressionibus, De pharmacis secundum genus, De simplicibus medicamentis, De differentiis pulsum, De antidotis.*

23. Mainardi, *In artem Galeni,* fols. 2r–3r.

24. Ibid., fols. 3r–4v.

25. Ibid., fols. 4v–5r.

26. See Daniela Mugnai Carrara, "Le epistole prefatorie sull'ordine dei libri di Galeno di Giovan Battista da Monte: Esigenze di metodo e dilemmi editoriali," in *Vetustatis Indagator: Scritti offerti a Filippo Di Benedetto* (Messina: Centro Interdipartimentale di Studi Umanistici dell'Università di Messina, 1999), pp. 207–234.

27. Mainardi, *In artem Galeni,* fol. 3r: "Diximus igitur . . . iuxta Galeni sententiam, corpus humanum medicinae subiectum statui aliquo pacto non posse, subiectum dico considerationis non operis. Conveniunt enim omnes illud subiectum non esse quod per accidens et secundario, non per se et primo consideratur. Tale esse corpus humanum a Galeno capite penultimo libri de partibus artis medicinalis didicimus."

28. Ibid., fol. 3r–v: "Verum autem subiectum secundum eiusdem eodem in loco sententiam sanitas existit, ut quam medicus per se primo considerat ad quam omnem reliquam refert considerationem, et per quam potius quam per aliud quodvis ab omni alio artifice separatur. Cum enim medicina ars sit factiva, imo potius refectiva, iuxta eiusdem Galeni sententiam in libro de medicinalis artis constitutione, per id quod reficit, non per id circa quod operatur, est a caeteris artibus distinguenda, quando et per hoc caeterae refectivae artes distinguuntur et quidem merito cum nihil vetet varias circa eandem rem reficiendam artes versari. Ut exempli gratia, circa domum, alia quidem ars est, quae imbricum, alia quae parietes, alia quae pavimenta instaurat, nec inter se domus ipsius consideratione, utpote quae una est distinguuntur, sed eius potius ratione, quod in ipsa domo reparatur. Cum igitur medicina non corpus humanum facere, sed sanitatem conservare vel reficere possit, aliaeque artes circa idem humanum corpus aliud scilicet in eo vel conservando vel reficiendo versari possint, per sanitatem non per corpus humanum a caeteris est segreganda."

29. Galenus, *Opera omnia,* 1:307–308: "Ἰατρική ἐστιν ἐπιστήμη ὑγιεινῶν καὶ νοσωδῶν καὶ οὐδετέρων οὐ διαφέρει δὲ οὐδ' εἰ νοσερῶν τις ἔποι. Τοῦ μὲν οὖν ἐπιστήμης ὀνόματος κοινῶς τε καὶ οὐκ ἰδίως ἀκούειν χρή." Mainardi translates: "Medicina est scientia salubrium, insalubrium et neutrorum. Non differt autem si aegrotativorum quis dixerit. Nomen vero scientia communiter et non proprie audire oportet" (30r); see also above, note 20.

30. On Galen's epistemological thought, see Michael Frede, "On Galen's Epistemology," in *Galen: Problems and Prospects,* ed. Vivian Nutton (London: Wellcome Institute for the History of Medicine, 1981), pp. 65–86; Mario Vegetti, "Modelli di medicina in Galeno," in ibid., pp. 47–63; and Stephania Fortuna, "La definizione della medicina in Galeno," *La parola del passato* 42, no. 234 (1987): 181–196.

31. See Heinrich Schipperges, "Die arabische Medizin als Praxis und Theorie," *Sudhoffs Archiv* 43 (1959): 317–328; John M. Riddle, "Theory and Practice in Medieval Medicine," *Viator* 5 (1974): 157–184; and Ottosson, *Scholastic Medicine and Philosophy,* pp. 68–76.

32. Siraisi, *Taddeo Alderotti and His Pupils,* p. 13; eadem, "Taddeo Alderotti and Bartolomeo da Varignana on the Nature of Medical Learning," *Isis* 68 (1977): 27–39; and eadem, "Medicine, Physiology, and Anatomy in Early Sixteenth-Century Critiques of the Arts and Sciences," in *New Perspectives on Renaissance Thought: Essays in the History of*

Science, Education, and Philosophy, in Memory of Charles B. Schmitt, ed. John Henry and Sarah Hutton (London: Duckworth, 1990), pp. 214–229.

On the relationship of Italian Aristotelianism and medicine, see Antonio Poppi, *Introduzione all'Aristotelismo Padovano* (Padua: Antenore, 1970); Charles B. Schmitt, "Filosofia e scienza nelle Università italiane del XVI secolo," in *Rinascimento: Interpretazioni e Problemi* (Bari: Laterza, 1979), pp. 353–398; Eugenio Garin, *Aristotelismo veneto e scienza moderna,* Saggi e testi 16 (Padua: Antenore, 1981); and Giancarlo Movia, "Struttura logica e consapevolezza epistemologica in alcuni trattatisti padovani di medicina del sec. XV," in *Scienza e filosofia all'Università di Padova nel Quattrocento,* ed. Antonio Poppi (Trieste: Lint, 1983), pp. 375–394.

33. See Leoniceno, *De tribus doctrinis,* 80D: "Oportuit enim ipsos cum de Galeni opinione disceptarent, eundem Galenum non Aristoteli, a quo non raro dissentit, sed magis Platoni, cuius semper summus fuit imitator, ostendere consentientem." See also 73A and 81B.

34. See Margherita Isnardi, "Techne," *La parola del passato* 16, no. 79 (1961): 257–296.

35. Mainardi, *In artem Galeni,* fol. 30r: "Quanquam haec definitio Herophili fuerit, ut ex introductorio et libro salubrium sexto aperte colligitur, nec a Galeno usquequaque probata, sicuti inferius ostendetur, placuit tamen Galeno ea hoc loco uti, veluti valde nota et satis commode suo proposito servienti, in qua scientiae nomen (quemadmodum ipse dicit) communiter accipere oportet, ut factivas etiam artes qualis est medicina comprehendat. Non proprie ut videlicet ex adverso contra artem distinctam et veris scientiis tantummodo conveniens." See also fols. 37v–38r.

36. Ibid., fol. 31r.

37. Ibid., fol. 31v: "Nos Galeni haerentes sententiae posse aliquo modo dici scientiam non negamus, proprie tamen et absolute esse artem putamus, cum sit habitus recta ratione factivus et non sit eorum quae necessario fiunt, sed finem suum hoc est sanitatem contingenter nanciscatur, quae arti adversus scientiam distinctae sexto moralium adscribit Aristoteles. Atque circa generationem, hoc est, res quae fieri a nobis possunt, non circa esse, id est, res necessarias versentur, quo etiam discerniculo in fine postremorum resolutivorum artem a scientia Aristoteles separavit."

38. As in Thomas Kuhn, *The Structure of Scientific Revolutions,* 2nd ed. (Chicago: University of Chicago Press, 1970).

39. See Pietro d'Abano, *Conciliator controversiarum quae inter philosophos et medicos versantur* (Venice, 1565; facsimile reprint Padua: Antenore, 1985), Diff. 3, fol. 6r. Also, Mainardi, *In artem Galeni,* fol. 31v: "Non enim Aponensi in hac parte standum, differentia tertia sui Conciliatoris exponenti, artem esse circa generationem, id est appellari artem dum invenitur, scientiam circa esse, id est, ubi iam inventa sit, ut propterea secum fateamur medicinam ab Hippocratem eam faciente, dici potius artem potuisse, quam a nobis, confiteri enim pariter oporteret omnem scientiam esse artem dum invenitur et omnem artem scientiam dum est inventa, quod certe est valde ridiculum."

40. On Galen's philosophical thought, see Pier Luigi Donini, "Galeno e la filosofia," in *Aufstieg und Niedergang der römischen Welt,* part 2, 36.5, ed. Wolfgang Haase (Berlin: De

Gruyter, 1972–), pp. 3484–3504; R. James Hankinson, "Galen's Philosophical Eclecticism," in ibid., pp. 3505–3522.

41. Avicenna, *Liber Canonis* (Venice, 1582), 1.1.1, fol. 3v. Ottosson, *Scholastic Medicine and Philosophy,* pp. 68–88.

42. "Ubi desinit physicus ibi medicus incipit." For the use of this Aristotelian passage (*De sensu et sensata* 1, 436a18–b2), on which is based the traditional relationship of medicine and philosophy, see Schmitt, "Aristotle among the Physicians," pp. 9–10.

43. Mainardi, *In artem Galeni,* fols. 31v–32r: "Non potest etiam medicina ad aliquam philosophiae partem referri, quod enim neque ad mathematicam neque ad divinam satis per se evidens est. Sed quod neque ad naturalem, Aristotelis vulgata sententia constare potest, inde dicentis medicum exordium capere, ubi desinit philosophus naturalis. Quod non ita intelligendum est, ut negetur eisdem de rebus utrunque considerare, cum de sanitate et morbo inter ea quae parva naturalia vocant scripserit Aristoteles secundoque de partibus animalium dixerit, ad naturalem philosophum attinere aliquo modo de causis morborum pertractare. Quod primo quoque Therapeutices affirmavit Galenus et secundo libro Anatomicarum aggressionum, ait diversam utriusque esse circa dissectiones considerationem, medicumque ea tantummodo considerare quae ad opus conducunt, nudam vero speculationem ad philosophum pertinere, quod primo Colliget scripsit Averrois."

44. Ibid., fols. 32r–v: "Verum quoniam, ut scribit Celsus, primi medicinae inventores fuere philosophi, medicina ab antiquis sapientiae pars credebatur, donec eam a philosophia separavit Hippocrates. Sed quoniam et ipse philosophus fuit, nonnulla quoque philosophica suae immiscuit medicinae, licet ad ipsam professionem contracta, sicut quando in libro elementorum et de natura humana, corpus humanum ex elementis compositum probavit, quia doleret. Posteriores quoque, et hi praesertim qui rationalem sectam professi sunt, quoniam et ipsi philosophi et quandoque magis quam medici, multa philosophica interdumque dialectica immiscuerunt, quae medicinam quidem ipsam venustiorem reddunt, sed a proprio fine multum divertunt, medicosque maiori admirationi, sed non propterea meliores reddunt, cum disserendi illis potius adsit quam curandi peritia et propterea eos a Galeno omnibus in locis reprehendi videmus."

45. Ibid., fol. 32v: "Indeque natum puto ut medicina inter scientias a multis numeretur, quoniam qui eam, ut nunc scripta est discere cupiunt, liberales artes omnes et universam philosophiam callere opus sit, licet ipsa per sese medicina ars et non proprie scientia sit dicenda."

46. Ibid., fols. 32v–33r: "Quod si quis eam veram scientiam esse contendat quoniam in ea verae demonstrationes fiunt . . . quarum causa, Galenus tum in fine huius libri tum alibi saepe instructum esse in demonstrationibus eum oportere mandat qui sit ad discendum medicinam accessurus. Dicam quod sicuti ordinatio ad opus facit medicinam non esse proprie scientiam, sed solum communiter, ita demonstrationes suas non proprie sed communiter dici demonstrationes, sicuti quinto libro sui Colliget, caput 8, voluit Averrois. Si quis vero neget ordinationem istam ad opus auferre nomen verae scientiae et demonstrationis is fateri cogetur omnes sellularias vilesque artes veras dici scientias debere et veras facere demonstrationes, cum et in illis multa per causas et per effectus probentur. Quod si

hi qui eas professi sunt, sicuti hi qui medicinam dialectici et philosophi fuissent, multa quoque in idem in illas transtulissent."

47. Ibid., fol. 33r: "Et si quis adhuc resistat quoniam ordinatio eiusmodi rationem scientiae ab Aristotele primo libro postremorum resolutivorum non videtur auferre, quae est rem per causam cognoscere et quod illius est causa et quod non contingit aliter se habere. Respondebo per hanc ultimam particulam artes omnes a vera scientia excludi, quoniam cum sit habitus factivi et ad extrinsecum opus ordinati, finis intentiones non necessario consequuntur nec sunt de his quae necessario fiunt, sicut ex sexto moralium superius ostendimus et propterea id de quo ars est, aliter habere contingit. Et si adhuc non vis cedere, dicens, multa esse in medicina quae non ita secum habent illam ad opus ordinationem, quin sine illa possint demonstrari, confitebor utique veras illas esse demonstrationes, sed ita a medicina sicuti ab eius genere, id est ab artis ratione, decidere et ad naturalem philosophiam conscendere."

48. Ibid., fol. 33r–v. See Pietro Torrigiano de' Torrigiani, *Plusquam Commentum in parvam Galeni Artem Turisani Florentini medici praestantissimi* (Venice, 1557), 8B.

49. Nancy G. Siraisi, "Changing Concepts of the Organization of Medical Knowledge in the Italian Universities: Fourteenth to Sixteenth Centuries," in *La diffusione delle scienze islamiche nel Medioevo europeo,* Convegno internazionale, Rome, 2–4 October 1984 (Rome: Accademia Nazionale dei Lincei, 1987), pp. 291–321; Agrimi and Crisciani, *Edocere medicos,* pp. 21–47.

50. Torrigiano, *Plusquam Commentum,* 10B.

51. Mainardi, *In artem Galeni,* fol. 34r–v: "Nunc an [medicina] theorica vel practica vel utraque dici possit videamus. Galeno ergo quoque hic haerentes, sicuti eam etiam proprie scientiam negavimus, ita nec theoricen, nec practicen proprie loquendo affirmamus. Exigit enim ratio, ut a quocunque genus, ab eodem et species submoveatur. Nec si totam factivam esse fateamur practicen propterea dicere cogimur, practica enim a praxis deducitur, quae vox latine actionem significat, quam esse aliud a factione septimo libro primae philosophiae Aristoteles testatur. A praxi vero id est ab actione morales scientiae practicae vocantur. Aliquid tamen esse in medicina non inficiamur, quod aliorum comparatione theoricum dici possit, quod et in libri theologicarum sententiarum proemio Scotus quoque testatur, totam medicinam practicen vere esse dicens, haberi tamen in ea, ad quod dici aliquo modo theoricum possit, licet et ipse practici nomen non bene intellexerit, quae res multa eum de praxi superfluo scribere nec dicam male coegit."

52. On the *disputa delle Arti,* see *La Disputa delle Arti nel Quattrocento,* ed. Eugenio Garin, 2nd ed. (Rome: Istituto Poligrafico e Zecca dello Stato, 1982); Giulio F. Pagallo, "Nuovi testi per la 'disputa delle arti' nel Quattrocento: La 'Quaestio' di Bernardo da Firenze e la 'Disputatio' di Domenico Bianchelli," *Italia Medioevale e Umanistica* 2 (1959): 467–481; see also *Sapere e/è potere: Discipline, dispute e professioni nell'università medioevale e moderna,* 3 vols. (Bologna: Istituto per la storia di Bologna, 1990).

53. Mainardi, *In artem Galeni,* fols. 33v–34r: "Nec velim vitio mihi verti quasi de medicina pessime merito, quoniam eam in artium numero repono, quo legulei infringere nobis solent, quasi vile sit artes profiteri vocarique, quod ipsi dedignantur, magistri. Nomen enim artis adeo nobilem signat, ut imperatoria quoque dignitas, qua nulla aliquando in ter-

ris maior fuit, Quintiliano teste, artis nomine censeatur. Nec dignitatem artis nomen abrogat medicinae, quia sit vilioribus commune, sicuti nec hominis nomen regibus, quia sit illis cum plebecula commune. Alioqui de se nobile quid ars repraesentat, cum qui arte pollent, ea carentibus semper praeponantur. Non solum autem artem dicimus esse medicinam, sed artium nobilissimam, quam et rethoricam maiorem, libro De artis medicinalis constitutione facit Galenus. Magistri etiam dicuntur non solum qui iam medicinam tenent, sed et qui ad ediscendam eam accedunt quia scilicet aliarum disciplinarum magistros esse debent, ut bene scripsit Aponensis qui medicorum scholas petituri sunt. Quantae vero praestantiae magistri nomen sit et magistratus Romanorum et magistri equitum et magni magistri apud Galliarum reges adhuc custoditum nomen ostendunt et quod maius his omnibus est, quod rex regum Christus magistri nomen non recusavit. Valere igitur cum suis ambagibus leguleios sinentes, nobilissimae artis magistros dici non erubescamus."

54. Ibid., fol. 28v: "Sed illud potius tenendum esse longe plura quae nondum vestigari potuerunt, quam ea quae humano ingenio sunt adinventa, ut adhuc verum sit illud Aristotelicum maximam eorum quae scimus partem, minimam esse eorum quae ignoramus. Quare cum adhuc in omnibus scientiis plurima supersint investiganda, hoc unum longo tempore peccaverunt maiores nostri, quod inventis stantes oraculique loco habentes quaecunque a senioribus scripta erant, nihil artibus adiecerunt, quod potissimum in medicina, magna cum iactura hactenus peccatum est."

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"A Diet for Barbarians": Introducing Renaissance Medicine to Tudor England

Vivian Nutton

Should one wish to choose any one region in which to examine in detail the introduction of Renaissance medicine and what it stood for, the example of Tudor England would surely be high on the list of preferred subjects. Its medicine and that medicine's practitioners are, when it began in 1485, obscure—few, save for the Welsh or hunters after the exotic, now remember Lewis of Caerleon, royal physician, mathematician, astrologer, and spy—yet it ends in 1603 with one of the most famous names in medical history, William Harvey, newly returned from Padua and failing, at least for the moment, to gain entry into the London College of Physicians.[1] Within little more than a century, England and its physicians had moved from northern darkness almost to center stage in European medicine. From letters, private papers, and publications—to say nothing of their grave monuments—one can gain an insight into the hopes and aspirations of those who, directly or indirectly, brought about this change and can see clearly what they themselves thought most important in the development of their medicine. Even if what they have to say touches rarely on natural philosophy in the narrow sense, as opposed to investigations of the wider world, at the very least it serves as a reminder that natural philosophy was but one key to unlock the secrets of nature.

It is important to stress, at the very outset, the low state of English learned medicine in the later Middle Ages, even as compared with its continental neighbors, let alone with Italy. In 1500 the two universities of Oxford and Cambridge between them produced at most five or six M.D.'s a decade, with Oxford somewhat more prolific than Cambridge.[2] A few foreign practitioners might come to England, usually in the train of prelates and princes. Henry VII employed a German, Jacobus Fries; a Frenchman, Jean Veyrier of Nîmes; and, most famous of them all, Giambattista Boerio of Genoa.[3] The timorous Ferdinando de Molina in 1490 was moved to make his will because "I am now in way to depart for to go to Oxford."[4] That town in 1500 saw the prosecution of an Italian, Dionisio of Nola, for practicing surgery without a license, and the town of Coventry was briefly home to a Greek,

Nicholas Rayes.[5] But the contribution of these visitors to English medicine was minimal; few stayed for long, or had eminent pupils. Nor was there much movement of physicians from England to Italy—the Hundred Years' War with France and the English civil wars saw to that. Between Thomas the Englishman in 1401 and William Hadcliffe at Padua in 1446, no Englishman went to Italy to study medicine, and between John Free in 1460 and John Chamber in 1503 I count a mere eleven medical travelers to Italy.[6] When they returned, it was far more often to political or ecclesiastical preferment, as Walter Lacey enjoyed, than to day-to-day medical practice.[7]

The great age of English medieval medicine—with John of Gaddesden, John of Arderne, and Mertonian natural philosophers like Simon Bredon, whose works were copied and circulated on the Continent—had long since departed, and the writings of English medical men were unknown abroad, even if they had been worth reading.[8] Roger Marchall's *Lanterne of fisicians* and the *loci communes* of John Argentine are poor things indeed.[9] They show how firmly fixed English medicine of the 1460s and 1470s was in the medicine of the 1300s, if not the 1200s. Signs of an acquaintance with such luminaries as Taddeo Alderotti are few; and although in the 1480s one can trace the gradual arrival of contemporary practical medical texts by Cermisone and Bartolomeo Montagnana, their apparent impact was small.[10] Institutionally, the situation was no better. England lacked any organization for the control or improvement of medicine in general—a result of its political fragmentation as much as of the weakness of its doctors. Its hospitals were numerous but usually tiny, and frequently tottering on the edge of bankruptcy;[11] there were no civic physicians or municipally paid healers; and such public health regulations as there were were poorly enforced.

The gradual establishment and consolidation of the Tudor dynasty, under Henry VII and still more under his son and successor Henry VIII, was the prerequisite for any wider medical developments, for, as David Starkey has argued, it was in the forms of politics and statecraft that Renaissance ideas came first to be felt.[12] England became more stable, more firmly governed, and wealthier, and both monarchs began to adopt openly fashions taken from France and Italy. In medicine, the new trend can been seen in the request by Henry VII around 1500 for a copy of the statutes of the hospital of S. Maria Nuova in Florence to serve as a basis for his new hospital of the Savoy in London.[13] Begun in 1508, though not completed for almost a decade, the Savoy hospital was a tangible, indeed monumental, sign of the new medical renaissance, even if the result was more English than Italian.

It is tempting to see in Henry's request the first evidence for the influence of a scholar, physician, and humanist—Thomas Linacre, newly returned

home from Italy. Born in 1460 and educated at Oxford, where from 1484 he was a fellow of All Souls, Linacre was to play a decisive role in the development of English medicine, even after his death in 1528.[14] His career is highly unusual: not least because he spent eleven years or more continuously in Italy, first with Politian and Chalcondylas in Florence, then for three years in Rome, and finally for five or six years in Venice and Padua, where he took a medical degree in 1496. How much Greek Linacre knew when he left England has been vigorously disputed, but all are agreed that it was his period in Italy that turned him into one of the finest Greek scholars of his day, specializing above all in scientific and medical translation. The 1490s, the years of his Italian sojourn, were a crucial decade in the transformation of medicine and science. The clarion call from Leoniceno and his fellow hellenists in northern Italy for the replacement of traditional Latin authors by their Greek sources was loud and rousing. Linacre, a friend of Aldus, was one of those who responded by translating texts from the Greek into a more classical Latin, beginning in 1499 with a translation of Proclus, *De sphaera.* His first publications on medicine, however, did not appear for almost twenty years: Galen's *De sanitate tuenda* in 1517; the *Methodus medendi* in 1519; *De temperamentis* in 1521; *De facultatibus naturalibus* in 1523; *De usu pulsuum* in 1524; *De symptomatum differentiis* in 1524; and, posthumously, a fragment from Paul of Aegina, *De diebus criticis,* in 1528. In quantity, and even more in quality, this was a considerable achievement. Basing himself largely on his own Greek manuscripts, Linacre turned into elegant and accurate Latin the most important of Galen's works on practical medicine.

But it was as a pedagogue, not a physician, that Linacre reappears at the English court in 1500, charged with the education of the young prince Arthur, and it was not until nearly ten years later, in 1509, that he was appointed a royal physician. A friend of Colet, Erasmus, and their circle, he was actively engaged in education—he wrote three grammar books for schools—and he numbered Thomas More among those to whom he taught Greek. It was this combination of Erasmian humanism (to use a shorthand term), Greek, and medicine that was to have an enormous impact on English medicine, for one would not go far wrong in describing the practice of learned medicine in England down to the end of the sixteenth century as being in the Linacre tradition.[15]

It was an influence not only mediated through Linacre's own personality, impressive though that was, and through his friendship with other humanists such as More and, later, Juan Luis Vives. It was also expressed in more permanent ways. Linacre was a very wealthy man, amassing, out of the income provided by various canonries and rectories, a considerable fortune in

books, land, and cash. At his death, he founded a lectureship in physic at St. John's College, Cambridge, and two at Oxford. St. John's appointed their first lecturer in 1525, but it was not until 1559 that the first such lecturer was admitted at Oxford. Linacre's will makes it clear what was to be taught: the new Galen, using, for the most part, Linacre's translations, with a strong bias toward practical therapy. They were specifically enjoined to deal with "literal" questions—that is to say, explication; and they were to avoid those that "Galen callyth logical," that is, more disputatious debates about natural philosophy, in part simply to save time and make it possible to cover Linacre's syllabus within two and a half to three years.[16] It was a bias later followed by Henry VIII when he in turn came to establish the new Regius Professorships of Physic at the two universities in the early 1540s. Along with the other new professorships of Hebrew, Greek, divinity, and civil law, medicine was now to participate fully in the new humanism, the learning that took texts from antiquity as the basis of sound theory and practice.[17] The impact on their respective universities of the Linacre lecturers has been well studied by Gillian Lewis and, even if one takes a less sanguine view of their achievements than she does, two things are clear: some of the holders of the post were men of distinction, even if not as well qualified in medicine as we might expect; and their books and publications display that prejudice in favor of the classics called for by their founder.[18]

Second, and even more significant, it was at the urging of Linacre, and of other Italian graduates in medicine around the court, that in 1518 the London College of Physicians was set up to govern medical practice in London and its immediate environs.[19] This was, in effect, the first time that such a governing institution had been created in London—an attempt a century earlier had failed within two years—and, at least in theory, it mandated for the first time a graduate qualification for the practice of physic in London. Its model was that of an Italian college, like that of Padua or Venice: a body of elite physicians charged with laying down and enforcing standards of practice within the locality.[20] This is not the place to recount in detail the vicissitudes of the College or to explain the difficulties faced in imposing the authority of a small committee—with never more than twenty-five members in all until the end of the century—over a burgeoning metropolis.[21] It is enough here to emphasize two points. First, like the College of Physicians at Lyons, the London physicians saw their role as superior even to that of the universities, and their standards as far outstripping even those of a Paduan M.D. And, second, the College's aim was to impose a Galenic medicine on all English medical practitioners. Exactly what was initially implied by this is unclear, since the earliest statutes have not come down to us, but Sir George

Clark has argued convincingly that the ferocious examination in the works of Galen with a little Hippocrates, as approved in 1563, must have gone back at least to 1541, if not earlier.[22] Institutionally, then, the London College of Physicians maintained, for at least a century, the preferences and prejudices of Thomas Linacre, if not of Galen of Pergamum.

It is only too easy to deride the London College for its ambitions, its outdated learning, its bookishness, and its elitism. Seen from the perspective of the 1590s, or even the 1570s, the efforts of successive councils and presidents, most notably John Caius, to impose the classical writ of the College on all throughout England who might wish to practice medicine appear ludicrously overoptimistic, and its leading spokesmen antiquarian bigots. But, as is becoming clear, in 1518 when the College was founded, and indeed into the 1550s, the new Greek-based medicine was seen as the utmost in modernity. By purifying the medicine of the Middle Ages of ignorant accretions, by using new and better translations of Galen, one could avoid many errors in practice—the program advocated by Leoniceno in Ferrara and eagerly taken up by other northern Italian Hellenists—and win new knowledge from texts whose longevity of itself guaranteed their value.[23]

Nor, until the introduction of Paracelsian medicines and ideas in the 1560s, was there any clear alternative to humoral medicine save empiricism. Even if there might be disagreement on details, the general principles of classical medicine were never challenged. Besides, Linacre's own translations, notably of Galen's *Method of Healing,* had rescued major practical Galenic texts from medieval neglect; and as the next generation of scholars was to show, they offered many apparently new ideas on therapy.[24]

It was a program that fitted perfectly with the new ideals of the utility of scholarship put forward by Erasmus, Colet, and their friends: the purification and improvement of learning by a return *ad fontes,* to the mainly Greek springs of their various disciplines. The young men of the 1520s who were to carry out this program—Thomas Lupset, Edward Wotton, and, above all, John Clement—were given royal support, financial as well as moral; they were provided with posts at the new humanist foundations in Oxford; they communicated regularly with Thomas More and his London circle; and they shared in the reforming interests characteristic of Erasmus, in theology as well as in medicine.[25] In their writings, in their libraries, and in their letters, we may glimpse their priorities—and their dislikes. The older Aristotle of the Oxford schools is replaced by Plato; the medieval scholastics by the church fathers, notably Chrysostom; logical analysis by exegesis and emendation.

This new English learning can claim, as its most enduring monument in medicine, the Aldine *editio princeps* of Galen, published in Venice in 1525.

It was seen through the press by three Englishmen, including John Clement, and by one Saxon, Georg Agricola, later to be more famous for his mineralogy than for his medicine. In the next decade, the editors of the Basel edition of Galen in 1538 gratefully acknowledged the valuable help they had received from notes sent from Britain. One can trace this tradition of medical textual scholarship in Greek through John Caius at Cambridge, and George Edrych at Oxford, down to Theodore Goulston at Oxford and London at the beginning of the seventeenth century.[26] In the quality of their Greek learning, these men compare favorably with their Continental counterparts, and, what is often forgotten, their publications often had a directly didactic purpose. Caius' editions and translations of Galenic anatomy were intended for practical use, and Edrych's commentary on Paul of Aegina's surgery was dedicated "pro iuuenum studiis ad praxim medicam."

In essence, what is being done in England amounts to little more than the continuation of the program and methods first announced by Leoniceno: the acquisition, collation, translation, and elucidation of Greek medical and scientific books and manuscripts in order to reach a better understanding of the principles on which medicine had for centuries been based. It was a program supported at the highest level by king and by court. When in the 1540s there arrived in England a Portuguese *converso,* Manuel Brudus, a member of a family that had long treated members of the Spanish nobility, he enjoyed the powerful patronage of the king's steward, Sir William Sidney, and leading English courtiers like Sir John Baker and Sir Thomas Audley. In return he dedicated to them his book *On Diet in Fever according to Hippocratic Principles,* in which he explained that the English diet of good red meat and beer was medically necessary for those who live in cold northern climates.[27] His little book is a neat exposition of modern humanist medicine, well suited to an audience already familiar with its main principles and able to appreciate the practical benefits of the new learning.

Those who were responsible for its propagation in England were also, like Leoniceno, eager explorers of the whole natural world. John Clement and George Owen were keen botanists, an interest they shared with William Turner despite their religious differences.[28] Many of the early members of the London College of Physicians were singled out for praise by William Bullen for their interest in botany or zoology, and even a diplomatic bag might contain seeds and specimens from abroad intended for a leading London physician.[29] One can detect a slight shift in emphasis over the generations. Clement, Owen, and Edward Wotton are rather more bookish than their successors: Wotton's treatise *De differentiis animalium,* printed after a long delay in Paris in 1552, contents itself largely with identification and with or-

ganization of material assembled out of classical texts. Conrad Gesner, to whom Wotton presented a copy, passed a harsh but not unjust verdict upon it: "he took a good deal from Athenaeus, but he did not take everything, nor was he as careful as I am myself."[30]

It is in the next generation, with those who came to maturity in the 1540s, such as John Caius and William Turner, that practical experience of the plants and animals themselves comes to the fore. True, their work, whether like Turner on plants, or like Caius on birds and animals (his book on *English Dogs* is still well worth reading today), is largely descriptive: concentrating on the identification and naming of the natural world, and taking Aristotle and Dioscorides as the starting points.[31] But both men impart a sense of the importance of observation and practical understanding of plants and animals. They examined them out of an Aristotelian enthusiasm for the natural world—even for such unlikely subjects as tinkers' curs, which, "with marueilous paceience beare bigge budgettes fraught with Tinckers tooles, and metall meete to mend kettels, porrige pottes, skellets, and chafers, and other such like trumpery requisite for their occupacion and loytering trade, easing him of a great burthen which otherwise he himself should carry upon his shoulders."[32] One has only to read Turner on the plants of the Rhineland, or Caius on the humble puffin or the greyhound, to be convinced that their energy and enthusiasm did not stop at the printed page or at their library door.[33] Gillian Lewis has drawn attention to a booming interest in botany and in botanical books from the 1540s onward in Oxford, and she has suggested that many Oxonians may have carried this passion for plants and herbs with them after their university days, even into the wilder reaches of North Wales.[34] All this signifies the transition from the world of Leoniceno to that of Conrad Gesner, a friend of both Caius and Turner and, like them, a practical man as well as a bibliophile. It marks, one might say, a return to Aristotle—not to Aristotle the logician but to Aristotle the naturalist—and one might indeed think of it as a contribution to natural philosophy, in the widest sense.

The same generation, and in particular John Caius, can also be credited with the introduction of the new anatomy from Italy into England. It was once thought that David Edwards, who taught medicine and Greek at Corpus Christi College, Oxford, around 1524, and who later migrated to Cambridge, had learned his anatomy at Padua around 1525.[35] Unfortunately, the Englishman abroad who was called Odoardus was Edward Wotton; although Edwards certainly did at least once dissect a corpse—whether in Oxford or in Cambridge is not clear—his learning appears to have been largely homegrown. This is not to say that some of it, as displayed in his *In anatomen introductio luculenta et brevis,* printed in London in 1532, does not derive from

reading an Italian exemplar, in this case Alessandro Benedetti, or that it is not also a testimony to the introduction of the new Greek technical terms into medicine.[36] But there is no evidence that Edwards knew the newly published and newly translated texts of Galen that, for effectively the first time, revealed the anatomical discoveries of that ancient physician and the central place that they held in his thought and writings.

The same could not be said of John Caius, that doughty defender of the status quo, who, like his mentor Galen, was passionate in his advocacy of dissection.[37] He lectured on anatomy himself, and his statutes for his refounded Cambridge college demanded at least one annual anatomy for its medical students. He collated manuscripts of Galen's *Anatomical Procedures,* which he edited with a commentary, and he also edited and translated into Latin *On Bones*. According to his autobiography, it was his work on anatomy that he prized most highly, not least because he had shown up the follies of Vesalius in translating Galen without a full mastery of Greek and, still more, in proclaiming that Galen had never dissected a corpse—which, of course, depends entirely on what one means by dissection.[38] That there was a market for the new anatomy in England is also clear from the success of Thomas Geminus in his plagiarisms of the *De humani corporis fabrica* of Vesalius, as well as from the number of copies of the *Fabrica* circulating in Oxford and Cambridge within a year or two of its publication.[39] Richard Caldwell, sometime fellow of Brasenose College, Oxford, was one of those most involved in 1570 in setting up the Lumleian Lectures in surgery at the London College of Physicians, and he himself produced a translation, via an earlier Latin version, of the *Tables of Surgerie* of Jean Tagault.[40] Another anatomical publicist, John Banester, author of the highly derivative *History of Man, Sucked from the Sap of the Most Approved Anatomists* (published 1578), had a license from Oxford to practice medicine and left his tiny ivory-and-boxwood manikin, which he presumably used in his anatomical demonstrations, to Cambridge.[41] As we know from Peter Jones's work on the books of Thomas Lorkyn, the long-lived Regius Professor of Physic, anatomical study was pursued enthusiastically in Cambridge; the very latest of discoveries were eagerly debated well into the 1580s, if not beyond.[42] William Harvey, a scholar and later fellow of Caius College, also reports on seeing at least one dissection carried out while he was there before he left for Italy.[43] One can draw a similar picture of the introduction of the new anatomy into London, and of the propagation of the new humanist medicine by leading members of the London College. They were joined in this by the learned surgeons forming the elite of the Company of Barber Surgeons, who took their knowledge of Galen and of ancient surgery at secondhand, via the French of Tagault or Vidius.[44]

In short, if one looks at English medicine around 1580, one cannot fail to be impressed by the vigor, if not always by the quality, of the work being done and by the great changes that had taken place since Linacre returned from Italy. There was now little to distinguish what was taking place in the English universities from that of, say, Montpellier, though not perhaps Bologna or Padua; and while the members of the London College were untiring (and unsuccessful) in their attempts to control the swarms of irregular practitioners who flocked to the ever-expanding and ever-wealthier capital, the same problems afflicted most of the medical colleges of northern Europe.[45]

What part in all this was played by natural philosophy? The answer is, sadly, almost none. Aristotle still formed part of the staple of the arts course in both Oxford and Cambridge, and in 1560 a Swiss student, Johann Ulmer, reported back very favorably on the medical teaching at Oxford in which the eight books of Aristotle's *Physics* were read daily.[46] How much of them the weary student could master at 6 A.M., when the lectures were held, or whether he was any better equipped to cope with an hour of Galen *On the Affected Parts* immediately afterward, is a matter to be left to the imagination. But compared with what is going on in northern Italy or at Wittenberg, there appears to have been little interaction between natural philosophy and medicine in England.[47]

There is, however, one possible exception to this. John Caius in 1544 published at Basel a treatise, *De methodo medendi,* which he republished with a few slight changes at Louvain in 1556.[48] Its opening pages, in traditional fashion, consider the precise meaning to be given to the three types of method outlined by Galen at the beginning of the *Ars medica* (*Ars parva*). Caius is brusque in his definition of method; it is a way and rationale for teaching and learning, based on the nature of the thing to be investigated, and his preferred advice is that one should follow Galen and Plato in breaking down a larger topic into more manageable parts and proceeding from there.[49] Caius is aware of the vigorous debate on this begun by Leoniceno—given his Italian connections, it would have been very surprising if he were not—but it is difficult to determine just what influence this debate had on him, for several reasons.[50]

First, his treatise is about a specific method, that of healing. Once Caius has explained his general understanding of what a method is, the rest of the first book is taken up entirely with recommendations for medical practice, which Caius divides up into the conservation, preservation, and rectification of the body's health. Book 2 is entirely concerned with the treatment of diseases. In all this one needs both method, which deals with universal

principles, and practice, which deals with individual instances; these are the two legs of medicine.[51] In other words, although the preface might suggest engagement with wider questions of natural philosophy, the bulk of this treatise pays no attention to them.

Second, Caius merely takes over the conclusions of Leoniceno that Galen's recommendations in the *Ars medica* were aimed at teaching, and that discussions on the epistemological value of Galen's three methods of approach can be subordinated to a focus on their utility in promoting a specific method of healing.[52]

Third, it is above all Galen who provides the information and model for Caius. Aristotle is mentioned only in passing, and with apparently less regard than Plato, whose methodology Galen had appreciated highly.[53]

Finally, and perhaps most crucial for my purposes, the arguments and indeed most of the wording of this book are not Caius' own. They are taken over directly from the lectures that the greatest Galenist of the sixteenth century, Giovanni Battista da Monte, had just given in Padua, on Galen's *Method of Healing for Glaucon*.[54] Caius' justification for this at the end of his life, that he was bringing to wider notice in a more elegant form the most significant conclusions for medical practice of the greatest physician and teacher of the day, rings as hollow today as it did then; and Caius' long list of predecessors, including Galen, who have taken over large chunks of others' writings and ideas in their own publications succeeds only in cloaking plagiarism with pedantry.[55] As we can see from the other published versions of da Monte's lectures, Caius, despite his protestations, was merely his master's voice.[56] Thus, even if we allow that this tract shows an awareness of wider debates in natural philosophy, it is hard to credit it all, or even mostly, to John Caius.

If we exclude this hybrid production, there is very little evidence for any of the English medical writers being influenced directly by any of the wider debates in natural philosophy taking place in Italy. Their hero was Galen, the anatomist, the therapist, and, one should not forget, the logician. The second possibility of a strong influence on medicine from natural philosophy comes with the work of William Harvey, and in particular with his *Exercitationes anatomicae de motu cordis et sanguinis in animalibus* of 1628. This has been recently emphasized by Roger French in his argument for the crucial role of Harvey and his discovery of the circulation of the blood in the transition from the medieval world of Aristotelian natural philosophy to the world of the eighteenth century.[57]

In one sense, French is saying nothing new. Thirty years previously Walter Pagel had argued strongly that Harvey's thought world was still that

of the Aristotelian universe, with its Aristotelian causes and its ideas on the perfection of circular motion; and he had connected some of Harvey's own arguments with those being put forward in Italy by Aristotelians such as Cremonini and Cesalpino.[58] Nor is there any dispute that Harvey owed much to that great Aristotelian anatomist Fabricius ab Aquapendente, his teacher at Padua.[59] Thus natural philosophy, in an Aristotelian sense, clearly does have a part to play in Harvey's work—but what that part was, as French unwittingly demonstrates, and when it began to exercise its influence are far from easy to determine.

French takes the strong line that Harvey was influenced considerably throughout his life by the natural philosophy of Aristotle as expressed in his *Physics* and its related books about the natural world. It was something that he had learned as a student in Cambridge, and it was only confirmed for him in Padua, where he was exposed, perhaps for the first time, to Aristotle's writings on animals, which had not formed part of the traditional syllabus of natural philosophy. Harvey's Aristotelianism found its expression in his language of discovery and in the careful proofs he offered for it in a manner reminiscent of a university disputation in philosophy or medicine. And, of course, French is right to point out that whether one accepted or rejected Harvey's discovery frequently depended far more on one's preexisting attitude toward a wider natural philosophy than on any single or specific argument put forward by Harvey.[60]

But once one begins to look for detailed evidence of influence from natural philosophy, French's arguments either collapse at crucial points or rely more on faith than on documentation. What lectures Harvey heard on Aristotle in Cambridge are unknown; they will have included lectures on the *Organon, Physics,* and *De anima,* but how the lecturers interpreted these texts or what subsidiary guides were used, two crucial questions, cannot be answered with any degree of certainty.[61] It may, however, be relevant to note that at least in the opinion of Charles Schmitt, who knew Renaissance Aristotelianisms better than most, Harvey's use of Aristotle was very different from that of the English tradition represented by John Case.[62] The intellectual career of Gabriel Harvey, a decade or so before his more famous namesake, would appear to show that Ramism was being rejected in favor of a stricter but much more elementary Aristotelianism, such as was later visible in the summaries of Bartholomaeus Keckermann, widely read in Cambridge in the 1610s.[63]

Whatever Harvey read of Aristotle in Cambridge or in Padua, overt acknowledgment of Aristotelian physics is rare in *De motu cordis,* although, as Gweneth Whitteridge has shown, the proofs that form the second half of the

book correspond exactly to the rules laid down by Aristotle.[64] Besides, if Andrew Wear's argument is correct, Harvey was following "the way of the anatomists," which was neither that of the philosophers nor that of the physicians, and which depended heavily on the precedent and the injunctions laid down by Galen.[65] Indeed, Galen is far more prominent in Harvey than is Aristotle, and one could with some force argue for a continuation in Harvey of the tradition of Galenism represented (in their different ways) by Fabricius and by John Caius. The quantitative argument about the sizes of the veins and arteries coming to and from the heart and the consequent meditation on the amount of fluid they might contain have Galenic precedents familiar to Harvey.[66] Harvey's consideration of the purpose of the elegantly and artistically contrived structure of the heart, its fibers and the veins, would have gladdened the heart of any Galenist brought up on *The Usefulness of Parts*. At least one of his experiments with ligatures was anticipated by Galen, and one might compare Harvey's careful use of logic to establish the truth of his observations with Galen's recommendations for his ideal anatomist.[67] Although chronologically much later, the notes that Harvey made around 1644 in the margin of one of his copies of Galen are of considerable significance for understanding how his mind worked. The texts Harvey was then reading were only peripherally concerned with practical medicine, but he underlined every single word that had any connection with logic and proof—"plausibility," "judgment," "demonstration," "accurate," and so on—all of which bespeaks an unusual interest in precision of argument.[68]

Even for Harvey, then, a certain skepticism is required in assessing the part played in his discoveries by natural philosophy, whether in the narrow sense of Aristotelian physics or in a larger one that goes on to encompass all aspects of science. From one perspective, Harvey unites an English intellectual tradition of medical Galenism and of studying the natural world of plants and animals with a more sophisticated anatomical tradition deriving from Italy and, through Fabricius, concentrating on comparative anatomy and physiology. In this, Harvey is not untypical of the leading figures in English medicine in the sixteenth century, which, in its passage from obscurity to a blaze of success, depended little if at all on natural philosophy, except as it was mediated by and through Galen. Instead, its main focus was practical rather than theoretical: it aimed at medical rather than intellectual benefits. It was not at all insular, for one can point to English scholars on the Continent, and to an increasing number of foreigners coming to England and even elsewhere in Britain. In the sophistication and precision of what was done, particularly to edit and interpret Galen, English medicine performed at a level that at least equaled the best that Italy could provide.

It was a tradition that began by emphasizing the advantages of Greek and of Greek medicine, and, as represented by the hierarchy of the London College, it gained institutional permanence. It was a tradition that encouraged observation and description of the natural world of plants and animals, and, certainly from the 1540s if not earlier, the importance of dissection as the foundation of medicine. It was supported at the very outset by the monarch and the court; as such, it was merely one of the ways in which England was transformed in the first half of the sixteenth century into a Renaissance monarchy. Although by 1580 orthodox Galenists were often finding their attempts to prosecute or force out Paracelsian practitioners frustrated by wealthy and eminent patrons, this was not the case earlier in the century. Besides, even in 1600, Galenists continued in control of the two universities and of the London College.

This pattern was not repeated in every other European country; France, Spain, Germany or Denmark developed in different ways and with different emphases—some political, some religious, others intellectual or more strictly medical. The clash between Aristotelian natural philosophers and Galenist physicians familiar to us from accounts of life at Bologna or Padua does not appear to have occurred in England, where Paracelsianism and Protestantism were more vigorous opponents.[69] But how to identify these differences—and, still more, how to explain them—is not at all easy. At least in some places, medicine as an academic discipline might remain relatively immune from the blandishments of natural philosophy. But whether that immunity was due to the authority of Galen, to the attitudes imparted by the new medical humanism, or to the cussedness and traditionalism of many of its English practitioners must remain an open question.

NOTES

1. Pearl Kibre, "Lewis of Caerleon, Doctor of Medicine, Astronomer and Mathematician," *Isis* 43 (1952): 100–108; Sir Geoffrey Keynes, *The Life of William Harvey* (Oxford: Clarendon, 1978), p. 39.

2. F. M. Getz, "The Faculty of Medicine before 1500," in *The History of the University of Oxford,* ed. Jeremy I. Catto and Ralph Evans, vol. 2, *Late Medieval Oxford* (Oxford: Clarendon, 1992), pp. 373–405; Damian R. Leader, *A History of the University of Cambridge, vol. 1, The University to 1546* (Cambridge: Cambridge University Press, 1988), pp. 202–210.

3. The data on most individual physicians are conveniently found in Charles H. Talbot and E. A. Hammond, *Medical Practitioners in Medieval England* (London: Wellcome Historical Medical Library, 1965), hereafter cited as TH. On Fries, see TH, pp. 96–98; Veyrier, TH, p. 192; Boerio, TH, pp. 117–119. For good overviews of medieval English

medicine, see Carole Rawcliffe, *Medicine and Society in Later Medieval England* (Stroud: Alan Sutton, 1995); Faye Getz, *Medicine in the English Middle Ages* (Princeton: Princeton University Press, 1998).

4. TH, p. 47.

5. TH, pp. 36, 228–229.

6. On Thomas, see G. B. Parks, *English Travellers in Italy* (Stanford: Stanford University Press, 1955), p. 636; Hadcliffe, TH, pp. 398–399; Free, TH, p. 147; Chamber, TH, p. 131–132. Others abroad include John Argentine, TH, pp. 114–115; Henry Bagot, TH, p. 75; William Buckingham, TH, p. 386; John Clerke, TH, pp. 133–134; Thomas Denman, TH, pp. 339–340; Donat of Ireland, Parks, p. 625 (possibly to be identified with Denys of Ireland; ibid., p. 627); Walter Lacey, TH, p. 369; Thomas Linacre, TH, pp. 348–350; John Oxney, Parks, p. 634; John Racour, TH, p. 177.

7. One would like to know more of the medical career of Robert Sherborn, later bishop of Chichester; see TH, pp. 300–302.

8. Getz, "Faculty of Medicine before 1500," pp. 389–393. Whether the elder John Caius, "doctor in medicinis" by 1495, obtained his degree in Italy is unclear; see Damian R. Leader, "Caius Auberinus: Cambridge's First Professor," in *A Distinct Voice: Medieval Studies in Honor of Leonard E. Boyle, O.P.,* ed. Jacqueline Brown and William P. Stoneman (Notre Dame, Ind.: Notre Dame University Press, 1997), pp. 322–327.

9. See TH, pp. 314–315 (Marshall), with L. E. Voigts, "A Doctor and His Books: The Manuscripts of Roger Marchall (d. 1477)," in *New Science out of Old Books: Studies in Manuscripts and Early Printed Books in Honour of A. I. Doyle,* ed. R. Beadle and A. J. Piper (Aldershot: Scholar Press, 1995), pp. 249–314; Oxford, Bodleian Library, Ashmole MS 1437 (Argentine). See also Damian Riehl Leader, "John Argentein and Learning in Medieval Cambridge," *Humanistica Lovaniensia* 33 (1984): 71–85.

10. Argentine in his commonplace book mentions a "Pilula Taddei"; copies of Montagnana (d. 1467) were owned by John Racour (TH, p. 177) and by William Goldwyn (d. 1482; TH, p. 396), who also had a work by Cermisone (d. 1441).

11. See Nicholas Orme and Margaret Webster, *The English Hospital, 1070–1570* (New Haven: Yale University Press, 1995).

12. David R. Starkey, "England," in *The Renaissance in National Context,* ed. Roy Porter and Mikulás Teich (Cambridge: Cambridge University Press, 1992), pp. 146–163.

13. Katharine Park and John Henderson, "The First Hospital among Christians," *Medical History* 35 (1991): 164–188.

14. Basic documentation, and much else, is in Francis Maddison, Margaret Pelling, and Charles Webster, eds., *Essays on the Life and Work of Thomas Linacre, c. 1460–1524* (Oxford: Clarendon, 1977), on which this paragraph largely depends.

15. V. Nutton, "John Caius and the Linacre Tradition," *Medical History* 23 (1979): 373–391; Jonathan Woolfson, *Padua and the Tudors: English Students in Italy, 1485–1603* (Cambridge: James Clarke & Co., 1998), pp. 73–102.

16. John M. Fletcher, "Linacre's Lands and Lectureships," and R. Gillian Lewis, "The Linacre Lectureships Subsequent to Their Foundation"; both in Maddison, Pelling, and Webster, *Thomas Linacre,* pp. 107–197, 223–264.

17. F. Logan, "The Origins of the So-called Regius Professorships," in *Renaissance and Renewal in Christian History,* ed. Derek Baker, Studies in Church History 14 (Oxford: Published for the Ecclesiastical History Society by B. Blackwell, 1977), pp. 272–277.

18. Lewis, "Linacre Lectureships."

19. Charles Webster, "Thomas Linacre and the Foundation of the College of Physicians," in Maddison, Pelling, and Webster, *Thomas Linacre,* pp. 198–222.

20. Sir George Clark, *A History of the Royal College of Physicians* (Oxford: Clarendon Press for the Royal College of Physicians, 1964): 64–66; Gweneth Whitteridge, "Some Italian Precursors of the Royal College of Physicians," *Journal of the Royal College of Physicians* 72 (1977): 67–80.

21. On the fortunes of the College, see Clark, *History;* Margaret Pelling and Charles Webster, "Medical Practitioners" in *Health, Medicine, and Mortality in the Sixteenth Century,* ed. Charles Webster (Cambridge: Cambridge University Press, 1979), pp. 165–235; Harold J. Cook, *The Decline of the Old Medical Regime in Stuart London* (Ithaca, N.Y.: Cornell University Press, 1986).

22. Clark, *History,* pp. 88–105.

23. For this perspective, see Daniela Mugnai Carrara, *La Biblioteca di Nicolò Leoniceno. Tra Aristotle e Galeno: Cultura e libri di un medico umanistico,* Accademia Toscana di Scienze e Lettere "La Colombaria" 18 (Florence: Olschki, 1991); Lawrence I. Conrad, Michael Neve, Vivian Nutton, Roy Porter, and Andrew Wear, *The Western Medical Tradition, 800 BC to AD 1800* (Cambridge: Cambridge University Press, 1995), pp. 250–264; V. Nutton, "The Rise of Medical Humanism: Ferrara, 1464–1555," *Renaissance Studies* 11 (1997): 3–19.

24. Jerome J. Bylebyl, "Teaching *Methodus Medendi* in the Renaissance," in *Galen's Method of Healing,* ed. Fridolf Kudlien and Richard J. Durling (Leiden: Brill, 1991), pp. 157–189.

25. Maria Dowling, *Humanism in the Age of Henry VIII* (London: Croom Helm, 1986); Vivian Nutton, *John Caius and the Manuscripts of Galen* ([Cambridge]: Cambridge Philological Society, 1987), pp. 38–49, 58–61.

26. For Caius, see Nutton, *John Caius;* for Edrych, Gillian Lewis, "The Faculty of Medicine," in *The History of the University of Oxford,* ed. James K. McConica, vol. 3, *The Collegiate University* (Oxford: Clarendon, 1986), pp. 238, 242; for Goulston, Daniel Béguin, "L'Edition Goulston et les prétendus manuscrits perdus de Galien," *Revue d'Histoire des Textes* 19 (1989): 341–349; Vivian Nutton, "The Galenic Codices of Theodore Goulston," *Revue d'Histoire des Textes* 22 (1992): 259–268.

27. M. Brudus Lusitanus, *Liber de Ratione Victus in singulis Febribus secundum Hippocratem ad Anglos* (Venice: heirs of P. Ravanus, 1544); a second edition was published at Venice in

1559. The much-traveled Brudus ended his life as one of the doctors of the sultan of Turkey.

28. William Turner, *De re herbaria* (London, 1538), sig. A 1v; idem, *A new herbal* (London: S. Mierdman, 1551), sig. A iiv; Charles E. Raven, *English Naturalists from Neckham to Ray* ([Cambridge]: Cambridge University Press, 1947), p. 69. For Clement, note also his "three fair herberes and a great cage for birds" in his garden in Bucklersbury; see A. W. Reed, "John Clement and His Books," *The Library,* ser. 4, 6 (1925–1926): 333.

29. William Bullein, *A Dialogue between Soarness and Charity, The Bulwarke of Defence against all Sicknesse* (London: John Kingston, 1562), pp. 4–5; on the diplomatic bag, see J. Gairdner, *Letters and Papers of the Reign of Henry VIII,* vol. 13.2 (London: Stationery Office, 1891), p. 16 n. 45.

30. Vivian Nutton, "Conrad Gesner and the English Naturalists," *Medical History* 29 (1985): 930–97.

31. Whitney R. D. Jones, *William Turner: Tudor Naturalist, Physician, and Divine* (London: Routledge, 1988); for John Caius as a naturalist, the best account still remains that of Raven, *English Naturalists.*

32. John Caius, *A Treatise of English Dogges,* in *The Works of John Caius,* ed. Edwin S. Roberts (Cambridge: Cambridge University Press, 1912), p. 27.

33. For the story of Caius' pet puffin, see Conrad Gesner, *Historia animalium, I–IV* (Zurich: C. Froschover, 1551–1558), 3:768. Caius' further comment is written in the margin of his own copy of Gesner, Gonville and Caius College, Cambridge, classmark L. 19.4, and repeated with slight verbal changes in his *De rariorum animalium atque stirpium historia libellus* (London: W. Seres, 1570), fols. 21v–22r.

34. Lewis, "The Faculty of Medicine," pp. 247–249.

35. The suggestion of Edwards's Paduan studies goes back to Alfred B. Emden, *A Biographical Register of the University of Oxford, A.D. 1501–1540* (Oxford: Clarendon, 1974), p. 185, and has been followed by most recent scholars, including Lewis, "The Faculty of Medicine," p. 255. For a disproof, see Nutton, *John Caius,* p. 74.

36. Edwards's book is reprinted, with introduction and translation by Charles D. O'Malley and Kenneth F. Russell, as *David Edwardes, Introduction to Anatomy, 1532* (London: Oxford University Press, 1961). They do not note the immense debt to Alessandro Benedetti, *Historia corporis humani sive Anatomice* (Venice: B. Guerraldus, 1502, and often reprinted); see now Alessandro Benedetti, *Historia corporis humani sive Anatomice,* ed. and Italian trans. Giovanna Ferrari (Florence: Giunti Gruppo Editoriale, 1998).

37. To the old biography of Caius by John Venn in his *Works,* ed. Roberts, add Clark, *History,* pp. 106–124; Christopher Brooke, *A History of Gonville and Caius College* (Woodbridge: Boydell Press, 1985), pp. 55–88; and Nutton, *John Caius.*

38. John Caius, *De libris suis* (London: W. Seres, 1570), reprinted in *Works,* ed. Roberts, pp. 75–83.

39. I know of at least six copies in circulation before 1550.

40. Francis W. Steer, "Lord Lumley's Benefaction to the College of Physicians," *Medical History* 2 (1958): 298–305.

41. *Pace* Lewis, "The Faculty of Medicine," p. 246, the manikin is to be found in the Cambridge University Archives.

42. Peter Murray Jones, "Thomas Lorkyn's Dissections 1564\5 and 1566\7," *Transactions of the Cambridge Bibliographical Society* 9 (1988): 109–229; idem, "Reading Medicine in Tudor England," in *The History of Medical Education in Britain,* ed. Vivian Nutton and Roy Porter (Amsterdam: Rodopi, 1995), pp. 153–183.

43. Keynes, *Life of Harvey,* p. 17.

44. Vivian Nutton, "Humanist Surgery," in *The Medical Renaissance of the Sixteenth Century,* ed. Andrew Wear, Roger K. French, and Ian M. Lonie (Cambridge: Cambridge University Press, 1985), esp. pp. 96–99; Margaret Pelling, "Appearance and Reality: Barber-Surgeons, the Body, and Disease," in *London, 1500–1700: The Making of the Metropolis,* ed. A. Lee Beier and Roger Finlay (London: Routledge, 1986), pp. 82–112. For some speculative interpretation of this boom in anatomy, see Jonathan Sawday, *The Body Emblazoned: Dissection and the Human Body in Renaissance Culture* (London: Routledge, 1995).

45. Margaret Pelling, *The Strength of the Opposition: The College of Physicians and Unlicensed Medical Practitioners in Early Modern London* (London: Macmillan, 1999).

46. Lewis, "The faculty of Medicine," p. 231.

47. On Italy, see Charles B. Schmitt, "Aristotle among the Physicians," in Wear, French, and Lonie, *Medical Renaissance,* pp. 1–15. For Wittenberg, see Vivian Nutton, "Wittenberg Anatomy," in *Medicine and the Reformation,* ed. Ole Peter Grell and Andrew Cunningham (London: Routledge, 1993), pp. 11–32; Sachiko Kusukawa, *The Transformation of Natural Philosophy: The Case of Philip Melanchthon* (Cambridge: Cambridge University Press, 1995).

48. John Caius, *De methodo medendi libri duo ex Cl. Galeni Pergameni et Jo. Baptistae Montani sententia* (Basel: H. Froben and N. Episcopius, 1544); reprinted in John Caius, *Opera aliquot et versiones* (Louvain: A. M. Bergagne, 1556). The latter is reprinted in *Works,* ed. Roberts, pp. 1–56, and this is the edition cited hereafter.

49. Ibid., pp. 7–14.

50. Daniela Mugnai Carrara, "Una polemica umanistico-scolastica circa l'interpretazione delle tre dottrine ordinate di Galeno," *Annali dell'Istituto e Museo di Storia della Scienza di Firenze* 8 (1983): pp. 31–57.

51. Caius uses this (traditional) metaphor at length at *De methodo medendi,* p. 56.

52. For this debate, see, as well as Mugnai Carrara, "Una polemica," Neal W. Gilbert, *Renaissance Concepts of Method* (New York: Columbia University Press, 1960); Andrew Wear, "Galen in the Renaissance," in *Galen: Problems and Prospects,* ed. Vivian Nutton (London: Wellcome Institute for the History of Medicine, 1981), pp. 238–245; and Bylebyl, "Teaching *Methodus Medendi.*"

53. Contrast Caius' single reference to Aristotle, in passing, at *De methodo medendi,* p. 9, with the fulsome praise of Plato on pp. 7–12.

54. Although Caius hints at this in his title, he makes no reference to da Monte in his text; and the casual reader would be easily misled into thinking that da Monte, like Galen, provided merely a starting point for Caius' own cogitations. The similar production by Crato (see note 56 below) is both more honest and more independent of da Monte's words.

55. Caius, *De libris suis,* pp. 73–75.

56. Caius' wording can be compared with that in Walenty Lublin's edition of da Monte's *In libros Galeni De arte curandi ad Glauconem explanationes* (Venice: B. Constantinus, 1554) and in the (much freer) version put out by Johann Crato von Crafftheim (with da Monte's approval), *Methodus therapeutica ex sententia Galeni et Joannis Baptistae Montani* (Basel: J. Oporinus, 1555); the three are printed consecutively in Johannes Baptista Montanus, *Opuscula* (Basel: P. Perna, 1558). For da Monte's reaction to Caius' publication, see his *In primi libri Canonis Avicennae primam fen commentaria* (Venice: V. Valgrisi, B. Constantinus, 1557), p. 8.

57. Roger French, *William Harvey's Natural Philosophy* (Cambridge: Cambridge University Press, 1994).

58. Walter Pagel, *William Harvey's Biological Ideas* (Basel: Karger, 1967).

59. On Fabricius ab Aquapendente, see Andrew Cunningham, "Fabricius and the 'Aristotle Project' in Anatomical Teaching and Research at Padua," in Wear, French, and Lonie, *Medical Renaissance,* pp. 195–222.

60. See especially French, *Harvey's Natural Philosophy,* pp. 51–70.

61. Prof. M. Feingold in discussion that followed this paper suggested that while the Aristotelian texts remained in the curriculum, they were studied as part of language training, and that by 1600 little trace, if any, remained of the advanced Aristotelianism common in Italy and Germany. If he is correct, Harvey's "natural philosophy" is far more likely to have derived from Italy than from Cambridge.

62. Charles B. Schmitt, "William Harvey and Renaissance Aristotelianism," chap. 6 of *Reappraisals in Renaissance Thought* (London: Variorum, 1989).

63. Virginia F. Stern, *Gabriel Harvey: His Life, Marginalia, and Library* (Oxford: Clarendon; New York: Oxford University Press, 1979), pp. 21–22, 70. Cf. W. T. Costello, *The Scholastic Curriculum at Early Seventeenth-Century Cambridge* (Cambridge, Mass.: Harvard University Press, 1958).

64. See William Harvey, *An Anatomical Disputation Concerning the Movement of the Heart and Blood in Living Creatures,* trans. Gweneth Whitteridge (Oxford: Blackwell Scientific Publications, 1976).

65. Andrew Wear, "William Harvey and the Way of the Anatomists," *History of Science* 21 (1983): 223–249; see also his introduction to William Harvey, *The Circulation of the Blood and Other Writings* (London: Dent, 1990).

66. Owsei Temkin, *The Double Face of Janus* (Baltimore: Johns Hopkins University Press, 1977), pp. 162–166.

67. Charles R. S. Harris, *The Heart and the Vascular System in Ancient Greek Medicine* (Oxford: Clarendon, 1973), pp. 381–383.

68. Vivian Nutton, "Harvey, Goulston, and Galen," chap. 14 of *From Democedes to Harvey* (London: Variorum, 1988).

69. Some good examples of conflict are found in Schmitt, *Reappraisals in Renaissance Thought*. The clash between Aristotle and Galen (and the new learning) is famously exemplified in the debate between Corti and Vesalius, summarized in Charles D. O'Malley, *Andreas Vesalius of Brussels* (Berkeley: University of California Press, 1964), pp. 98–100.

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9

From the Laboratory to the Library: Alchemy According to Guglielmo Fabri

Chiara Crisciani

In the history of Latin alchemy, much remains to be learned about the period from John of Rupescissa to Paracelsus. In particular, fifteenth-century alchemical texts, which include both examples of alchemical research and assessments of alchemy, have been among the least studied by historians. Yet these are precisely the texts that may be expected to illuminate the process whereby the three major shifts in emphasis that characterized alchemy between the end of the Middle Ages and the early modern period were disseminated and received. These changes were the relative discredit into which transmutatory alchemy had fallen, the increasing importance of therapeutic doctrines and goals in the alchemy of the elixir and fifth essence, and the emergence in alchemical literature of linked alchemical and religious themes that do not always refer to work in the laboratory.

These three developments were interrelated in various complex ways that have yet to be fully clarified. They evidently evolved from trends already present in medieval alchemy; but they also belong to a general restructuring both of the scientific disciplines of alchemy and medicine and of forms of knowledge—empirical, rational, prophetic, and magical. The work of Guglielmo Fabri that is the subject of the present paper provides one noteworthy example of a fifteenth-century alchemical text in which continuity and innovation go hand in hand and in which previously developed topics are reworked and transformed. Fabri seems to be at a crossroads between the trends and problems of late medieval alchemy and their development in the early modern period. He provides us with a useful vantage point for evaluating continuity and innovation, the utilization of traditional sources and concepts, and the introduction of new themes and approaches destined to undergo further development in the future.

I

The *Liber de lapide philosophorum et de auro potabili,* which as far as I know is unedited, seems to have been written about 1449 and certainly before the

end of the fifteenth century.[1] The author, Guglielmo Fabri de Die, does not present himself as an alchemist; indeed, he does not present himself at all.[2] From the few pieces of information that can be found about him we know that he was a doctor "of law and medicine" and that he was part of the entourage of Duke Amadeus VIII of Savoy during the years in which Amadeus was an antipope elected by the Council of Basel under the name of Felix V; Guglielmo's duties as a court functionary seem to have been chiefly connected with his legal qualifications.[3] But Fabri evidently served as a faithful adviser and a cultivated secretary; no doubt, too, the pope appreciated him as a physician because of his transalpine, or French, origin and education. Thus, it was specifically to Guglielmo Fabri that the pope turned for what at first sight looks like a consilium.

De lapide opens with the pope's description of his disease and bitter remarks about the incompetence of his attending physicians (fol. 245r–v). Felix V—an uneasy duke in search of a new form of majesty, a hermit-prince, an aged pope disturbed by the choices he had made and frustrated in his hopes[4]—now also suffered in body. In addition to the weakness of age, he was also afflicted by a kind of paralysis of one hand and one foot, which was so painful that he groaned aloud in the course of his conversation with Fabri. The attending physicians—Italians who followed the "common way of *vulgares medici*"—had asserted that no cure was possible. However, he had heard of another "secret kind of healing" (*medendi genus secretum*) described by Arnald of Villanova and other Frenchmen, which was able to provide a remedy for the "discomforts of age" (*incommoda senectutis*), and therefore perhaps also for the affliction from which he was suffering.[5] Groaning and sighing, the pope cited some learned examples of prolongevity; he wondered, angrily, why such remedies had now vanished or were known only to very few people. Eventually, after much skirting around the subject, he came to potable gold and the transmutatory art, saying to Guglielmo: "What do you have to say about that medicine of the philosophers that they call the elixir? . . . Is it possible that something of truth or power is to be found in these things?" (fol. 245 v: "post multos circuitos devenit ad aurum potabile et ad artem trasmutatoriam dicens: 'Quod ais tu de illa medicina philosophorum quam elixir dicunt? . . . Estne possibile latere in illis aliquid veritatis et virtutis?'").

This, supposedly, is the situation and the question that gave rise to Fabri's text. *De lapide* presents itself as a report of dialogues between the author and the pope in a series of meetings. The dialogues are interspersed with short treatises, with which Fabri found it more appropriate to respond to the pope's demands, given their relevance and the pope's imperiousness. The text is thus a mixture of genres: the report of meetings and dialogues, character-

ized by a loose conversational tone and by the rhetoric of patronage, frames three treatises on specific themes mostly written in an impersonal scholastic style. They deal with (1) the possibility of transmutation, which is treated by means of a *demonstratio* based on the Aristotelian four causes;[6] (2) the therapeutic efficacy of potable gold, inserted in a reasoned survey on the nature and virtue of gold; and (3) the interpretation of some particularly occult terms, namely *telchem* or *thelesim* and *yxir.*

Beyond the frame of dialogue, the three texts are also unified by a limitation that the pope imposed on Fabri, as well as by Fabri's own choice. Felix V insisted that the style, forms of argument, and authorities used must be exclusively Peripatetic. Fabri was in complete agreement and chose to proceed in all three treatises by starting from authorities, moving on to rational demonstration, and ending in *experimentum.* On this basis, he undertook to satisfy the pontiff, travelling along "the correct path of philosophers" (*semitam rectam philosophantium*).[7] And in fact Fabri's whole attitude is completely philosophical: he confidently handles doctrines, trends, and works (at least, some of the works) of Latin alchemy, but he has nothing to do with the *opus,* as at one point he declares and as his entire text reveals. Neither in the section on transmutation nor in that on potable gold does Fabri ever give any indications about specific ingredients, operations, or processes. The term *opus* in its technical sense never appears in *De lapide;* the work is a purely doctrinal treatise by a philosopher and never assumes the operative character present in other contemporary texts by physicians interested in alchemy.[8]

II

It will have become apparent that in presenting the pope's first question, Fabri reformulated it: where the pope sought concrete information about the truth and power of the elixir, Fabri transformed this request into a broader inquiry into the art of transmutation and potable gold. The question was only on one subject, the answer on two. Evidently, for Fabri the elixir is the pivotal concept of transmutatory alchemy and could also be linked to remedies—for instance, potable gold—pertaining to a medical alchemy. Already, then, we learn that in the mid-fifteenth century a question on the elixir suggested two objects and two different projects, which could be either unified or separate.

The so-called pseudo-Lullian tradition of the elixir combined these projects. According to that tradition, a preparation composed solely of mineral ingredients is the instrument both of perfecting imperfect metals and of healing the diseases of man, for whom it can also prolong life.[9] In one sense,

the medical tradition of the fifth essence was also unifying: although in *De consideratione quintae essentiae* John of Rupescissa sought only pharmacological and therapeutic results, he nonetheless maintained that quintessence of wine could reinforce the therapeutic virtues of artificially prepared gold.[10] But the very fact that Fabri discussed the question of the elixir in two separate sections, one on transmutation and the other on potable gold, shows that—at least for the moment and formally—he opted for a distinction between transmutatory and medical alchemy. This attitude is consonant with the position of those fourteenth- and fifteenth-century physicians who considered from various points of view, and for the most part maintained a distinction between, the disciplines of alchemy and medicine.[11] Yet in reality Fabri oscillated between distinction and convergence of transmutatory and medical projects, as we can see from his passages on alchemical theory and especially from the sources that he used.

Let us briefly examine his alchemical theory. It joins the most traditional alchemical theory of the nature of metals with a theory of transmutation that in essentials follows Albertus' *De mineralibus,* in which transmutation is explained as a process of purification of metals. Fabri cites word for word the medical analogy with which Albertus closed his analysis of the possibility of transmutation.[12] Albertus had named the elixir, but without giving any details about its composition or role.[13] Fabri, too, is not clear about what the elixir is. In his discussion of the formal cause of transmutation, the elixir is defined as form that will give perfection, or, rather, that will give true nature to imperfect metals, which are to be understood as matter with respect to this form that they are waiting to assume. But where does this form come from and how does it work? Here again Fabri uses suggestions from Albertus and from the *Summa perfectionis* of "Geber," decontextualizing them and depriving them of all operative reference. He uses these suggestions to construct a solution that is as original in its totality as it is oversimplified.

The form, according to Fabri, burns whatever is corruptible and imperfect in the metal and saves "whatever *humiditas radicalis* there is in the metal, digesting the humidity and converting it into perfect gold" ('*quod est in metallo de humiditate radicali, illam digerens et convertens in perfectum aurum*'). In other words, the elixir eliminates "all the *superfluitates* from the metal and maintains only the parts of quicksilver existing in the metal . . . because it attracts what is similar to its nature, but repels what is contrary to it." As a result of this oversimplification, Fabri explains transmutation as a purification of corruptible superfluities followed by a *digestio* that reinforces the *humiditas radicalis*. Hence, the *humiditas radicalis* is the central structure both in the metal to be perfected and in the perfect metal (fols. 247v–248r). In the second sec-

tion on potable gold Fabri notes—still basing himself on Albertus—that by its own nature, gold has a matter that is totally purified from two superfluous and dangerous kinds of humidity. Therefore, among its many virtues, it can eliminate superfluous humors from the human body and can support humidity analogous to its own, that is, the radical moisture of man, given that in gold "only radical humidity remains."[14]

The connection that Fabri proposes between metallurgical alchemy and "medical metallurgy" rests therefore on the theoretical efficacy of the concept of radical moisture:[15] as the elixir works on the *humiditates* of the metal, so potable gold works on the radical moisture. The connection is undoubtedly original: I have not found any trace of it, in this formulation, in other authors or in the texts that Fabri uses, in which indeed elixir, radical moisture, and gold are linked in various other ways.[16] However, in Fabri the connection is based on an analogy that maintains a distinction between the processes that it connects. Therefore the identity of functions between elixir and gold does not allow one to identify them; and it does not follow that a single agent "cures" metals and men, as was affirmed in the *Testamentum,* one of the main pseudo-Lullian treatises. Moreover, unlike ps.-Lull, ps.-Arnald, and Rupescissa, Fabri does not maintain that elixir transforms gold in any way and that gold, precisely because it has been treated in this way, becomes more suitable for strengthening human radical moisture. These stages in the process would make Fabri's conception into a simplified but organic whole like those proposed by those authors. But this sequence is specifically excluded by the passage he quotes from Albertus, to which I have just referred: for Albertus and for Fabri, it is natural gold, not treated gold, that is free of those dangerous humidities.

When one turns to Fabri's sources, it becomes clear that he was well-acquainted with various writings from which he could have drawn the idea of a single agent capable of curing metals and men, had he chosen to do so. In fact, throughout the second section, he makes explicit use of precisely those texts—the *Testamentum,* the *De retardatione accidentium senectutis* of "Bacon" and/or "Arnald"—in which alchemical procedures and therapeutic virtues are organically united.[17] Moreover, he lists most of the therapeutic properties of gold according to the canonical medical texts, but, in addition, he frequently follows word for word (although without explicit quotation) the emphatic descriptions of the virtue of the alchemical remedy found in the texts named. Finally, in what he calls an "aphorism," which is in fact a little hymn of praise, Fabri exalts the celestial sun and the terrestrial sun (that is, gold), which are linked both by analogy and by a relationship of influence, through which the first infuses the second with the most ample array of

virtues. The comparison, the praises, and the enthusiasm are those of Rupescissa in *De consideratione* and of Arnald in *De vinis*.[18]

In other words, Fabri uses texts in which metallurgical and medical purposes are united in order to propose a theory that instead distinguishes between these purposes. He does not justify—or even perhaps perceive—this incongruity. He has decided not to analyze the various doctrines of the texts he uses at all profoundly from a theoretical point of view but rather to exploit these doctrines in, so to speak, a rhetorical way. It is as if he were drawing on a generalized store of interpenetrating medical, alchemical, and medico-alchemical knowledge, unified in his eyes more by homogeneity of language and the possibility of intertextuality than by theoretical coherence. In this textually fluid environment, potable gold, elixir, and fifth essence can be interchangeable—especially for anyone, who, like Fabri, considers only their exceptional properties and virtues, does not inquire into the theoretical or scientific presuppositions, and does not try out the practical procedures of manufacture.

Given this oscillation between distinction (in treating transmutatory and medical alchemy in two sections), analogy (founded on the theory of radical moisture), and unification (in his use of sources), it was no accident that Fabri finally postulated the fundamental unity of metallurgical and medical alchemical projects in *thelesim*. This substance, totally vague and especially secret because of its absolute *fortitudo,* lies at the heart of the *Emerald Tablet,* which, as a generic wisdom text, served as a foundation for any and all trends within alchemy. Whoever possesses the *yxir* or *thelesim* of which Hermes speaks, concludes Fabri, obtains infinite riches and overcomes the disabilities of every disease.[19]

III

The analogy drawn by Fabri between the two radical moistures—that of gold and that of human beings—is, as already noted, an original contribution that is based on considerations taken from texts of both metallurgical alchemy and medical alchemy. Fabri himself, however, does not develop this potentially fertile idea theoretically.[20] Indeed, the idea, however interesting, may not be the most significant contribution of his text taken as a whole. More striking is the complex image that *De lapide* presents of alchemy as a discipline—of its connections not only with medicine but also with other values and branches of knowledge.

It will already have become obvious that Fabri was well aware of the difference between the metallurgical and the medical approaches in Latin

alchemy. Furthermore, Fabri knew perfectly well that metallurgical alchemy had aroused doubt and perplexity from the very beginning and that in his own day it was discredited—invalidated by ecclesiastical prohibitions and rendered suspect by the tricks of empirics and incompetent practitioners (fol. 205r). Nevertheless, his *demonstratio* guaranteed the possibility of the art of transmutation.

Certainly, Fabri had an up-to-date knowledge of the principal disputes and arguments of the "quaestio de alchimia" that in the thirteenth and fourteenth centuries accompanied the introduction and development of alchemical research in the West, finally silting up into the enormous *quaestio-tractatus* of Petrus Bonus of Ferrara and into the judicial accusations of the inquisitor Nicolás Eymerico.[21] Many of the arguments in Fabri's demonstration are in fact traceable in preceding *quaestiones*. They are, however, reproposed not in a *quaestio* but in a *demonstratio*—which, like a *quaestio,* certainly links Fabri to the use of syllogistic argument but, unlike a *quaestio,* allows him to avoid the listing and refutation of positions different from his own.[22] Moreover, his *demonstratio* is not "scholastic," in the sense that it does not originate from commentary on a text—unlike, for example, the *quaestiones* on alchemy by Themo the Jew and Pomponazzi, both of which are part of commentaries on the *Meteorologica*.[23] It is not even "alchemical," in the sense that it does not aim at removing specific doubts, errors, and perplexities—as "Geber" did in his *Summa,* before proceeding with his treatise on specialized alchemical theories and instructions. Fabri's *demonstratio,* although following the rules of the genre (to demonstrate by means of the Aristotelian four causes), is at once systematic and open: he is free both merely to hint at themes that were obligatory points for discussion in the *quaestiones* and to introduce digressions in which he expands on themes that he thinks significant.

Thus, for example, earlier authors who wrote on metallurgical alchemy had frequently laid great stress on demonstrating the epistemological link of *subalternatio* as a way of guaranteeing a place for their discipline in scientific naturalistic knowledge. In contrast, Fabri simply assumes a hierarchical structure in which alchemy is a *scientia* or, rather, a *pars philosophiae,* which is subalternate to natural philosophy and more specifically to *De mineralibus*. This science elaborates theories that should guide the operations of practical alchemists, who are called *mechanici* and *subalternati*: they are to be ruled and controlled by the true philosopher (*De lapide,* fols. 246r–v, 250r). Similarly, the relationship between alchemy as an *ars* and nature, which had been central to the *quaestio de alchimia,* is no longer a problem—or, at any rate, not for Fabri—and therefore is not discussed.[24] On this subject, Fabri repeatedly declares himself in agreement with Albertus' position and simply mentions a

relationship of *imitatio-ministratio,* like that which medicine and agriculture have with nature (fols. 246v, 252v).

However, Fabri introduces on his own account a long paragraph on the nature and virtues of fire into his discussion of the efficient instrumental cause of performing the *opus*. Here, along with physical properties and scientific authorities, appear ps.-Dionysius and his *Angelic Hierarchy,* Pythagoras and Plato, the Chaldeans, and Scripture; and an analogy is proposed between the Holy Trinity and the fiery trinity of light, live coals, and flame. Fabri was not the first author to divide fire in this way; moreover, since he (following the ps.-Baconian *Speculum secretorum*) endowed the fire of alchemists with almost the same transmutatory efficacy as the *lapis,* and since the *lapis* could be (according to Bonus) a perfect analogy of the Holy Trinity, it is not surprising that this fiery trinity could be compared to the divine Trinity. Nevertheless, the explicit analogy may be Fabri's own. At any rate, despite having checked a number of likely texts, I have not yet found any earlier sources for this trinitarian analogy, which Fabri asserts was set forth by great philosophers.[25]

Again, at the end and as a complement to the *demonstratio,* Fabri inserts a whole passage on the role of ethics in transmutation (fols. 249r–250v). The philosopher who is an inquirer into this art (*philosophus huius artis inquisitor*), who is content with inquiry after truth alone, "must be not only a natural philosopher but also a moral philosopher." So, in addition to a rational *subalternatio* of alchemy to natural philosophy, which makes it a true science, we find a sort of *subalternatio* to ethical values, which makes it a virtuous science. In the literature of metallurgical alchemy there were certainly admonitions and exhortations about moral qualities necessary for the alchemist.[26] Fabri knows these moral qualities, links them to the Aristotelian *Ethics,* and amplifies them into a reflection that unites scientific knowledge with prophetic-religious knowledge, philosophical virtue, and political power.

Let us see how. Fabri here is commenting on the prologue of the *Tractatus aureus* of Hermes. From it, he infers that Hermes was a prophet because he declares that he has been divinely inspired and because he "tells in advance" (before revelation) his faith in one God, in free will, in resurrection, and in the Last Judgment.[27] Thus alchemy appears to be *partim divina*[28]—that is, it derives also from inspiration and prophetically expresses religious truth; therefore, alchemical truths are also concealed in the images and analogies used by the prophets of old. For this reason, the alchemist prays God to unveil meanings to him and to help him in operating.[29] Such knowledge, which is simultaneously rational and holy, necessarily required those high moral qualities that in fact the alchemists recommend. But—and here Aristotle intervenes—virtue is also the ability to choose with free will and operate *delec-*

tabiliter. How then can the alchemist—at once philosopher, illuminated by inspiration, and virtuous by reason of his freedom—allow himself to be constrained by the unjust violence of princes who too often oppress seekers after truth? Fabri has no doubts: the *valens philosophus* would prefer to die for the alchemical art rather than reveal that which is the fruit both of divine inspiration and of his free will as a researcher. Three examples of "scientific suicide" to defend knowledge from tyrannical oppression confirm the philosophical virtue of alchemist philosophers, which is inseparable from their true knowledge.[30]

Warnings about difficult relations between alchemists and the powerful are topoi in the literature of metallurgical alchemy.[31] Rupescissa too warns, with prophetic zeal, against those tyrants who, at the advent of Antichrist, will oppress evangelical men.[32] Fabri transforms the warnings by weaving them together with classical examples and Aristotelian philosophy. Thus transformed, they become the basis on which Fabri constructs his concept of the correct and ideal relation between alchemists and princes,[33] to which I shall return. Finally, at the end of this passage—the themes of which are obviously very dear to his heart—Fabri stresses that theoretical knowledge is inseparable from philosophical virtue and from the proper exercise of power. Alchemy and its goals are legitimate and acquirable without those crimes that usually go along with seizing power; indeed, the acquisition of power without infamous crimes could in a certain way be favored by alchemy (fols. 249v–250r). Its legitimacy resides above all in the fact that it is a just method of searching for truth because it proceeds "first of all by theory with the true doctrine of philosophy."[34] Certainly, tyrants are not virtuous, because they are ignorant and aggressive; equally lacking in virtue are the deceitful practices of fraudulent and wandering alchemists, because they proceed "casually like empirics," far from the light of theory and of true philosophy. Tyrants and empirics are thus joined at opposite but symmetrical extremes with respect to an ideal center where the powerful and virtuous knowledge of the alchemists and the wisdom of their protectors is to be found. Tyrants have power but not knowledge and wisdom. Therefore their power is crude and fragile. Empirics have only apparent knowledge; therefore it is inefficacious and deceitful. Both are in any case ethically deviant and distorted, far from philosophical virtue.

IV

This analysis, which has brought out some values—scientific, ethical, and religious—of the image of alchemy held by Fabri, will, I believe, have made

clear the sense in which I spoke of Fabri as standing at a crossroads. That will become clearer still if we consider what Fabri has to say about the other, medical, variety of alchemy. We have already seen how much Fabri uses texts from this branch, even though he did not completely accept their basic concept. More generally, Fabri is one of the earliest and most noteworthy compilers and constructors of the legend of Lull the alchemist, his relations with Arnald, his stay in England, and his relations with kings.[35]

This legend is important because it provided a supporting structure that, from the fifteenth century onward, accompanied the accumulation of the Lullian corpus and supplied an explanation for the resemblance between the positions held in the most ancient core of the corpus and those found in texts attributed to Arnald and John Dastin. Fabri knew these texts and was aware of the common orientation of their authors.[36] He named them many times and described them as operating together for—or rather, with—King Edward of England. About Edward himself, he said: "How many labors King Edward of England undertook! In the dress of a hermit, he went around the whole world for the sake of this art."[37]

Several points are worth stressing here. It was around these personages that Fabri constructed his own model of ideal alchemical patronage, which we are thus able to read. There is a king, directly interested in alchemy to the point of personally undertaking tiring tasks, journeys, and the hermit's solitary life; three wise alchemists come to him from afar, and he treats them with every honor; they instruct him; they work with him and for him; they perform the *opus;* and the king divides its results with them. Besides sharing knowledge and wealth, Edward would like to share his power, namely the kingdom, with them too; but they "say that to reign and to philosophize are two incompatible things" (fol. 253r), and leave their books to the king and to posterity. We can recognize elements here—the eremitical life, the refusal of power, the bequest of writings; the mastery and collaboration between the wise man and the king—which go back to two archetypes of the relation between the wise man/alchemist and king: the *Liber* of Morienus and the *Secretum secretorum*. As usual, Fabri reworks these elements in new forms; in this case perhaps he uses them also to characterize his own relationship with the pope. Indeed, just as the three alchemists put philosophy in first place, so when Felix V compliments Fabri on his excellent demonstration and wants him next to prove alchemy through experiment, Fabri replies that the philosopher must rest content solely with speculative inquiry into truth.[38]

Moreover, Fabri, like modern historians, perceives agreement in doctrine among the three alchemists and traces a genealogy that has its origin in Roger Bacon.[39] In fact, Fabri made much use of "Bacon," both *De retarda-*

tione (which, although much used without attribution, is in one instance explicitly quoted as by Arnald) and the *Speculum secretorum*—in the latter case specifying that Bacon "was a Peripatetic." This is yet further evidence of Fabri's sensitivity to the specific characteristics of medical alchemy. Also like modern historians, however, he was not able to trace explicit derivation from Bacon and had to content himself with simply pointing out a chronological relation: "Roger came before them."

V

Fabri was very familiar with and sympathetic to the authors of medical alchemy, but his sympathy fell short of complete accord. He contributed to the construction of a legend that highlights a doctrinal trend synthesizing alchemy and medicine; but he also readily broke up the synthesis or at least did not adopt it consistently. Moreover, Fabri was also theoretically competent in metallurgical alchemy. He provided a logical demonstration of the possibility of metallurgical transmutation and confirmed its legitimacy. But he did not touch on the operative doctrines and the *opus,* nor did he appear to value them particularly highly. In fact, he warns the pope that he has written the demonstration for him "not in order that you should spend money in trying out such secrets," but only to show "the possibility of the thing."[40] As for *experimentum,* which according to Fabri's own declaration at the beginning was indispensable to a Peripatetic proof, appeal to the evidence of sense experience is not lacking.[41] But when at the end of the demonstration the pope asks for *experimenta* in the sense of operative proofs, Fabri, as we have seen, reminds him of the primary value of philosophical truth alone. After that, a long silence follows. Again, at the end of the section on gold, at the moment of "descent to experiments," Fabri affirms that these would be too incredible; and in any case he prefers to replace them with the praise of gold in the aphoristic hymn about the harmony between the celestial and the terrestrial sun.[42]

How, therefore, did he conceive of alchemy, of trends within alchemy, of the alchemical *opus,* the elixir, and potable gold? They were not subjects to which he intended to give a profound theoretical and critical analysis in order to reach a definitive solution. Nor were they goals that would demand the operative intervention that gives rise to actual processes and tangible results. Instead, they were for him essentially, primarily, and above all exceptionally interesting textual objects. Fabri analyzed them by means of doctrinal and exegetical exercises and applied to them the techniques of erudition, namely collecting and amplifying.

This interpretation of his text explains its apparent theoretical uncertainty by highlighting Fabri's relative indifference to specific comparisons and definitive solutions. It may also explain why Fabri chose to deal with the subject not within the constraints of the *quaestio* format but in a more elastic *demonstratio*. Again, this interpretation reinforces the idea that the most convincing and substantial relation between alchemy and medicine on which Fabri focused is that which emerges from his learned and erudite gathering together and common use of the disciplines' respective texts. So it is hardly surprising that the pleasures of erudition are judged by Fabri to be among the principal aims and results of his research. Indeed, Fabri recognizes that his rational inquiry about potable gold and also his demonstration on transmutation are undertaken chiefly "as a recreation and exercise" (fol. 251r: "causa solaci et me exercitandi volo experiri ad quod potero pervenire"). What are involved are exercises in doctrine and logical ability, which are interesting, pleasurable, certainly also rigorous, but not radical. They are pleasurable for Fabri and also for the pope who, while he groans from pain at the beginning of the text and during the first meeting, in the end gets up laughing. Perhaps he has not solved his physical problems, but it has evidently done him good to devote himself "with so much pleasure to these difficult arguments" (fol. 253v).

At the same time, erudition can be a good interpretive tool. In fact, the objects (alchemy, potable gold, elixir, etc.) presented by the texts gathered and used by Fabri all involve language that is to a certain extent metaphorical and allusive, as Fabri and the pope recognized at the very beginning of their meetings. These objects, accordingly, require two kinds of exegesis. One is the reduction to univocal Peripatetic semantics undertaken by Fabri in the first section. The other, different but no less valid, is that of erudition and allegorical interpretation. I think that the excursus on fire and the story of the deeds of the three alchemists in part have this function. From this point of view, moreover, we can consider the entire third (and last) section of *De lapide,* which is devoted precisely to the analysis of mysterious terms—*telchem aut thelesim* and *yxir*: "these are two very secret words among the ancient philosophers and prophets" about which "all seers prophesied and wrote an infinite number of allegories" (fols. 251r–253v).

Here also, as always, Fabri starts from the texts and follows the analysis of his favorite Albertus, but in this case he uses the *Speculum astronomiae*. He distinguishes two arts to which these terms pertain. One is licit transmutatory alchemy (*yxir*); the other (linked with *thelesim-telkem*), although placed by "great philosophers" side by side with philosophy and medicine, is an ill-defined astrological-magical science.[43] The goals of this science, as listed by

Thebith Bencorat, are prohibited by divine and human law.[44] Arnald devoted some space to it in his *De sigillis,* but readily—Fabri points out—came down from the heavens of this difficult and fallible science "to the bowels of the earth," that is, to research on minerals, and found out the truth, which is alchemy.[45] In fact the alchemical science of the elixir fulfills in a legitimate and natural way, without danger to either body or soul, all the goals that the forbidden science of the *thelesim* promises (fols. 252v–253r). As we can see, in this section Fabri seems to distinguish two sciences—magic and alchemy—and two meanings of *thelesim*. In one sense, *thelesim* is equivalent to a magical link, pertains to magic, and is forbidden. In the other sense, *thelesim* is equivalent to *yxir,* as the permissible, efficacious, and true *thelesim* of Hermes—that is, the highly generic elixir-*thelesim-fortitudo* of the *Tablet*. Up to this point, Fabri is presenting an interesting—and unusual—reduction of magic to alchemy. He transforms the illicitness and vagueness of magic into the legitimate rationality of alchemy.

But this treatment of alchemy also makes it assume the broad ends, the power, and the sacred aura of the magic art. As a result, in this section the elixir has become highly generic and polyvalent; it therefore can be interpreted in many different ways. In fact, it becomes a nucleus of aggregation and amplification that produces a paratactic list of scriptural quotations, mythical fables, and references to poets (fol. 252r). This exuberant series of definitions, so interesting in its richness and potentially capable of amplifying the meaning of "alchemy," is not further developed in any way, and its innovative character remains implicit. It surely confirms that for Fabri, alchemy had to do with religiosity and mythology. But it also shows that at the time when he wrote, these links were not yet the basis for a concept of alchemy aimed at perfection of the soul and spirituality of the adept. Nor were they yet the basis for the elaboration of a fully developed mythological hermeneutics tracing the art back to ancient poet-philosophers and thus capable of interpreting elusive alchemical instructions by means of mythological *fabule*.

As is well known, these developments became obvious later, after Fabri, during the sixteenth century.[46] They had already made an embryonic but very significant appearance in the *Pretiosa margarita* of Petrus Bonus.[47] However, even a brief comparison of Fabri's work with this text reveals how different the two are in style and intention. When Bonus speaks of the ancient philosopher-alchemists, as he is considering their alchemical theories and *dicta* regarding the *lapis* (a union of body, spirit, and soul, which is finally revealed in all its glory at the end of the *opus,* arising out of depurated matter, etc.), he remarks that for the very reason they were alchemists, they were prophets too. In other words, Bonus starts out from his own theory on the

lapis; he considers some particular technical phases of the *opus* and the concrete features of the *lapis* mentioned in the alchemical texts. He thus points out that the ancients, who knew the truth of alchemical phenomena because they had seen them during their operative working, must necessarily have glimpsed some facts and truths of the Christian religion, which had the same characteristics. Fabri expresses the same opinion, but he is simply commenting on the generic statements of the prologue of Hermes' *Tractatus aureus*. Bonus maintains that alchemy, "partim divina," is an all-pervasive science that permeates all other forms of knowledge and draws them to itself. This is why the poets' verses and *fabule* can be interpreted as having reference to the *opus,* of which they show specific stages and features.[48]

Unlike Petrus Bonus, Fabri rests his list of scriptural and poetic allusions neither on a fully articulated, explicit conception of alchemy nor on a philosophical analysis of alchemical language. Moreover, he has no interest or competence in the operations and techniques of alchemists, on which Bonus had based his reflection on alchemist-prophets and poet-alchemists. Therefore, Fabri's references to Scripture and the poets do not serve to explain. Rather, he uses wide erudition and symbolic amplification to stress and exalt just one concept: the power of a *thelesim*-elixir, the mysteriousness and elusiveness of which are more and more emphasized and not explained.[49]

VI

Other physicians more or less contemporary with Fabri also took an interest in alchemy and in the relation of alchemy and medicine. In 1456 a petition was presented to King Henry VI of England that was very different from many others in which a license to practice transmutatory alchemy was requested. The signatories, among whom were various medical practitioners and court physicians, proposed researches aimed at utilizing the philosopher's stone as a medicine that would be much more powerful than those handed down by the ancients. It is the "mother of medicines," the agent of perfection for all bodies in the pseudo-Lullian tradition. The petition was accepted; but we are better informed about the manuscript of the *Testamentum* prepared by Kirkeby, one of the signatories, than about the outcome of the research.[50]

Moving on to other cases closer to Fabri, either culturally or professionally, we can better describe the position of Michele Savonarola, university professor and physician at the Estense court from 1440; he wrote a *Libellus de aqua ardente* for Leonello d'Este.[51] In this work, following the tendency of fourteenth-century physicians, Savonarola distinguished between

alchemy and medicine. He doubted the possibility of manufacturing the quintessence, praising instead the therapeutic value of *aqua ardens,* which can prolong life. In his treatise, gold maintains its traditional properties and as such is an ingredient in numerous medicinal recipes. However, he held it to be indigestible; he therefore defined potable gold as "something to laugh at," while *aqua ardens* was a "precious treasure," especially useful in times of plague.[52] Savonarola's position on the relation of medicine and alchemy is characterized by distinction of fields, attention to the possibility of the exchange of ingredients and techniques, and knowledge of alchemical theories and operations.

Antonio Guaineri, professor at the University of Pavia and court physician to Amadeus VIII, appears more confused about the subject. Perhaps he was one of those physicians incapable of curing Amadeus because they were following "the way of vulgar medical practitioners," whose ignorance the pope lamented with Fabri at the beginning of our text. Certainly, Guaineri's texts, which collectively amount to a *practica,* are dedicated to operative medicine. In them he competently describes tools and techniques of distillation, sublimation, and fermentation; and he is very attentive—with a mixture of contempt and professional interest—to the practices and remedies of the *vulgares* and to the skills of pharmacists, goldsmiths, and *gemmarii.* In Guaineri's work, texts are cited that are unusual to find in a *practica,* such as Albertus' *De mineralibus* and the *Secretum secretorum.* He reports some alchemical remedies and products of techniques that are common to alchemy and pharmacology. He describes a recipe for an excellent ointment for paralysis (evidently not very efficacious on his august patient), which he got from a hermit who, having become expert in compounding medicines during years of vain alchemical research, subsequently became a physician. As for potable gold, it appears "absurd" to him for the same reasons as it did to Savonarola, but he adds: "I have, however, heard from two alchemists worthy of faith that they can undoubtedly manufacture it."[53] Finally, one member of Piedmont's Albini di Moncalieri family of physicians, all of whom were linked to the court of Savoy, left a splendid recipe for potable gold; in his dryly technical instructions, Albini stressed that with a little quantity of this gold, "in three days wonders will occur."[54]

In their diversity, these positions bear witness to the widespread interest in alchemy among physicians and in particular to the physicians' lively attention to potable gold. Moreover, all these authors and their ideas are in various ways linked to courtly needs and culture. Fabri has only these two very general characteristics in common with this group; in many specific features, his text is quite different.

Fabri's distance from the *opus* and from practice allows him to isolate and define specific themes and comparisons, as well as to devote his analysis exclusively to aspects of his own choice, avoiding the standard contexts in which alchemical themes are developed in medical texts. Moreover, if we agree that Fabri's way of writing is to be understood primarily as a form of erudition, we can see how this erudition enriches and enlarges the themes under discussion, when it is set against the narrow technicality of Albini's recipe for potable gold, Guaineri's casual anecdotes about alchemists, and Savonarola's sober considerations on *aqua ardens.* In other words, having defined his subject and removed it from practice, Fabri made it into a new object—specifically, a textual object—around which he could collect anthropological notes, poetic and mythological references, and ethical evaluations of a kind that we cannot find in most medical texts. Indeed, the rules governing the writing of such texts would make these subjects inappropriate and out of place. Thus, Fabri proposed to the pope neither efficacious remedies nor *experimenta;* instead of the "secret medicine" (*medendi genus secretum*) which the pope had requested, he offers a self-sufficient collection of quotations, symbols, interesting stories, unforeseen textual interweavings, and themes developed in unusual ways. That is, he offers not a cure for the pope's physical disease but satisfaction for his intellectual curiosity in a context not of therapy but of erudition. This has to be intended as an edifying pedagogy as well as a development giving a new connotation to the ancient motto continually repeated by the alchemists: "Liber aperit librum."

VII

After having described the formation of an ideal alchemical patronage in which king and alchemists work together with practical success, Fabri embarks on a different kind of relation, which he presents as based principally on pleasurable study. This transformation does not escape the pope, nor does he seem happy with a textual object that he can possess only by erudition. Therefore, eventually, he exclaims "with a certain vehement outcry": "Who can say, in these days, 'I have the true elixir?'" (fol. 253v).

To this last cry—a lament more than a question—not even historians can give a precise response, because of the many different directions in which alchemy moved during the fifteenth century, in which the elixir could have so many different meanings. Certainly Fabri had no response. But as others had dedicated texts to the pontiff in order to produce the *opus* or had produced the *opus* for kings, so too Fabri offers an *opus* to his august interlocutor. What Fabri produces is a literary opus, manufactured by working on

textual ingredients that he manipulates and assembles, thus transforming them. This opus is evidently produced in the library, not in the laboratory. When Fabri leaves the pope—as he informs us—he retires to his house (perhaps into his *studiolo*?), entrusts himself to his *ingeniolum,* peruses a great many books—and writes.

The lack of operative referent and the distance between the *opus* and manual work, typical of many alchemical texts written in the Middle Ages and the early modern period, have justly been viewed as a sign and result of a process of "spiritualization" of alchemy. In this view, the art was deemphasizing the program of transmutation and turning either into medical-pharmacological research or into a search for spiritual perfection of the adept. But much remains to be learned about fifteenth-century alchemy. Fabri's is only one of many little-known texts; perhaps we should not attach too much weight to a work that does not seem to have circulated or exercised subsequent influence. Nevertheless, it seems to me to represent an example of a possible third line of development within Renaissance and early modern alchemy. In fact, one can retreat from the laboratory not only to the "oratory"[55] but also to the library and reach for the shelves of erudition. Here, in a doctrinal and erudite context, transmutation, wondrous remedies, therapeutic goals, and alchemico-religious intuitions could continue to be maintained in some unity; in any case, their textual basis could be preserved, even if they were transformed and mixed together in strange combinations. In this way, a textual and conceptual complex, which had already been organized and enriched, was transmitted. Such a complex could be elaborated even further, either leading to the pleasures of erudition or perhaps becoming the basis on which subsequent researchers could work according to different goals.

I believe that this third way of erudition was of considerable significance, especially in the fifteenth century, when the newly venerated classical authors met the venerable alchemists. Even in later alchemical projects—more engaged and coherent, based on more solid and better-thought-out philosophical grounds—erudition remains a feature and above all a mental attitude that is never entirely absent.

NOTES

I would like to thank Michela Pereira, who first drew my attention to Fabri's text, and Nancy Siraisi, who helped me in translating this paper.

1. Bologna, Biblioteca Universitaria (Fondo Caprara), MS lat. 104 (Frati, no. 138), fols. 245r–253v: "Incipit Liber Guylielmi De Dya de lapide philosophorum et de auro potabile ad summum pontificem. Gratulanti mihi dudum . . . " (hereafter cited as *De lapide*).

On this manuscript and Fabri's text, see Lodovico Frati, "Indice dei codici latini conservati nella R. Biblioteca Universitaria di Bologna," *Studi italiani di filologia classica* 16 (1908): 155–158; Lynn Thorndike, *A History of Magic and Experimental Science* (New York: Columbia University Press, 1923–1958), 4:342–344; on the Fondo Caprara, see Didier Kahn, "Le fonds Caprara de manuscrits alchimiques de la Bibliothèque universitaire de Bologne," *Scriptorium* 48, no. 1 (1994): 62–110. MS lat. 104 contains several other alchemical treatises; see notes 16 and 54, below.

2. *De lapide* seems to be the only work under Fabri's name. I do not deal here with problems concerning his identity and career, which would require too lengthy an analysis: see, however, Thorndike, *Magic and Experimental Science,* 4:342–344; Ernst Wickersheimer, *Dictionnaire biographique des médecins en France au Moyen Age,* new ed. with supplement by Danielle Jacquart (Geneva: Droz, 1979), 1:242; Elisa Mongiano, *La cancelleria di un antipapa: Il bollario di Felice V (Amedeo VIII di Savoia)* (Turin: Palazzo Carignano, 1988), p. 114; *Concilium Basiliense,* vol. 7, *Die Protokolle des Concils 1440–1443,* ed. Hermann Herre (Basel, 1910; reprint, Nendeln/Lichtenstein: Kraus Reprint, 1971), p. 201; Heribert Müller, *Die Franzosen, Frankreich und das Basler Konzil (1431–1449)* (Paderborn: F. Schöningh, 1990), 1:159, 2:603. See also the (not entirely reliable) notices and summary of Fabri's work provided by Giovanni Carbonelli, *Sulle fonti storiche della chimica e dell' alchimia in Italia* (Rome: Istituto Nazionale Medico-farmacologico, 1925), pp. 84–93.

3. Fabri's name is not recorded in medical documents related to the Savoy Court. Antonio Guaineri was the most famous of the physicians who officially worked at the court in that period. See discussion later in this paper; Danielle Jacquart, "De la science à la magie: Le cas d'Antonio Guainerio, médecin italien du XVe siècle," *Littérature, Médecine et Société* 9 (1988): 137–156; and eadem, "Theory, Everyday Practice, and Three Fifteenth-Century Physicians," in *Renaissance Medical Learning: Evolution of a Tradition,* ed. Michael R. McVaugh and Nancy G. Siraisi, Osiris, 2nd ser., 6 (Philadelphia: History of Science Society, 1990), pp. 140–160.

4. On the multifaceted personality and political attitude of Amadeus VIII/Felix V and the courtly culture that he promoted, see Bernard Andenmatten and Agostino Paravicini Bagliani, eds., *Amédée VIII–Félix V, premier duc de Savoie et pape (1383–1451),* Colloque International, Ripaille-Lausanne, 1990 (Lausanne: Bibliothèque Historique Vaudoise, 1992), especially the contributions of Jacques Chiffoleau, Catherine Santschi, Elisa Mongiano, Sheila Edmunds, Robert Bradley, and Terence Scully. See also Enea Silvio Piccolomini, *De viris illustribus,* ed. Adrianus Van Heck (Vatican City: Biblioteca apostolica vaticana, 1991), pp. 74–79; and idem, *Commentarii rerum memorabilium . . . ,* ed. Adrianus Van Heck (Vatican City: Biblioteca apostolica vaticana, 1984), 1:54, 435–441.

5. On aging and prolongevity, besides the classic introduction of Gerald J. Gruman, *A History of Ideas about the Prolongation of Life: The Evolution of Prolongevity Hypotheses to 1800,* Transactions of the American Philosophical Society, new series, 56, part 9 (Philadelphia: American Philosophical Society, 1966), see now Agostino Paravicini Bagliani, *Medicina e scienze della natura alla corte dei Papi del Duecento* (Spoleto: Centro Italiano di Studi sull'Alto Medioevo, 1991), esp. chaps. 6, 7, 9, and 10; Faye M. Getz, "To Prolong Life and Promote Health: Baconian Alchemy and Pharmacy in the English Learned Tradition," in *Health, Disease, and Healing in Medieval Culture,* ed. Sheila Campbell, Bert Hall, and David Klausner (New York: St. Martin's Press, 1991), pp. 135–145; Michela Pereira, "Un tesoro

inestimabile: Elixir e 'prolongatio vitae' nell'alchimia del Trecento," *Micrologus* 1 (1993): 161–187; Luke Demaitre, "The Care and Extension of Old Age in Medieval Medicine," in *Aging and the Aged in Medieval Europe,* ed. Michael M. Sheehan (Toronto: Pontifical Institute of Mediaeval Studies, 1990), pp. 3–22.

6. More or less contemporaneously, the Savoy court cook, Master Chiquart, was imperiously asked (as he repeatedly remarks) by Amadeus VIII to write a treatise on the courtly culinary art. Cookery is considered here as a "science et art, science de l'art de cuysinierie et de cuysine." In the prologue, Chiquart, too, lists "les quatre causes principales que doyvent estre en toute bonne oeuvre, c'est assavoir, cause efficient, material, formal et final"; see *Du fait de cuisine par Maistre Chiquart, 1420,* ed. Terence Scully, in *Vallesia* 40 (1985): 130, 127. Chiquart remarks that, in several cases, the good cook should follow the dietetic directions of the physician; for his part, Fabri stresses the theoretical value of the true science of cooking as opposed to the mere practice of "coquus mechanicus" (fol. 250r).

7. *De lapide,* fol. 245v: "Si peripateticorum solis auctoritatibus insistere opporteat et eorum conclusionibus uti, non est necesse ut degenerem ab eorum stillo et ideo fortassis sermo videbitur minus cultus. Sane malo cum philosophis sedere mensa inculta coloribus quam cum philologis gladium semper accuere et numquam percutere; sententie enim philosophie sui natura pulchre sunt et facunde." Fol. 246r: "Quia autem sanctitas vestra peripatetichorum scholam deligerit credo quia sola ista inter ceteras pauca protulit que non sint digna fide. Omnia enim que dixit Aristoteles eleganter probat ratione aut experimento."

8. In addition to the scientific and philosophical authors (mainly Aristotle and Avicenna) whom learned physicians were normally expected to master, Fabri also competently handled philosophical and patristic sources unusual in both medical and alchemical treatises: *De unitate et uno,* ascribed to Boethius; Boethius, *De consolatione philosophiae;* Isidore of Seville, *Etimologiae;* ps.-Dionysius, *Hierarchia angelica;* Apuleius, *De Deo Socratis;* Ambrose's commentary on Luke.

9. The basic text of this tradition is the pseudo-Lullian *Testamentum.* A critical edition of this work by Michela Pereira is forthcoming. For the time being I use the *Testamentum* edited in Jean Jacques Manget, *Bibliotheca Chemica Curiosa* (Geneva, 1702), 1:707–777; regarding the wonderful powers of the lapis/elixir, see pp. 776B–777A. Among the many studies she has devoted to this tradition, its theories, and development, see Michela Pereira, *L'oro dei filosofi: Saggio sulle idee di un alchimista del Trecento* (Spoleto: Centro Italiano di Studi sull'Alto Medioevo, 1992); eadem, "Teorie dell'elixir nell'alchimia latina medievale," *Micrologus* 3 (1995): 103–148; eadem, "'Mater medicinarum': English Physicians and the Alchemical Elixir in the Fifteenth Century," in *Medicine from the Black Death to the French Disease,* ed. Roger French et al. (Brookfield, Vt.: Ashgate, 1998), pp. 26–52; see also above, note 5.

10. See John of Rupescissa, *Liber de consideratione quintae essentiae* (Basel, 1561), liber primus, pp. 22–23.

11. See Chiara Crisciani, "Medici e alchimia nel secolo XIV: Dati e problemi di una ricerca," in *Atti del Congresso internazionale su medicina medievale e scuola medica salernitana* (Salerno: Centro Studi Medicina 'Civitas Hippocratica,' 1994), pp. 102–118; see also later discussion in this paper.

12. See *De lapide,* fol. 247r, and compare Albertus Magnus, *De mineralibus,* book 3, tractatus 1, in his *Opera omnia,* ed. P. Jammy (Lyon, 1651), 2:252a–b. On different forms of analogy between alchemy and medicine, see Chiara Crisciani, "Il corpo nella tradizione alchemica: Teorie, similitudini, immagini," *Micrologus* 1 (1993): 189–233, and Barbara Obrist, "Alchemie und Medizin im 13. Jahrhundert," *Archives internationales d'histoire des sciences* 43 (1993): 209–246.

13. See Pereira, "Teorie dell'elixir," p. 125.

14. *De lapide,* fol. 251v: "Quia [aurum] igitur est in complexione temperatum, ideo habet vim temperandi, et quia materia illius fuit summe depurata duobus humiditatibus superfluis, videlicet unctuosa et inflamabile et aquosa seu flematica evaporabili . . . ideo habet vim summe depurandi humores superfluos et confortandi suum simile videlicet humidum radicale, cum in eo sola humiditas que est radicalis remaneat." The remarks about the two dangerous humidities are virtually quoted from Albertus Magnus *De mineralibus,* book 4, tractatus unicus, chap. 7, "De natura et commixtione auri," in *Opera Omnia,* ed. Jammy, 2:264b–265a.

15. For the medical concept of radical moisture, see Michael R. McVaugh, "The 'Humidum Radicale' in Thirteenth-Century Medicine," *Traditio* 30 (1974): 259–283; see also Gad Freudenthal, "The Problem of Cohesion between Alchemy and Natural Philosophy: From Unctuous Moisture to Phlogiston," in *Alchemy Revisited,* ed. Zweder R. W M. von Martels (Leiden: Brill, 1990), pp. 107–116.

16. To give only a few examples, something of the kind can be found in Roger Bacon, *De retardatione accidentium senectutis,* ed. A. G. Little and E. Withington, in vol. 9 of *Opera hactenus inedita Rogeri Baconi* (Oxford: Clarendon, 1928), esp. pp. 43–46; idem, *De conservatione iuventutis,* in ibid., especially pp. 133–134, 139–140; ps.-Arnald of Villanova *De vita philosophorum,* ed. Antoine Calvet, *Chrysopoeia* 4 (1990–1991): 62, 68, 72–74; idem, *De conservanda iuventute,* in his *Opera omnia* (Basel, 1585), col. 818; ps.-Lull, *Liber Mercuriorum* (third part of *Testamentum*), chap. 18: "De aquis et medicinis pro humano corpore," Oxford, Corpus Christi College, MS 244, fol. 63va; John of Rupescissa, *De consideratione,* p. 23; *Tractatus de investigatione auri potabilis editus a quodam solemni medico,* Bologna, Biblioteca Universitaria (Fondo Caprara), MS lat. 104, fols. 271r–283v (a very interesting anonymous text in the same codex as Fabri's *De lapide*), at fol. 282v.

17. See, among the many studies he devoted to the "Alchimica" of ps.-Arnald, the contribution of Antoine Calvet, "Mutations de l'alchimie médicale au XVe siècle: A propos des textes authentiques et apocryphes d'Arnaud de Villeneuve," *Micrologus* 3 (1995): 185–209. See also Giuliana Camilli, "'Scientia mineralis' e 'prolongatio vitae' nel 'Rosarius philosophorum,'" *Micrologus* 3 (1995): 211–225; Michela Pereira, "Arnaldo da Villanova e l'alchimia: Un'indagine preliminare," in *Actes de la I trobada internacional d'estudis sobre Arnau de Vilanova* (Barcelona: Arxiu de Textos Catalans Antics, 1995), 2:95–174; and note 5 above. These and other recent studies on the relationship between alchemy and medicine in the fourteenth and fifteenth centuries point out the pivotal role of "Arnald" in the development of this network of medical-alchemical conceptions. Arnald, a famous and authoritative physician and alchemical *auctoritas,* involved in several texts on prolongevity (authentic, attributed, or with paternity as in the case of *De retardatione*—variously ascribed to Arnald or Bacon), became a more and more important and reliable reference, especially for those physicians interested in potable gold and alchemical remedies.

See, for some witnesses of this role, Chiara Crisciani and Michela Pereira, "Black Death and Golden Remedies: Some Remarks on Alchemy and the Plague" in *The Regulation of Evil: Social and Cultural Attitudes to Epidemics in the Late Middle Ages,* ed. Agostino Paravicini Bagliani and Francesco Santi (Florence: Società Internazionale per lo Studio del Medioevo Latino, 1998), pp. 7–39.

18. Rupescissa, *De consideratione,* pp. 22–24, 48–53; Arnald of Villanova, *De vinis* in his *Opera omnia,* cols. 586, 591. Outstanding praises of the two "suns" can also be found in the treatise of the *Solemnis medicus* (see note 16 above), fols. 279r–280v. Danielle Jacquart pointed out the relevance of *héliocentrisme* also in the sober ideas on alchemical remedies of Michele Savonarola: see "Médecine et alchimie chez Michel Savonarole (1385–1446)," in *Alchimie et philosophie à la Renaissance,* ed. Jean-Claude Margolin and Sylvain Matton (Paris: Vrin, 1993), pp. 109–122.

19. *De lapide,* fols. 252v–253r: "Non credo fore aliud telkchem permissum nisi verum yxir Hermetis quem Aristoteles vocat patrem omnis telchem vel thelesim"; "Est enim yxir recte factum fortuna fortunarum, quia divitias largitur ad plenas quadrigas, ut dicit Raymondus in Testamento. . . . Itaque nullum impedimentum morborum nec aliud potest prevalere adversus habentem."

20. The idea would later be developed, for instance, by Giovanni Bracesco in his *Lignum vitae,* edited in Manget, *Bibliotheca Chemica Curiosa,* 1:911–938; cf. Sylvain Matton, "Marsile Ficin et l'alchimie: Sa position, son influence," in Margolin and Matton, *Alchimie et philosophie,* pp. 155–156.

21. Petrus Bonus of Ferrara, *Pretiosa Margarita Novella,* edited in Manget, *Bibliotheca Chemica Curiosa,* 2:1–80; Nicolás Eymerico, *Contra alchimistas,* in "Le traité 'Contre les alchimistes' de Nicolas Eymerich," ed. and trans. Sylvain Matton, *Chrysopoeia* 1 (1987): 93–136. On the *quaestio de alchimia,* see Chiara Crisciani, "La 'questio de alchimia' fra Duecento e Trecento," *Medioevo* 2 (1976): 119–168; Barbara Obrist, "Die Alchemie in der mittelalterlichen Gesellschaft," in *Die Alchemie in der europäischen Kultur und Wissenschaftsgeschichte,* ed. Christoph Meinel (Wiesbaden: Harrassowitz, 1986), pp. 33–60; William Newman, "Technology and Alchemical Debate in the Late Middle Ages," *Isis* 80 (1989): 423–445.

22. The *quaestio* format would still be used later—for instance, by Benedetto Varchi, *Sulla verità, o falsità dell'archimia, questione,* ed. Domenico Moreni (Florence, 1827); see Alfredo Perifano, "Benedetto Varchi et l'alchimie," *Chrysopoeia* 1 (1987): 181–208.

23. Thaemo Judeus, *Quaestiones in quattuor libros Metheororum,* ed. George Lockert (Paris, 1515–1518), fols. CCIva–CCIIIra. Pomponazzi's *quaestio* is transmitted by three *reportationes:* Paris, Bibliothèque Nationale, MS lat. 6535, fols. 334r–350r; Osimo, Biblioteca del Collegio Campana, MS 45, fols. 122r–126r; and in his commentary on Aristotle, *Meteora,* in Milan, Biblioteca Ambrosiana, MS lat. R 96 sup., fols. 162r–241v, which I have not been able to consult. The last of these manuscripts has recently been edited. See Paola Zambelli, "Pomponazzi sull'alchimia: da Ermete a Paracelso?" in *Studi filologici e letterari in memoria di Danilo Aguzzi-Barbagli,* ed. Caniela Boccassini, Filibrary series, no. 13 (Stony Brook, N.Y.: Forum Italicum, 1997), pp. 100–122. See Bruno Nardi, *Studi su Pietro Pomponazzi* (Florence: Le Monnier, 1965), esp. pp. 79–84; Franco Graiff, "I prodigi e l'astrologia nei commenti di Pietro Pomponazzi al 'De caelo,' alla 'Meteora' e al 'De

generation,'" *Medioevo* 2 (1976): 331–361; and Amalia Perfetti, "Aristotélisme et alchimie dans l'anonyme 'Trilogio della trasmutatione dei metalli,'" in Margolin and Matton, *Alchimie et philosophie,* pp. 223–251.

24. See Crisciani, "La 'quaestio de alchimia'" and "Il corpo nella tradizione alchemica"; Newman, "Technology and Alchemical Debate"; Barbara Obrist, "Art et nature dans l'alchimie médiévale," *Revue d'histoire des sciences* 49.2–3 (1996): 215–286; Michela Pereira, "L'elixir alchemico fra 'artificium' e natura," in *Artificialia,* ed. Massimo Negrotti (Bologna: CLUEB, 1995), pp. 255–267.

25. *De lapide,* fol. 247r–v. Fire as light, flame, and glowing coal is introduced by Aristotle merely as an example of a possibly misleading attribution of species in *Topics* 5.5, 134b–135a. These three forms of "fire" appear later (with the correct reference to Aristotle) in Alexander Neckam, *De naturis rerum libri duo,* ed. Thomas Wright (London, 1863; reprint, Nendeln/Lichtenstein: Kraus Reprint, 1967), 1.17, "De igne," p. 57; they are also present in Bartholomaeus Anglicus, *De proprietatibus rerum* book 10, "De igne et eius proprietatibus" (chap. 4, "De igne"; chap. 5, "de flamma"; chap. 7, "de carbone"—I thank Jole Agrimi for this reference) and in Berthold Blumentrost, *Questiones disputatae circa tractatum Avicennae de generatione embryonis et librum meteorum Aristotelis,* ed. Rüdiger Krist, Würzburger medizinhistorische Forschungen 43 (Pattensen: Horst Wellm, 1987), p. 59; A very similar exemplum, based on the *ignea lux* that could be both *in carbo* and *in flamma,* is used by John of La Rochelle to explain the link between the rational soul and the body and the threefold nature of the soul; see Jean de la Rochelle, *Summa de Anima,* ed. Jacques Guy Bougerol (Paris: Librairie Philosophique J. Vrin, 1995), prima consideracio, VI (40), "De anima quantum ad corpus," pp. 125–130, esp. p. 127 (I owe this reference to Michela Pereira). However, John does not go on to develop the analogy between the threefold fiery soul and the Trinity.

26. For a survey of these moral qualities, see Chiara Crisciani, "Aspetti della trasmissione del sapere nell'alchimia latina: Un'immagine di formazione; uno stile di commento," *Micrologus* 3 (1995): esp. 158–162.

27. *De lapide,* fol. 249r. After having quoted the initial paragraph of *Tractatus aureus* ("Cum tanta etatis prolixitate experiri non desisterem . . . "), Fabri interprets it as follows: "In istis verbis Hermes unum deum confitetur et liberum arbitrium et diem judicii, resurrectionem et fidem."

28. *De lapide,* fol. 252v; see Bonus, *Pretiosa margarita,* p. 29A: "ipsa (alchimia) partim est naturalis et partim divina sive supra naturam."

29. *De lapide,* fol. 249r: "Venit [Deus] igitur multiplice prece placandus, ut apperiat artifici typos, figuras et analogias vatum et prophetarum antiquorum et ut auxilietur artificem in operatione sua." Besides Bonus, another outstanding interpretation of prophecies in alchemical terms is to be found in ps.-Arnald of Villanova, *Exempla in arte philosophorum.* See now the edition of Antoine Calvet, "Le 'tractatus parabolicus' du pseudo-Arnaud de Villeneuve," *Chrysopoeia* 5 (1992–1996): 145–47. See also Barbara Obrist, "Le rapport d'analogie entre philosophie et alchimie médiévales," in Margolin and Matton, *Alchimie et philosophie,* esp. pp. 56–64.

30. *De lapide,* fol. 249v: one of these cases (the philosopher who prefers to bite his own tongue rather than reveal the alchemical secret) is clearly a "modern" adaptation of

the political resistance of Zeno of Elea described by Diogenes Laertius, *De vitis philosophorum . . . libri decem* 10.5, 25–29.

31. See, among others, ps.-Albertus, *Libellus de alchimia,* in his *Opera omnia,* ed. Jammy, 21:3–4.

32. See John of Rupescissa, *De consideratione,* esp. the prologue; see also his *Liber lucis,* chap. 1, in Manget, *Bibliotheca Chemica Curiosa,* 2:84A. The cruel attitude of the oppressive tyrant against the brave, honest alchemist is also outlined in Thomas Norton, *Ordinall* (second half of fifteenth century), especially in the second part, where the virtuous deeds of the alchemist Thomas Daulton are told. He, although imprisoned, condemned, and hard-pressed by the king and other powerful personages, firmly kept secret the *magisterium* (in Manget, 2:293–294).

33. *De lapide,* fol. 249v: "Non debet igitur cogi philosophus directe vel indirecte nec male tractari, sed multipliciter honorari et verbis et factis dulciter attrahi."

34. *De lapide,* fol. 250r: "Et hic est verus modus inquirendi veritatem rerum, primo per theoricam cum vera doctrina philosophie, et non casualiter sicut empirici deceptores, vagi, omni prorsus lumine destituti vere theorice."

35. See Michela Pereira, *The Alchemical Corpus Attributed to Raymond Lull* (London: Warburg Institute, University of London, 1989): on the relevance of Fabri's contribution to the legend she notes, "Fabri is the first writer, so far as I know, to bring together the two parts of the legend—Arnald and the visit to England" (p. 43).

36. Fabri mentions Dastin, although he never quotes from his works; he uses both ps.-Lull, *Testamentum,* and Arnald (*De vinis, De sigillis*), and he explicitly attributes to the latter the *De retardatione,* usually ascribed to Roger Bacon. Note that Fabri changes the title of the Arnaldian medical work "De vinis" into "De vinis seu elixir," thus clearly showing that in his own view, this text deals mainly with alchemy.

37. *De lapide,* fol. 249v: "Quot labores sumpserit rex Anglie Odoardus, qui in habitu heremite pro hac arte circuivit orbem terrarum"; cf. *Visio Edwardi,* edited in Pascale Barthélemy and Didier Kahn, "Les voyages d'une allégorie alchimique: De la 'Visio Edwardi' à l' 'Oeuvre royale de Charles VI,'" in *Comprendre et maîtriser la nature au Moyen Age: Mélanges d'histoire des sciences offerts à Guy Beaujouan* (Geneva: Droz, 1994), p. 519: "Circuivi ego mundum ad ipsum inveniendum. . . . " The editors point out (pp. 495–496) that a version of the *Visio* with a prologue (in which Edward is represented as king, philosopher, and hermit) did indeed appear in the fifteenth century, when the legend of Lull in England also spread. The *Visio* and Fabri's *De lapide* are literally linked at least as regards the image of the king-hermit wandering in search of alchemy.

38. *De lapide,* fol. 249r: "Et utinam posses experimento rem sic probare uti probasti perypateticorum clarissima ratione. . . . Cui demum dixi philosophum contentari sola veritatis inquisitione indeque secutum est silentium et sic finis, pro tunc."

39. *De lapide,* fol. 253v; see Pereira, *L'oro dei filosofi,* esp. chap. 4.

40. *De lapide,* fol. 250v: "non ut es vestrum effundatis in experientia tantorum secretorum, sed ut videatis possibilitatem rei maxime fundatam in principiis nature."

41. See *De lapide,* for instance at fol. 247r, where some *experimenta* concerning heat and fire are mentioned; see above, note 7.

42. *De lapide,* fol. 251r: of the therapeutic virtues of gold Fabri, following Avicenna, maintains that in many cases "redducimus nos ad experimentum, cum magis conferat medico de talibus experiri quam ratiocinari"; fol. 252r: "Quibus omnibus contemplatis descendi ad experimenta et vidi aurum operari in corpore humano talia que si scriberem crederentur impossibilia."

43. *De lapide,* fol. 252r–v. In the thirteenth and fourteenth centuries, the possible link between alchemy and magic was addressed—either to deny or maintain it—in some texts by jurists evaluating the legitimacy of alchemy, in several decrees of religious orders prohibiting their members from its study and practice, and by some theologians (e.g., Thomas Aquinas and Giles of Rome). The link was strongly asserted by the inquisitor Eymeric, who accused all alchemists of making a pact with the Devil. See William Newman, introduction to *The "Summa perfectionis" of Pseudo-Geber,* ed. Newman (Leiden: Brill, 1991), pp. 30–40; Chiara Crisciani and Michela Pereira, *L'arte del sole e della luna: Alchimia e filosofia nel medioevo* (Spoleto: Centro Italiano di Studi sull' Alto Medioevo, 1996), pp. 45–53.

44. *De lapide,* fol. 252v: the forbidden goals are "fortuna et impedimentum, substantia et negotiatio, principatus et prelatio, coniunctio et separatio"; cf. Albertus Magnus, *Speculum astronomiae,* ed. Stefano Caroti, Michela Pereira, and Stefano Zamponi, under the direction of Paola Zambelli (Pisa: Domus Galilaeana, 1977), p. 33. This edition has been reproduced: see Paola Zambelli, *The "Speculum astronomiae" and Its Enigma: Astrology, Theology, and Science in Albertus Magnus and His Contemporaries,* Boston Studies in the Philosophy of Science 135 (Dordrecht: Kluwer, 1992).

45. *De lapide,* fol. 252v. Fabri here is commenting on the proem of "Bacon," *De retardatione,* p. 1, taken by him to be by Arnald; in quoting the passage, he radically alters its meaning: instead of "et inveni ibi vanitatem et temporis perditionem," he quotes and comments "et inveni veritatem quia per artem alkimie inveni yxir." Once more, he is thus endorsing the image of Arnald as an alchemist.

46. Even if we consider only Italian culture, it will suffice to mention the works of Augurelli, Bracesco, Quattrami, Percolla, Nazari. On alchemy and mythology, see H. J. Sheppard, "The Mythological Tradition and Seventeenth-Century Alchemy," in *Science, Medicine, and Society in the Renaissance: Essays to Honor Walter Pagel,* ed. Allen G. Debus (New York: Science History Publications, 1972), 1:47–59; François Secret, "Mythologie et alchimie à la Renaissance," in his "Notes sur quelques alchimistes italiens de la Renaissance," *Rinascimento,* 2nd ser., 13 (1973): 203–206; Joachim Telle, "Mythologie und Alchemie: Zum Fortleben der Antiken Götter in der frühneuzeitlichen Alchemieliteratur," in *Humanismus und Naturwissenschaften,* ed. Rudolf Schmitz and Fritz Krafft (Boppard: Boldt, 1980), pp. 135–154.

47. Petrus Bonus (first half of the fourteenth century) was perhaps one of the first authors who, in his coherent image of alchemy as both *scientia* and *donum Dei,* stressed its rational as well as its religious features and pointed out its links with prophecy, mythology, and poetry. See, for instance, *Pretiosa margarita,* pp. 29–30, 34, 42, and the titles of some

chapters— e.g., 6: " . . . quod haec Ars sit naturalis et sit divina, et quod per ipsam philosophi antiqui fuerunt vates de futuris miraculis divinis"; 9: "In quo ostendit . . . quod Philosophi hujus scientiae tetigerunt eam cum omnibus aliis scientiis." See Chiara Crisciani, "The Conception of Alchemy as Expressed in the 'Pretiosa Margarita Novella' of Petrus Bonus of Ferrara," *Ambix* 20 (1973): 165–181; Obrist, "Le rapports d'analogie." Although Fabri never refers explicitly to Bonus, it seems plausible to me that he knew *Pretiosa margarita.*

48. See Bonus, *Pretiosa margarita,* p. 4B: "cum ipsa (alchimia) omnes artes et scientias ad se trahat, et immisceat se eis"; p. 34A: "ita quod scientia ista nihil dimisit, quin a se detraheret, et sibi componeret."

49. That Fabri is here extolling, not explaining, the *lapis* was evidently clearly perceived by the pope, whom the text at this point represents as firmly interrupting the author's praises with "Satis est, de laudibus eius est superius" (fol. 253r).

50. See Getz, "To Prolong Life and Promote Health"; Pereira, " 'Mater medicinarum.'"

51. Michele Savonarola, *I trattati in volgare della peste e dell'acqua ardente,* ed. Luigi Belloni (Pel 59 Congresso nazionale della Società italiana di medicina interna, Roma, 12–14 ottobre 1953; Milan, 1953); see Jacquart, "Médecine et alchimie," and the article of Katharine Park in this volume.

52. Savonarola, *Trattati,* pp. 75, 80, 88.

53. Antonio Guaineri, *Opus preclarum ad praxim* (Pavia, 1518), fols. 219vb; see also fols. 28ra–b, 218–220, 238r, and above, note 3.

54. Karl Sudhoff, ed., "Eine Herstellungseinweisung für 'Aurum potabile' und 'Quinta essentia' von dem herzoglichen Leibartze Albini di Moncalieri (14. Jahrhundert)," *Archiv für die Geschichte der Naturwissenschaften und der Technik* 5 (1914): 198–201. Bologna, Biblioteca Universitaria (Fondo Caprara), MS lat. 104, the codex containing Fabri's *De lapide,* also contains three other texts, each different in scope and style, focused on potable gold, of which Albini's recipe (fol. 310r) is one. Besides the long treatise (fols. 271r–283v) of the *Solemnis medicus,* there is also a *Practica de auro potabili* (fols. 254r–255v), composed of a collection of short recipes plus one excerpt from ps.-Lull, *Liber Mercuriorum.* It is clear that the collector of these texts was very interested in this old remedy (the therapeutic virtues of gold were well known and easily to be found in practical medical texts), which came to be of outstanding importance precisely during the fifteenth century, perhaps because it was undergoing a new alchemical characterization and preparation: see Crisciani and Pereira, "Black Death and Golden Remedies," and Chiara Crisciani, "Oro potabile fra alchemia e medicina: due testi di peste," in *Atti del VII Convegno Nazionale di Storia e Fondamenti della Chimica, 1997,* published as *Rendiconti dell'Accademia Nazionale delle Scienze detta dei XL,* 21,2 (1997): pp. 83–93.

55. The reference is, of course, to the famous image, engraved by Hans Vredemann de Vries and inserted in Heinrich Khunrath, *Amphitheatrum sapientiae aeternae* (Hanover, 1609). The picture shows the adept working and praying in a dual purpose room: his laboratorium/oratorium.

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The Homunculus and His Forebears: Wonders of Art and Nature

William Newman

Homunculi Duo

The intrepid reader of the *Chymical Wedding of Christian Rosencreutz* (1616) will encounter the following bizarre sequence of events. The hero of the romance, Rosencreutz, receives an anonymous invitation to the mysterious wedding of a king and queen, delivered to him by a beautiful, winged lady. After seeing a castle with invisible servants; a mysterious play featuring lions, unicorns, and doves; and a roomful of wondrous self-moving images, Rosencreutz finally meets the bride and groom. At the end of a sumptuous dinner accompanied by an elaborate comedy, the joyful couple, along with their royal retinue, are abruptly beheaded by a "very *cole-black* tall man."[1] After their blood is carefully collected, the bodies are then dissolved into another red liquor by Rosencreutz and a group of fellow alchemists. These laborants summarily congeal the fluid in a hollow globe, whereon it becomes an egg. The alchemists then incubate the egg, which hatches a savage black bird: the bird is fed the previously collected blood of the beheaded, whereupon it molts and turns white, and then iridescent. After a series of further operations, the bird, now grown too gentle for its own good, is itself deprived of its head and burned to ashes.[2]

This panoply of processes is an obvious recitation of the traditional regimens or color stages that were supposed to lead to the agent of metallic transmutation, the philosophers' stone.[3] Indeed, the philosophers' stone was often described as the end result of processes figuratively pictured in terms of copulating kings and queens who are murdered and reborn. But in the end, the bodies of *this* bride and groom are reassembled out of the ashes of the unfortunate bird by placing the moistened mass into two little molds. As they are heated, there appear "two beautiful bright and almost *Transparent little* Images . . . a Male and a Female, each of them only *four* inches long," which are then infused with life. These are identified in the margin as *Homunculi duo*.[4] The reader, having expected the end result to be the philosophers' stone, may be somewhat surprised at the outcome. This at least was the reaction

of the alchemists who were employed at the court of the decapitated couple, for Rosencreutz informs us that they imagined the process to have been carried out "for the sake of *Gold,*" adding that "to *work in Gold* . . . is indeed a piece also of this art, but not the most *Principal,* most necessary, and best."[5] In short, according to the *Chymical Wedding of Christian Rosencreutz,* the real goal of alchemy is the artificial generation of human beings, and the manufacture of precious metals only a byline.

The author of the *Chymical Wedding* was Johann Valentin Andreae (1586–1654), a well-known Lutheran theologian and the composer of the utopian *Christianopolis*.[6] Perhaps it is unnecessary to say that for Andreae, the production of homunculi is largely an allegory of spiritual regeneration with the aim of charming the reader rather than teaching him to be a Frankenstein.[7] Andreae's reorientation of alchemy to the spiritual rebirth of man has a history as long and devious as the operations described by Rosencreutz. But even more tortuous is the path by which the homunculus reached Andreae, as there is nothing in the *Chymical Wedding* to suggest its origin. For Andreae's homunculus was born, oddly, from the confluence of two distinct traditions within the occult sciences; one of them a practical genre devoted to the artificial production of living beings, the other an apologetic literature whose goal was the defense of alchemy against its detractors. As I shall show, Andreae's source, Paracelsus von Hohenheim (1493–1541) and his followers, had already performed this fusion of traditions. Indeed, it is Paracelsus who made the generation of the *homunculus,* or artificial human, a theme sufficiently dear to Western civilization that Goethe's Faust carries one on his shoulder for much of *Faust* part 2. The following paper will have as its telos the analysis of Paracelsus' homuncular ruminations; but in order to achieve that end, we must first review the relation of Paracelsianism to late medieval alchemy.

Anyone who compares the alchemical writings of the thirteenth century, when the discipline was first being appropriated by the medieval West, with the output of Paracelsus and his followers will be struck by the vastly greater scope that the iatrochemists envision for their alchemy. The Paracelsian three principles—mercury, sulfur, and salt—are no longer simply the ingredients of metals and some minerals, as were the older mercury and sulfur inherited from the Arabs. Instead, the Paracelsians argue that they have discovered the components of the entire globe and its contents, even asserting that the heavens themselves are made up of their three principles.[8] A similar expansion of scope may be seen in the Paracelsians' claims for the medical role of the chemical art. The alchemy of Geber or Albertus Magnus limited itself to the replication and study of inanimate objects, while the expanded discipline of Paracelsus was above all a medical application of alchemical

techniques, as well as a veritable chemical physiology, which used alchemy to explain a host of vital processes. Although Paracelsus was heavily indebted to earlier medical alchemists such as John of Rupescissa and pseudo-Lull, it is fair to say that there is nothing so comprehensive as his cosmological iatrochemistry in the Middle Ages.[9]

In this paper I shall argue that a similar expansion took place in Paracelsus' view of the power of alchemy to replicate natural products, leading him and his followers to the position that human creative power was practically unlimited. The homunculus, as artificial human, was the crowning piece of human creative power, making its artificer a sort of demiurge on the level of a lesser god. It has long been acknowledged that the Renaissance tradition of natural magic promoted a view of "man the maker"; but as I shall also show, the use of the homunculus as a marvel of human art has its origin in a medieval debate focusing strictly on alchemy rather than magic, and this debate predates the Renaissance by several centuries.[10] Finally, I shall describe the sexual and religious ambiguities that the homunculus presented to Paracelsus, for these cast an oblique light on his mental landscape that throws several features into sharp relief. But before discussing these issues, we must first examine the philosophical background to Paracelsus' discussion of human creative power.

I. THE POWERS OF ART

It is a well-known feature of Aristotelian natural philosophy that the Stagirite made a point of distinguishing between natural and artificial products. In the *Physics* (2.1, 192b28–33) Aristotle distinguishes between a natural and artificial product by pointing out that the former will have "within itself the principle of its own making" (τὴν ἀρχὴν ἐν ἑαυτῷ τῆς ποιήσεως), whereas in the case of the latter, this principle resides "in some external agent" (ἐν ἄλλοις καὶ ἔξωθεν).[11] Whereas a seed naturally develops into a tree, a piece of wood does not naturally grow into a house. The artificial product requires a carpenter, who acts as the "external agent" by building the house out of wood. Hence natural and artificial products are essentially different. Nonetheless, Aristotle allows in the *Physics* (2.8, 199a16) that "the arts either, on the basis of Nature, carry things further than Nature can, or they imitate Nature" (ὅλως τε ἡ τέχνη τὰ μὲν ἐπιτελεῖ ἃ ἡ φύσις ἀδυνατεῖ ἀπεργάσασθαι, τὰ δὲ μιμεῖται), thus opening up an avenue for the argument that art can improve on nature.[12]

As I have documented elsewhere, the Latin alchemy of the Middle Ages began a sustained effort to erode the traditional Aristotelian dichotomy

between natural and artificial products by building on Aristotle's admission that art can improve on nature.[13] This movement led numerous alchemists to a position that is strikingly prescient of the parallel claim made in Francis Bacon's *Descriptio globi intellectualis* four centuries later; the works of art and nature diverge "not in form or essence, but only in the efficient."[14] The theme had already become a *quaestio disputata* in alchemical writings of the High and late Middle Ages, reacting to the *De congelatione et conglutinatione* of the Persian philosopher Avicenna (980–1037), a section of Avicenna's *Kitāb al-shifā'* that was misleadingly attached to Aristotle's *Meteors* by Alfred of Sareshel at the beginning of the thirteenth century.[15] Involuntarily under the pseudonym of Aristotle, Avicenna there debunked alchemy by claiming generally that "art is inferior to nature, and cannot equal it, however much it may strive."[16] It is therefore imperative to realize that the Avicennian attack on alchemy is embedded in a strongly worded ne plus ultra concerning technology as a whole. As such, it became a locus classicus for the discussion of human art in a variety of realms, and remained so even in the seventeenth century.[17]

Whatever Avicenna may have said about human art in his other works, his position in the *De congelatione* was far more forceful than any taken by the Stagirite himself. Avicenna's attack, which terminates with the phrase "sciant artifices alkimie species metallorum non posse transmutari," came to be known in Latin simply by the incipit *sciant artifices*. The *sciant artifices* was a challenge to alchemy that could not be ignored: it was thus taken up by the army of subsequent alchemists and rebutted in many an alchemical *Theorica*. Let us consider one such example.

An influential *Book of Hermes* that was circulating already in the thirteenth century is organized around a succession of attacks on alchemy and their subsequent rebuttals.[18] One of these attacks takes up the cudgels of Avicenna, saying "Metallic bodies, inasmuch as they are works of nature, are natural, but human works are artificial, and not natural."[19]

The opponent of alchemy here merely states the distinction between natural works and human works: the implication, obviously, is that these are two radically different realms that cannot lead to the same products. "Hermes" replies with the following rebuttal:

> But human works are variously the same as natural ones, as we shall show in fire, air, water, earth, minerals, trees, and animals. For the fire of natural lightning and the fire thrown forth by a stone is the same fire. The natural ambient air and the artificial air produced by boiling are both air. The natural earth beneath our feet and the artificial earth produced by letting

> water sit are both earth. Green salt, vitriol, tutia, and sal ammoniac are both artificial and natural. But the artificial are *even better than the natural,* which anyone who knows about minerals does not contradict. The natural wild tree and the artificially grafted one are both trees. Natural bees and artificial bees generated from a decomposing bull are both bees. Nor does art do all these things; rather it helps nature to do them. Therefore the assistance of this art does not alter the natures of things. Hence the works of man can be both natural *with regard to essence* and artificial *with regard to mode of production.*[20] (my emphases)

The response of Hermes begins with a set of empirical examples provided by the four elements; fire, air, water, and earth. The author wants to show that man can produce "artificial elements" that are fully identical to the naturally occurring forms. In like fashion he can make artificial forms of "green salt" (perhaps verdigris—copper acetate), vitriol (copper or iron sulfate), tutia (zinc carbonate), and sal ammoniac (ammonium chloride). These artificially produced minerals will not be simply equivalent to their natural counterparts—they will be better. Finally, new types of trees produced by grafting and bees "spontaneously produced" out of dead livestock are identical to their natural exemplars. Hermes concludes from this barrage of empirical evidence that art makes these multifarious products only by aiding nature. In a line that is astonishingly close to the viewpoint of Bacon, Hermes says that human works and natural works are identical as to essence (*secundum essentiam*), even if they differ according to their means of production (*secundum artificium*). This is effectively identical to Bacon's claim that the works of art and nature diverge "not in form or essence, but only in the efficient."

What is of particular significance at present is Hermes' insistence on the alchemist's ability to replicate not only inanimate matter but also lower life-forms. Playing on the common belief that one could generate bees spontaneously merely by causing a cow's body to rot, Hermes claims that this provides yet another instance of man acting as the efficient cause to nature. The same idea occurs in the classic text of alchemy from the High Middle Ages, the *Summa perfectionis* of "Geber."[21] Here the author rebuts an anti-alchemical argument which claims that the art cannot succeed because it is dependent on the action of stars and planets whose exact positions cannot be determined by the inaccurate science of astrology.[22] To this Geber replies, "we see, when we want to lead a worm into being from a dog, or other putrescible animal, [that] we do not consider immediately the position of the stars, but rather the disposition of the ambient air, and other perfective causes of putrefaction other than that."[23] Like Hermes, Geber gives the alchemist an

active role in generating insects from a rotting corpse, for he considers "the disposition of the ambient air." This is yet another instance of the power of human art. And like Hermes, Geber is intent on limiting this power to the production of lower life-forms. At another point the *Summa* even explicitly denies the ability of man to infuse a soul into matter.[24]

The position of "Hermes" and "Geber" was the one adopted by the majority of Latin alchemists in the Middle Ages. The alchemists make few references to attempts to produce what we would call "vertebrate" life-forms; and when these do occur, they are usually portrayed in negative terms. A good example of this tendency may be seen in the fourteenth-century *De essentiis essentiarum* spuriously ascribed to Thomas Aquinas. The pseudonymous author reports an attempt made by Rāzī to create an artificial human being in a vessel, but he notes that even if this could happen, the creature would still probably lack a rational soul.[25] Let us therefore pass to a later thinker who seems to have harbored no such doubts.

II. PARACELSUS AND ARTIFICIAL LIFE

In 1572 the iatrochemical physician Adam von Bodenstein published a work supposedly written in 1537 by Paracelsus. This *De natura rerum,* which may be a reworking of a genuine Paracelsian text,[26] opens with a discussion of the art/nature dichotomy:

> The generation of all natural things is of two sorts, as [there is] one which happens by means of nature alone without any art, [while] the other happens by means of art—namely alchemy. In general, however, one could say that all things are born from the earth by means of putrefaction. For putrefaction is the highest step, and the first beginning of generation, and putrefaction takes its origin and beginning from a moist warmth. For the continual moist warmth brings about putrefaction and transmutes all natural things from their first form and essence, as also their powers and virtues. For just as the putrefaction in the stomach turns all food to dung and transmutes it, so also the putrefaction that occurs outside the stomach in a glass [i.e., a flask] transmutes all things from one form into another.[27]

The *De natura rerum* immediately places itself in the context of the alchemical debate about the artificial and the natural by asserting that the generation of all natural things occurs in two ways—either by means of nature without art or with the aid of art, that is, the art of alchemy. Although the author is not overly concerned with philosophical niceties, he at once assimilates natural and artificial generations in saying that both come from "the

earth" by means of warm, moist putrefaction. Thus the putrefaction that occurs in the stomach is not essentially different from that which occurs in a glass vessel: as pseudo-Hermes asserted, they differ only *secundum artificium*.

After a few words on the wonders of putrefaction, which allows one thing to be transmuted into another, the *De natura rerum* extends the foregoing logic to a discussion of eggs. In incubating her egg, the hen merely supplies the necessary heat for the "mucilaginous phlegm" (*mucilaginische phlegma*) within to rot and, in so doing, to become the living matter that will develop into a chick.[28] The key agent, once again, is putrefaction. But as is well known, this incubation and ensuing putrefaction can be performed artificially by means of warm ashes, without the brooding hen. More than this, if a living bird be burned to powder and ashes in a sealed vessel, and its remains left to rot into mucilaginous phlegm in "a horse's womb" (*venter equinus*—a technical term for hot, decaying dung), the same phlegm may again be incubated, to produce "a renovated and restored bird" (*ein renovirter und restaurirter vogel*). In this fashion, all birds may be killed and reborn, so that the alchemist becomes a sort of little god who brings about a miniature conflagration complete with a "rebirth and clarification" (*widergeburt und clarificirung*) of matter like that which will accompany the Last Judgment. This clarification of matter by the fire of the Day of Judgment is one of Paracelsus' habitual themes; he expounds it at length in his late *Astronomia magna,* the definitive statement of his philosophy.[29] We shall soon encounter another example of such quasi-incorporeal matter, though one that is clarified by a different means. The *De natura rerum* goes on to announce that the death and rebirth of birds forms "the highest and greatest *magnale* and mystery of God, the highest secret and wonderwork."[30]

Despite this categorical statement, the *De natura rerum* has even greater marvels to offer, as the author then says: "You must also know that men too may be born without natural fathers and mothers. That is, they are not born from the female body in natural fashion as other children are born, but a man may be born and raised by means of art and by the skill of an experienced spagyrist, as is shown hereafter."[31] Having introduced the homunculus, the text then digresses to discuss the unnatural union of man with animals, which can also produce offspring, though "not without heresy" (*so mag solches on kezerei nicht wol geschehen*). Still, one should not automatically treat a woman who gives birth to an animal as a heretic, "as if she has acted against nature" (*als ob sie wider die natur gehandelt hette*), for the monstrous offspring may only be a product of her disordered imagination.

Animals too can produce monsters, when their offspring do not belong to the same race as the parents. But the author of *De natura rerum* is more

interested in the case of monsters which "are brought to pass by art, in a glass" (*durch kunst darzu gebracht werden in einem glas*). A good example of such artificial monsters is the basilisk, which is made from menstrual blood sealed up in a flask and subjected to the heat of the "horse's womb."[32] The basilisk is "a monster above all monsters" (*ein monstrum uber alle monstra*) for it can kill by its glance alone. Being made from menstrual blood, it is like a menstruating woman, "who also has a hidden poison in her eyes" (*die auch ein verborgenen gift in augen hat*) and can ruin mirrors and make wounds impossible to heal with her glance, or spoil wine with her breath. But the poison of the basilisk is much stronger than that of the woman per se, because it is the living and undiluted embodiment of her poisonous excrescence:

> Now I return to my subject, to explain why and for what reason the basilisk has the poison in its glance and eyes. It must be known, then, that it has such a characteristic and origin from impure [i.e, menstruating] women, as was said above. For the basilisk grows and is born out of and from the greatest impurity of women, from the menses and the blood of the sperm.[33]

One could therefore say that for the author of the *De natura rerum,* the basilisk is the epitome of the female itself, a valuation that does not seem to contradict the undisputed corpus of Paracelsus.[34]

Soon after this memorable account, the *De natura rerum* arrives at a lengthy description of the homunculus and its mode of generation. Coming directly after the discussion of the basilisk, which was made by a sort of artificial parthenogenesis, the homunculus seems to be its masculine twin. Just as the basilisk embodied the quintessence of feminine impurity, so the homunculus, created without any feminine matter, will serve as a magnification of the intellectual and heroic virtues of masculinity. But first let us relate its mode of production:

> We must now by no means forget the generation of homunculi. For there is something to it, although it has been kept in great secrecy and kept hidden up to now, and there was not a little doubt and question among the old philosophers, whether it even be possible to nature and art that a man can be born outside the female body and [without] a natural mother. I give this answer—that it is by no means opposed to the spagyric art and to nature, but that it is indeed possible. But how this should happen and proceed—its process is thus—that the sperm of a man be putrefied by itself in a sealed cucurbit for forty days with the highest degree of putrefaction in a horse's womb, or at least so long that it comes to life and moves itself, and stirs, which is easily observed. After this time, it will look somewhat like a

> man, but transparent, without a body. If, after this, it be fed wisely with the arcanum of human blood, and be nourished for up to forty weeks, and be kept in the even heat of the horse's womb, a living human child grows therefrom, with all its members like another child, which is born of a woman, but much smaller.[35]

As we can see, the author of the *De natura rerum* introduces his homunculus within the framework of the traditional question of the limits of human art. Unlike the timid philosophers of old, the author says, he is willing to affirm the powers of human art in making a test-tube baby. And doubly marvelous will this creature be, having grown out of sperm alone, unpolluted by the poisonous matrix from which the basilisk took its origin. Because of its freedom from the gross materiality of the female, the homunculus is translucent and, as it were, bodiless. Like the "clarified" birds produced by alchemical techniques, the homunculus is almost incorporeal. Hence the author can use the homunculus as yet another excuse to vaunt the powers of human art, which he immediately sets out to do. The *De natura rerum* announces that from such homunculi, if they reach adulthood, arise further marvelous beings, such as giants and dwarves. These creatures have wonderful strength and powers, such as the ability to defeat their enemies with "great, forceful victory" (*grossen, gewaltigen sig*) and to know "all hidden and secret things" (*alle heimlichen und verborgne ding*). Why are they so gifted? Because "they receive their life from art, through art they receive their body, flesh, bone, and blood. Through art they are born, and therefore art is embodied and inborn in them, and they need learn it from no one."[36]

The reasoning here is straightforward. Because the homunculus is a product of art, in its mature state it has an automatic and intimate acquaintance *with* the arts, and consequently knows "all secret and hidden things." Hence the homunculus is not merely an artificial marvel in itself but a key to further marvels. It is the final expression of man's power over nature, as the author says, "a miracle . . . and a secret above all secrets."[37]

The *De natura rerum* and Earlier Tradition

At this point, it is fair to ask whether the composer of the *De natura rerum* has created this fantasy out of whole cloth or has drawn from earlier sources. As I have shown, the context of the *De natura rerum* is largely determined by the question of artificial and natural products. We have also seen that the creation of lower forms of animal made up one part of that debate, as in the *Book of Hermes* and the *Summa perfectionis* of "Geber." But the *De natura rerum* has gone far beyond those texts in its detailed and extravagant descriptions of

artificial generation. Where is the author getting this material? Let us first consider the argument made by Gershom Scholem and affirmed by Walter Pagel that the homunculus finds its roots in medieval legends of the Jewish *golem*.[38] The golem was an artificial man created out of "virgin earth" by means of Cabalistic rituals involving Hebrew letters. As Moshe Idel has argued, however, there is little or no evidence that the golem was to be made of human sperm or sealed up in a flask.[39] For the origins of the homunculus we should seek a more proximate source.

In fact, the source of the *De natura rerum*'s homunculus can be found mainly in medieval Arabic literature on the generation of artificial animals, a tradition already described in Paul Kraus's famous book on Jābir ibn Ḥayyān, published in 1942. The corpus ascribed to the eighth-century Persian sage Jābir ibn Ḥayyān comprises over two thousand works, which were mostly written in the ninth and tenth centuries. Most of these works deal with alchemy and natural magic, and in them one finds instructions for the making of artificial humans. Jābir's *Kitāb al-tajmīʿ*, for example, advises that one take an undefined "element," "matter," "essence," "body," or "sperm" and seal it up in a mold with detachable parts.[40] One then inserts this into a perforated vessel, which is heated in a water bath to putrefy. By varying the shape of the mold, one can produce any sort of being, such as a young girl with a boy's face, or an adolescent with the intelligence of a man.[41]

Despite the similarity of Jābir's recipe to that of the *De natura rerum,* I have been unable to find any direct line of transmission from the Arabic of Jābir to our putative Swiss magus. But in the course of his description, Jābir mentions another tradition, attributed to Plato, which the Persian alchemist disavows.[42] I refer to the *Kitāb al-nawāmīs,* or *Book of Laws,* of pseudo-Plato, a work that was already known in Latin by the thirteenth-century bishop of Paris, William of Auvergne. William refers to this work as the *Liber neumich,* a corruption of the Arabic *nawāmīs,* but it is also called the *Liber vaccae* in honor of its first victim, a cow.[43] It is not unlikely that the author of the *De natura rerum* too may have known the *Liber vaccae,* and its bizarre prescriptions may be one source for his homunculus recipe.

Pseudo-Plato begins his book with directions for making a "rational animal," which I shall synopsize as follows: "Whoever wishes to make a rational animal should take his own water while warm, and let him mix (*conficiat*) it with an equal measure of the stone that is called stone of the sun. This is a stone that shines at night like a lamp until the place in which it is found is illuminated."[44] Then one must take a cow or ewe. Its vulva is cleansed with medicines and its womb made capable of receiving what is put therein. If a cow is used, the blood of a ewe is put on its vulva; if a ewe, the contrary. The

orifice is then plugged with the stone of the sun. After this, the animal is put in a dark house, and every week it is given a pound of the other animal's blood to eat. One must then take some sunstone, as much sulfur, as much magnet, and as much green tuthia. One should grind them, mix with willow sap, and dry in the shadows. When the cow or sheep gives birth, one must "take that form and put it in that powder. For it will at once be clothed in human skin."[45] Then that form should be put "into a great glass or lead vessel." After three days it will be hungry and will move about. "Therefore feed it from that blood which has gone forth from the mother" for seven days. Then "the animal form which is agreeable to many miracles will be finished."[46] It can be used to change the progress of the moon, or to change one into a cow or sheep. "And if you take this form and feed and nourish it for forty days, and feed it with blood and milk, nothing else, and the sun does not see it," you may then vivisect it and use its fluids to anoint your feet, whereupon you can walk over water. Finally, "if a man has raised it and nourished it until a whole year passes, and left it in milk and rainwater, it will tell him all things that are absent."[47]

There are numerous parallels between pseudo-Plato's recipe for the rational animal and the *De natura rerum*'s homunculus, though there are also obvious differences. The choice of human sperm, the feeding with blood, the initial nourishing for forty days in a flask followed by a longer period of maturation, and finally the gift of preternatural intelligence are topoi shared by both texts. But there are multiple divergences as well, such as the complicated mixture of minerals that pseudo-Plato uses in order to clothe his rational animal with skin, or his advice that it should be eviscerated. Either the author of the *De natura rerum* has drawn on different sources or he has considerably toned down his primary source. At any rate, I think one must agree that there is sufficient resemblance between the *De natura rerum* and this Arabic literature of artificial generation to make a dependence on the tradition as a whole both plausible and necessary.

If we now pass from the *De natura rerum* to a work that belongs more definitely to the genuine Paracelsian corpus, it will be possible to cast our net a bit wider. In addition to the Arabic tradition of artificial generation, there is another source that Paracelsus may have used for his homuncular ruminations. I refer to the popular tradition of the *mandragora,* known even in Middle High German as *Alraun* or *Alraune*.[48] In his *Liber de imaginibus* of uncertain date, Paracelsus attacks dishonest apothecaries who carve roots to look like a man and sell them as *Alraun.* He denies categorically that any root shaped like a man really grows naturally.[49] Nonetheless, Paracelsus affirms in another passage that the mandrake can indeed be produced, even if the

natural philosophers and physicians have enveloped it in error. In the *De vita longa* (1526/1527), after discussing the theory that pearls are generated from sperm, he says:

> the homunculus, which the necromancers falsely call "alreona" and the natural philosophers "mandragora," has become a topic of common error, on account of the chaos in which they have obscured its true use. Its origin is sperm, for through the very great digestion that occurs in a *venter equinus* the homunculus is generated, like [a man] in all things, with body and blood, with principal and lesser members.[50]

Here Paracelsus argues that the mandrake incorrectly described by necromancers and philosophers is really a homunculus, which they have misidentified. Paracelsus may be thinking here of the old German folk-legend that the *Alraun* grew primarily beneath gallows, where it was generated from the sperm or urine of hanged criminals: in honor of its provenance, the *Alraun* was also called *Galgenmann*.[51] In order to understand his reasoning, one must realize that Paracelsus customarily employs the expression *venter equinus,* a technical term in alchemy for decaying dung used as a heat source, to mean any source of low, incubating heat. Thus it was easy for him to interpret the mandrake legend as a garbled recipe for the homunculus, in which the earth beneath the gallows acted as a *venter equinus*.

Implications of the Homunculus for Paracelsus

Having located the proximate sources of the Paracelsian homunculus, let us now pass to a discussion of its meaning for him. If we turn to Paracelsus' tract *De homunculis* (ca. 1529–1532), it becomes clear at once that the production of the artificial man, though an object of wonder and a means of advancing the power of human art, could also be a potent image of sin. Paracelsus begins *De homunculis* by observing that man has both a spiritual and an animal capacity; calling a man a wolf or dog is a matter not of simile but of identity. This refers to Paracelsus' theory of the microcosm, according to which man, who is made from the *limus* or dust of the earth, and not ex nihilo, contains all the powers and virtues of the creation within himself.[52] When someone acts in a bestial fashion, he therefore actualizes the beast within and literally becomes the animal whose behavior he imitates. It is the essence of a thing, not appearance, that determines its identity. The animal body of man exists independent of the soul, and it produces a defective, soulless sperm when one is possessed by it. It is from this defective, animal sperm, Paracelsus now tells us, that homunculi and monsters are produced: therefore they have no soul.

But this process can happen in different ways. First, as soon as a man experiences lust, sperm is generated within him. He has a choice at that point: either to act on his lust and let the semen pass out or to keep it within, where it will putrefy internally. If he should allow the semen to pass out of his body, it will proceed to generate as soon as it lands on a *Digestif*—that is, a warm, moist subject that can act as an incubator. This "polluted sperm" must produce a monster or homunculus when it is "digested."[53] Paracelsus remarks that this is also possible for women, though he adds that in their case it is more frequent for the seed to remain within, once generated by lust. It then putrefies internally and causes diseases such as a uterine mole, which mocks pregnancy but can lead only to a monstrous growth.[54] In the case of a male, the retention and putrefaction of sperm can lead to scrotal hernia (*Carnoeffel*) or another growth, for the diverted seed produces "flesh, decay, and lumps."[55] Interestingly, Paracelsus refers to this outcome as a "Sodomitic birth," for to him, even the internal production of seed without emission is a form of sodomy.[56]

The theme of sodomy occupies Paracelsus at some length. The logic of his argument leads him to conclude that intestinal worms and various rectal fauna are caused by the action of pederasts, and that the potential for producing intestinal homunculi is the real reason for Saint Paul's injunctions against the abusers of children. Similarly, the omnipotent generative power of sperm is used to explain the presence of horrible growths and even homunculi in the stomach and throat of sodomites who have ingested this dangerous fluid.[57]

At this point the reader may well wonder how one is to escape the destructive power of his or her own seed, given that soulless offspring are not produced only by such unorthodox sexual practices; they can result from mere seminal retention alone. The answer to this is as simple as it is shocking. Addressing himself to the reader as parent, Paracelsus tells us that either we must see to it that our sons get married or else we must castrate them, so that the root of this evil be dug up with all its branches.[58] In the case of women, there is simply no solution other than marriage. One is tempted at first to read this filial prescription as mere hyperbole, but some earlier remarks from *De homunculis* make it clear that Paracelsus is in deadly earnest. In a passage that begins abruptly from a fragment, he says:

> [God] has built his church on Peter, that is, on his chosen, so he will build his church on no other virgin (*jungfrau*). For one must not trust the same, [for] a reed in water is steadier. I announce this to you so that you understand that Christ does not want to have virgins (*jungfrauen*) whom he has

> not chosen, because they are unsteady like the reed; rather he wants to have his own chosen, who remain faithful to him. But if man wants to hold himself chaste by force, from his own power, he should have himself castrated or castrate himself (*sol man beschneiden oder sich selbs beschneiden*), that is, remove the fountain where that lies of which I write. Therefore God has formed it—so that this may happen easily—not like the stomach or the liver, but outside the body. This is not given to women: therefore they are commanded by men. [If they are eunuchs,] they are either so by nature, or else God receives them with a sort of force, not according to their own will.[59]

Here Paracelsus expands on his notion that genuine chastity can only come with castration, since lust has the inevitable effect of generating seed. A self-professed virgin is not really such unless he has eliminated the very source of his own seed. From this statement Paracelsus arrives at a truly extraordinary conclusion: it is for the convenience of enacting their own self-mutilation that God has blessed men with external genitalia. Thus women, who have not the benefit of this option, must be placed under the rulership of men. To conclude this line of reasoning, men have a simple choice—they may either marry, in which case their semen is continually exhausted and used up properly, in producing ensouled children, or they should eliminate the production of further useless seed by self-castration. To do otherwise is to become the involuntary begetter of homunculi.

Even the most blasé of readers cannot fail to find Paracelsus' *De homunculis* an extraordinary document. The complex of ideas concerning sexual pollution, unnatural generation, disease, and religious purification by castration is, even by sixteenth-century standards, bizarre. No doubt some will be inclined to argue that the *De homunculis,* as one short tract among the huge literary output of Paracelsus, should be considered an aberration. But that is not the case. If we turn to other Paracelsian treatises, parts of the same complex emerge, though with some modifications. The fragmentary *De praedestinatione et libera voluntate* of about 1535 seems to argue that man has the freedom to choose whether he generate seed or not, saying that his free will consists partly "in the reception of the blood in the semen. . . . Thus you may live in purity, [or] in unchastity, whichever you wish."[60] Although this passage is more or less incomprehensible as it stands, Paracelsus seems to be saying that the generation of semen is a matter of choice, a message that he put in unforgettably draconian terms in *De homunculis*. In fact, the notion that seed is generated by choice receives much further expansion in Paracelsus' early *Buch von der Geberung der Empfintlichen Dingen in der Vernunft* (ca. 1520). Here Paracelsus says that men and women are born without seed.[61] Seed is

only generated in a man or a woman by choice, in the following manner. The blood coexists in the body with a *liquor vitae,* which the fantasy (*speculatio*) can ignite just as fire ignites wood. When this ignition occurs, the seed separates from the *liquor vitae* dispersed throughout the body by a process that Paracelsus calls *egestio,* then passes into the *vasa spermatica.*[62] Whenever seed has been produced, Paracelsus says, the "light of nature is not, but is dead"; that is, the faculty of understanding has vanished. Consequently, he adds, it is necessary that the philosopher never generate seed. Indeed, God himself wants to have a "pure man, not a changed one"; that is, he desires a man unpolluted by the generation of semen.[63]

At another point in *Das Buch von der Geberung,* however, Paracelsus makes it clear that despite God's preference of the pure man over the impure, procreation is not a sin. His message is basically that of *De homunculis*—a good Christian has two choices, either to use his seed for the purpose of generation or to avoid its production altogether—although *Das Buch von der Geberung* lacks the overt injunction that we can achieve the latter goal only by means of self-mutilation. In essence, Paracelsus seems to be erecting two orders of men—a perfectly chaste philosophical elect, which never generates seed, and a progenerative plebs. He even goes so far as to suggest that the perfectly chaste man can experience physical rebirth through baptism, to have his Adamic, elemental body literally replaced by the flesh of the new birth. Such a regenerated man can become a *magus coelestis,* an *apostolus coelestis,* a *missus coelestis,* or a *medicus coelestis.*[64] The fate of the procreative man, however, is far less clear, for in many other places Paracelsus supports legitimate marriage.[65] It would exceed my scope here to try to resolve this vexed point in Paracelsus' philosophy. Let me merely reiterate that for *Das Buch von der Geberung,* at least, the message is that procreation, or even the generation of seed, eliminates the possibility of learning from the light of nature.

HABENT SUA FATA HOMUNCULI

As we have seen in the foregoing, Paracelsus has extremely ambivalent views on the matter of generating seed, at times passing into an almost Manichaean rejection of the "common man" who traffics in procreation. Yet one thing is clear. If one does in fact generate seed, he or she must look very carefully to its ultimate resting place. Once the sperm has been produced, neither abstinence nor emission per se is acceptable, since both can result in the generation of uncontrolled and dangerous monstrosities. According to Paracelsus' *De homunculis,* the only proper destination for male sperm is the female womb, the one environment guaranteed not to produce a homunculus. The

De natura rerum, on the other hand, whether genuine or not, has turned the pangenerative vice of human seed into a virtue. By means of the "alchemical" technique employed in incubating a flask at moderate heat, one can isolate the male seed from the female and thereby produce a transparent, "bodiless" homunculus. In this fashion, human art can generate a being unimpeded by the materiality of normal female birth, hence surpassing the artifice of nature.

Here we see the fruit of that confluence of traditions described above—the "rational animal" of the Arabic writers on spontaneous generation has combined with the Latin response to Avicenna to give birth to the Paracelsian homunculus. But this union was not without its dangers. Even in the Middle Ages, there was a powerful feeling that alchemy had transgressed on the creative powers of the godhead in its claim of mineral replication.[66] One version of the *Secret of Secrets* of pseudo-Aristotle contains the following relevant passage: "It must be known that it is impossible to know how to produce genuine silver and gold, since it is impossible to become the equal (*equipari Deo Altissimo*) of God the Highest in his own works."[67]

How much stronger would be the reaction to the homunculus! I shall cite but three examples from seventeenth-century England. Henry More, whose diatribes against "Eugenius Philalethes," or Thomas Vaughan, formed the pretext for writing his *Enthusiasmus Triumphatus,* saw Paracelsianism as the embodiment of philosophical enthusiasm. To More, Paracelsus was the "great boaster," whose "delirious Fancies" and "uncouth and supine inventions" found their epitome in the conceit that "there is an artificiall way of making an *Homunculus.*" Nor would More be pacified by such writers as Johann Valentin Andreae, who tried to allegorize the homunculus, being "ashamed of the grosse sense of it." More saw the artificial man as merely another instance of the Swiss boaster giving vent to "the wildest Philosophicall Enthusiasmes that ever was broached by any either Christian or Heathen."[68]

An equally unsympathetic view of the homunculus is found in an exact contemporary of More's, one not usually mentioned for her philosophical restraint. I refer to Margaret Cavendish, whose Epicurean *Poems and Fancies* appeared in 1653. Cavendish, despite her reputation for eccentricity, was consistently opposed to the claims of alchemy. Her comments on the homunculus are particularly enlightening, for unlike More, she treats the issue of artificial life within the context of the art/nature debate:

> The greatest Chymists are of a strong Opinion, that they can enforce Nature, as to make her go out of her Natural Pace, and to do that by Art in a

> Furnace, as the Elixar, that Nature cannot in a hundred or a thousand Years; and that their Art can do as much as Nature, in making her Originals another way than she has made them; as *Paracelsus* little Man, which may be some Dregs gathered together in a Form, and then perswaded himself it was like the Shape of a Man, as Fancies will form, and liken the Vapours that are gathered into Clouds, to the Figures of several things.[69]

Like Henry More, Cavendish wants to see the homunculus as a son of Paracelsus' extravagant fancy, formed by free association from the residue in a flask. But she is unequivocal in her condemnation of the alchemical enterprise that the homunculus embodies—the surpassing of nature by art. Indeed, she is opposed even to the notion that art can equal nature, for as she continues to expostulate, this would make of man a little god.

> Nay, they will pretend to do more than we ever saw Nature to do, as if they were the God of Nature, and not the Work of Nature, to return Life into that which is dead. . . . [F]or though the Arts of Men, and other Creatures, are very fine and profitable, yet they are nothing in comparison to Natures works, when they are compared. Besides, it seems impossible to imitate Nature, as to do as Nature doth, because her Waies and her Originals are utterly unknown: for Man can only guess at them, or indeed but at some of them. . . . [T]hough he can extract, yet he cannot make; for he may extract Fire out of a thing, but he cannot make the principle Element of Fire; so of Water and Earth; no more can he make the Elizar [i.e., Elixir] than he can make the Sun, Sea, or Earth. . . . But Nature hath given such a Presumptuous Self-love to Mankind, and filled him with that Credulity of Powerfull Art, that he thinks not only to learn Natures Waies, but to know her Means and Abilities, and become Lord of Nature, as to rule her, and bring her under his Subjection.[70]

It is fascinating to hear the resonances of Avicenna's *sciant artifices* in this passage and to witness Cavendish's denial of the very defense of art raised by the *Book of Hermes*—that man can "create" the four elements. Even the pious doubts of the *Secret of Secrets* commentator are echoed here, in Cavendish's complaint that the "greatest Chymists" confuse themselves with the "God of Nature." Yet the primary focus of Cavendish's attack is no longer the mere transmutation of metals, which she subjoins almost as a footnote, but the making of an artificial man. It is the mute witness of the homunculus, above all, that indicts the alchemist as an impious imposter. The sober natural philosopher must realize that "we scarce see the Shadow of Natures Works" but live in a twilight land at best, where we are apt to break our heads with errant wandering.

A final twist to the fate of the homunculus may be seen in the *Demonstration of the Existence and Providence of God* published by the Calvinist divine John Edwards in 1696. Edwards's book is above all a natural theology, and as such it expounds at length on the wondrous intricacy of the human body. The author finds particular support for his view in the fact that the symmetry and interconnectedness of the body's parts testify to the transcendence of their maker. This sets him apart from mere earthly workmen, who cannot create such organic perfection as to impart genuine life to their products. As Edwards says,

> This is no Workmanship of Humane Skill, here is no Automaton made by Art, no Daedalus's walking Venus, no Archytas's Dove, no Regiomontanus's Eagle and Fly. Here is none of Albertus magnus or Frier Bacon's speaking head, or Paracelsus's Artificial Homuncle. Here is nothing but what proceeds from a divine Principle and Art, and therefore cannot be reckoned among those mechanical Inventions which have an external Shew of Sensation and Life for a time, but are destitute of a vital Spring.[71]

Here Edwards ranks the homunculus among such famous mechanical automata as the brazen head of Roger Bacon and the dove of Archytas, in order to deny it any genuine self-moving principle. Even if the homunculus really can exist, it will only be a clever counterfeit of life and not a genuinely vital being. Remarkably, Edwards has managed to turn the argument of the Paracelsian *De natura rerum* on its head—where the author of that text used the homunculus as the final illustration of man's power over nature, Edwards employs it to demonstrate the feebleness of human art. It is nature alone, the living testament of the divine will, that can produce true life: the alchemist and mechanic can only fabricate a pallid imitation.

It is quite clear, then, that Paracelsus' readers in the seventeenth century were alert to the status of the homunculus as a hero of art, even when they rejected the artificial man as a fraud or a fancy. Few seem to have followed the path of Andreae in harnessing the homunculus to the yoke of Christian soteriology. And indeed, the homunculus as pictured either in the *De natura rerum* or *De homunculis* is an intractable vehicle of salvation. Neither the "bodiless" product of human artisanal mastery nor the obscene and tumorous growths of unbridled lust could serve the ministrations of the regenerate soul. In sum, by fusing together the traditions of artificial generation, alchemical debate, and an unorthodox Catholicism, Paracelsus and his epigones managed to create an image of the alchemist as a *magus coelestis,* approaching the creative powers of divinity itself. This holy magus held the keys

of art and nature; in fabricating his homunculus, he could even mimic the supreme creative act of God, though on a smaller scale. Can anyone perceive this image without, like Margaret Cavendish, dimly hearing in the background the words of Genesis 3:5—"your eyes shall be opened, and ye shall be as gods, knowing good and evil"?

NOTES

1. Quoted in John Warwick Montgomery, *Cross and Crucible: Johann Valentin Andreae (1586–1654), Phoenix of the Theologians,* (The Hague: Martinus Nijhoff, 1973), 2:414.

2. Ibid., pp. 440–456.

3. For a similar and contemporary allegory involving death, resurrection, and color changes, see Basil Valentine, *Die zwoelf Schluessel,* in *Elucidatio secretorum, das ist, Erklaerung der Geheimnussen . . .* (Frankfurt: Nicolaus Steinius, 1602), pp. 398 ff. (entry taken from John Ferguson, *Bibliotheca Chemica* [Glasgow, 1906; reprint, Hildesheim: Olms, 1974], 1:239). For a discussion of such alchemical allegories, see William Newman, *Gehennical Fire: The Lives of George Starkey, an American Alchemist in the Scientific Revolution* (Cambridge, Mass.: Harvard University Press, 1994).

4. Quoted in Montgomery, *Cross and Crucible,* 2:458.

5. Ibid., p. 464.

6. Ibid., 1:122–131.

7. See Montgomery, *Cross and Crucible,* vol. 2, where he demonstrates this point exhaustively in his valuable commentary to the text.

8. Walter Pagel, *Paracelsus: An Introduction to Philosophical Medicine in the Era of the Renaissance* (Basel: Karger, 1958), pp. 82–104. For an assessment of Paracelsus in relation to medieval alchemy, see Wilhelm Ganzenmüller, "Paracelsus und die Alchemie des Mittelalters," in his *Beiträge zur Geschichte der Technologie und der Alchemie* (Weinheim: Verlag Chemie, 1956), pp. 300–314.

9. Pagel, *Paracelsus,* pp. 244, 258–259, 263–273. For the transmission of Rupescissa's work in German, see Udo Benzenhöfer, *Johannes de Rupescissa: Liber de consideratione quintae essentiae omnium rerum deutsch* (Stuttgart: Steiner, 1989).

10. Frances A. Yates, *Giordano Bruno and the Hermetic Tradition* (London: Routledge and Kegan Paul, 1964), pp. 144–156.

11. Aristotle, *Physics,* trans. Philip H. Wicksteed and Francis M. Cornford, Loeb Classical Library (1929; reprint, London: Heinemann, 1970), 1:109.

12. Ibid. p. 173.

13. William Newman, introduction to *The "Summa perfectionis" of pseudo-Geber,* ed. and trans. Newman (Leiden: Brill, 1991), pp. 1–40.

14. Francis Bacon, *Descriptio globi intellectualis,* vol. 5 of *The works of Francis Bacon,* ed. and trans. James Spedding et al. (London: Longmans, 1870), p. 506.

15. William Newman, "Technology and Alchemical Debate in the Late Middle Ages," *Isis* 80 (1989): 423–445, esp. 427.

16. Quoted in Newman, introduction to *The "Summa perfectionis,"* p. 49: "ars est debilior quam natura et non consequitur eam quamvis multum laboret."

17. Mary Richard Reif, "Natural Philosophy in Some Early Seventeenth-Century Scholastic Textbooks" (Ph.D. diss., St. Louis University, 1962), p. 238: "One final question briefly touched upon by several authors concerns the possibility of producing a truly natural product by means of human skill. The question is usually posed in this way: 'Can art effect certain works of nature?' The specific problem which they almost always have in mind is the transmutation of baser metals through the art of alchemy." See also Charles B. Schmitt, *John Case and Aristotelianism in Renaissance England* (Kingston, Ont.: McGill-Queen's University Press, 1983), pp. 193–205.

18. Quoted in Newman, introduction to *The "Summa perfectionis,"* pp. 6–15. For the Latin text, see pp. 52–56.

19. Ibid., p. 11.

20. Ibid., pp. 11–12.

21. See Newman, introduction to *The "Summa perfectionis,"* pp. 57–103, for a discussion of the indubitably Latin origin of the *Summa.*

22. Geber, *The "Summa perfectionis,"* pp. 643–644.

23. Ibid., p. 650.

24. Ibid., pp. 647–648.

25. Lynn Thorndike, *A History of Magic and Experimental Science* (New York: Columbia University Press, 1923–1958), 3:139. See Manchester, University of Manchester, John Rylands MS 65, fol. 205v, where the author ascribes the experiment to "Rasis in libro de proprietatibus membrorum animalium."

26. Karl Sudhoff rejected the authenticity of *De natura rerum* in its present form, though he suggested that it might contain "Hohenheimische Ausarbeitungen oder Entwürfe" (in Paracelsus, *Sämtliche Werke,* ed. Sudhoff [Munich: Oldenbourg, 1922–1933], 11:xxxiii), but Will-Erich Peuckert questions this rejection: see *Theophrastus Paracelsus: Werke,* ed. Peuckert (Basel: Schwabe, 1968), 5:ix. Kurt Goldammer also accepts the authenticity of *De natura rerum,* with reservations: "Der Gedanke der Substanzenseparierung hat dann auch die paracelsische Todesanschauung in jenen berühmt gewordenen Ausführungen der umstrittenen Schrift 'De natura rerum' geliefert, von der ich annehme, das sie in ihrer Grundidee echt ist, wenn auch eine Überarbeitung durch Schülerhände sich nicht ausschliessen lässt"; see "Paracelsische Eschatologie, Zum Verständnis der Anthropologie und Kosmologie Hohenheims I," *Nova Acta Paracelsica* 5: (1948): 52.

27. [pseudo?] Paracelsus, *De natura rerum,* in vol. 11 of *Sämtliche Werke,* ed. Sudhoff, p. 312: "Die generation aller natürlichen dingen ist zweierlei, als eine die von natur

geschicht on alle kunst, die ander geschicht durch kunst nemlich durch alchimiam. wiewol in gemein darvon zureden, möchte man sagen, das von natur alle ding würden aus der erden geboren mit hilf der putrefaction. dan die putrefaction ist der hoechst grad und auch der erst anfang zu der generation, und die putrefaction nimbt iren anfang und herkomen aus einer feuchten werme. dan die stete feuchte werme bringet putrefactionem und transmutirt alle natürliche ding von irer ersten gestalt und wesen, desgleichen auch an iren kreften und tugenden. dan zu gleicher weis wie die putrefaction im magen alle speis zu koz macht und transmutirts, also auch ausserhalb des magens die putrefactio so in einem glas beschicht, alle ding transmutirt von einer gestalt in die andere."

28. Ibid., p. 313.

29. See Paracelsus, *Astronomia magna,* in vol. 12 of *Sämtliche Werke,* ed. Sudhoff, p. 322. After the world has been consumed by fire in the final conflagration, everything will be as "ein eidotter ligt im clar." This will be a *perspicuum,* and this will be both a *chaos* and also "das wasser, von dem die geschrift sagt, auf welchem der geist gottes getragen wird."

30. Paracelsus, *De natura rerum,* p. 313: "das ist auch das höchst und grössest magnale und mysterium dei, das höchst geheimnus und wunderwerk."

31. Ibid.: "Es ist auch zu wissen, das also menschen mögen geboren werden one natürliche veter und mütter. das ist sie werden nit von weiblichem leib auf natürliche weis wie andere kinder geboren, sonder durch kunst und eines erfarnen spagirici geschiklikeit mag ein mensch wachsen und geboren werden, wie hernach wird angezeigt &c."

32. Ibid., pp. 315–316: "dan der basiliscus wechst und wird geboren aus und von der grössten unreinikeit der weiber, aus den menstruis und aus dem blut spermatis, so dasselbig in ein glas und cucurbit geton und in ventre equino putreficirt, in solcher putrefaction der basiliscus geboren wird."

33. Ibid., p. 315: "Nun aber damit ich widerumb auf mein fürnemen kom, von dem basilisco zuschreiben, warum und was ursach er doch das gift in seinem gesicht und augen habe. da ist nun zu wissen, das er solche eigenschaft und herkomen von den unreinen weibern hat, wie oben ist gemelt worden. dan der basiliscus wechst und wird geboren aus und von der grössten unreinikeit der weiber, aus den menstruis und aus dem blut spermatis."

34. See, e.g., Paracelsus, *De generatione hominis,* in vol. I of *Sämtliche Werke,* ed. Sudhoff, p. 305, where the female is viewed as the principle of all evil: "Das aber ein mensch vil lieber stilet als der ander, ist die ursach also, das alles erbars in Adam gewesen ist und das widerwertige der êrbarkeit, unêrbarkeit in Eva. solches ist auch also durch die wage herab gestigen in die samen nach dem ein ietlichs sein teil davon gebracht hat, nach dem ist er in seiner natur. denn etwan hat die diebisch art uberwunden, etwan die hurisch, etwan die spilerisch &c." Cf. the parallel locus in Paracelsus, *Das Buch von der Geberung der Empfindlichen Dinge in der Vernunft,* in ibid., pp. 278–281.

35. Paracelsus, *De natura rerum,* pp. 316–317: "Nun ist aber auch die generation der homunculi in keinen weg zu vergessen. dan etwas ist daran, wiewol solches bisher in grosser heimlikeit und gar verborgen ist gehalten worden und nit ein kleiner zweifel und frag under etlichen der alten philosophis gewesen, ob auch der natur und kunst möglich sei, dass ein mensch ausserthalben weiblichs leibs und einer natürlichen muter möge geboren

werden? darauf gib ich die antwort das es der kunst spagirica und der natur in keinem weg zuwider, sonder gar wol möglich sei. wie aber solches zugang und geschehen möge, ist nun sein process also, nemlich das der sperma eines mans in verschlossnen cucurbiten per se mit der höchsten putrefaction, ventre equino, putreficirt werde auf 40 tag oder so lang bis er lebendig werde und sich beweg und rege, welchs leichtlich zu sehen ist. nach solcher zeit wird es etlicher massen einem menschen gleich sehen, doch durchsichtig on ein corpus. so er nun nach disem teglich mit dem arcano sanguinis humani gar weislich gespeiset und erneret wird bis auf 40 wochen und in steter gleicher werme ventris equini erhalten, wird ein recht lebendig menschlich kint daraus mit allen glitmassen wie ein ander kint, das von einem weib geboren wird, doch viel kleiner."

36. Ibid., p. 317: "dan durch kunst uberkomen sie ir leben, durch kunst uberkomen sie leib, fleisch, bein und blut, durch kunst werden sie geboren, darumb so wirt inen die kunst eingeleibt und angeboren und dörfen es von niemants lernen."

37. Ibid.: "dan es ist ein mirakel und magnale dei und ein geheimnis uber alle geheimnus."

38. Gershom Scholem, "Die Vorstellung vom Golem in Ihren Tellurischen und Magischen Beziehungen," *Eranos-Jahrbuch* 22 (1953): 235–289; see p. 281. For Pagel's acceptance of Scholem's argument, see his *Paracelsus,* pp. 215–216.

39. Moshe Idel, *Golem: Jewish Magical and Mystical Traditions on the Artificial Anthropoid* (Albany: State University of New York Press, 1990), pp. 185–186. Idel rejects Scholem's hypothesis that the homunculus theory owed a debt to the literature on the golem.

40. Jābir ibn Hayyān, *Jābir ibn Ḥayyān, contribution à l'histoire des idées scientifiques dans l'Islam,* ed. Paul Kraus, Mémoires présentés à l'institut d'Egypte vol. 44–45 (Cairo: Institut français de l'archéologie orientale, 1942), 2:110.

41. Ibid., p. 111.

42. Ibid., pp. 104–105 n. 12.

43. Thorndike, *Magic and Experimental Science,* 2:735.

44. New Haven, Yale University, Codex Paneth, fol. 392vb: "Qui vult facere animal rationale accipiat aquam suam dum calidam[?] et conficiat eam cum equali mensura eius ex lapide qui nominatur lapis solis. et est lapis qui lucet in nocte sicut lucet lampas donec illuminatur ex eo locus in quo est."

45. Ibid., fol. 393ra: "accipe illam formam et pone eam in illo pulvere. ipsa enim statim vestietur cute humana."

46. Ibid.: "pone illam formam animalem in vas magnum vitreum vel plumbeum non aliud usque quo pretereant ei tres dies et pacietur famem et agittabitur. Ciba ergo ipsam ex illo sanguine qui exivit de matre. et non ergo cesses similiter donec pretereant septem dies. . . . ipsa complebitur forma animalis que convenit rebus multis mirabilibus."

47. Ibid., fol. 393rb: "Et si acceperis hanc formam et cibaveris et nutriveris ipsam usque quo pretereant ei .xl. dies et cibabis eam sanguine et lacte non alio et non viderit eam

sol. . . . Et si homo rexerit eam et nutriverit ipsam usque quo pertranseat ei annus integer, et dimiserit eam in lacte et aqua pluviali narrabit ei omnia absencia."

48. Friedrich Kluge, *Etymologisches Wörterbuch der Deutschen Sprache* (Berlin: de Gruyter, 1989), p. 22. See also Albert Lloyd and Otto Springer, *Etymologisches Wörterbuch des Althochdeutschen* (Göttingen: Vandenhoeck and Ruprecht, 1988), 1:168–170, and Johannes Hoops, *Reallexikon der Germanischen Altertumskunde,* 2nd ed. (Berlin: de Gruyter, 1973), 1:198.

49. Paracelsus, *De imaginibus,* in vol. 13 of *Sämtliche Werke,* ed Sudhoff, p. 378: "dem geb ich zur antwort und sag, es sei nicht war, das alraun die wurzel menschen gestalt hab, sonder es ist ein betrogne arbeit und bescheisserei von den landfarern, die dan die leut mer denn mit disem alein bescheissen. dan es ist gar kein wurzel die menschen gestalt hat, sie werden dan also geschnizlet und geformirt; von got ist keine also geschaffen oder die von natur also wechst, darumb ist weiter darvon nit zu reden &c."

50. Paracelsus, *De vita longa libri quinque,* in vol. 3 of *Sämtliche Werke,* ed. Sudhoff, p. 274: "homunculus, quem necromantici alreonam, philosophi naturales mandragoram falso appellant, tamen non nisi in communem errorem abiit propter chaos illud, quo isti obfuscaverunt verum homunculi usum. origo quidem spermatis est; per maximam enim digestionem, quae in ventre equino fit, generatur homunculus, similis ei per omnia, corpore et sanguine, principalibus et minus principalibus membris." A parallel passage is found in the German text of *De vita longa,* p. 304.

51. Will-Erich Peuckert, *Handwörterbuch der Sage* (Göttingen: Vandenhoeck and Ruprecht, 1961), 1:406.

52. Paracelsus, *Astronomia magna,* pp. 33–38.

53. Paracelsus, *De homunculis,* in vol. 14 of *Sämtliche Werke,* ed. Sudhoff, p. 331: "sonder das verstanden also, das also der polluirt sperma, so er sein digestion und erden begreift, on ein monstrum nicht fürgêt."

54. Retention of female seed was associated with the production of a mole by many physicians from the Middle Ages on. See Danielle Jacquart and Claude Thomasset, *Sexuality and Medicine in the Middle Ages,* trans. Matthew Adamson (Princeton: Princeton University Press, 1988), p. 153. They cite Albertus Magnus, *Quaestiones supra de animalibus,* ed. Filthaut, book 10, Q. 5.

55. Paracelsus, *De homunculis,* p. 332. "daraus wird nun fleisch, moder, truesen &c." Paracelsus was influenced, no doubt, by earlier medical concerns about the retention of seed. Galen comments on this problem and relates the case of Diogenes the Cynic, who supposedly masturbated openly as a means of prophylaxis; see Galen, *De locis affectis,* book 6, Kuehn, 8:417–420, as cited in Jean Stengers and Anne Van Neck, *Histoire d'une grande peur: La masturbation* (Brussels: Université de Bruxelles, 1984), p. 41. See also Jacquart and Thomasset, *Sexuality and Medicine,* p. 149.

56. Paracelsus, *De homunculis,* p. 332: "ein sodomitisch geburt."

57. Ibid., pp. 333, 334–335: "also wissen auch, das in den stercoribus humanis vilerlei tier gefunden werden und seltsam art, die da komen von den sodomiten, von welchen Paulus

schreibt, und sie nent knabenschender, wider die Römer &c. . . . dergleichen auch so wissen, das die sodomiten solch sperma in das maul fallen lassen &c, und also oftmals in magen kompt, gleich als in die matricem als dan so wechst im magen auch ein gewechs draus, homunculus oder monstrum oder was dergleichen ist, daraus dan vil entstehet und seltsam krankheiten sich erzeigen, bis zum lezten ausbricht."

58. Ibid., p. 336: "drumb ziehe und ordne ein ieglicher sein kint in ehelichen stant oder in das verschneiden, damit der graben der dingen abgraben werde, die wurz aus der erden gezogen, mit allen esten heraus gerissen."

59. Ibid., p. 331: ". . . Dan hat er auf Petrum sein kirchen gebauen, das ist auf den erwelten, so wird er auf kein ander jungfrau sein kirchen sezen. dan den selbigen ist nicht zu vertrauen, das ror im wasser ist bestendiger. das zeig ich euch dorumb an, auf das ir verstanden, das Christus nicht wil jungfrauen han, die er nicht erwelt hat, von wegen das sie wie das ror unbestendig seind, sonder wil sein erwelten han, die selbigen bleiben im bestendig. so aber der mensch sich selbs mit gewalt wil keusch halten, aus seinen kreften. so sol man beschneiden oder sich selbs beschneiden, das ist den brunnen abgraben, do das in ligt, darvon ich hie schreib. drumb hats got beschaffen, das wol mag beschehen, nicht wie den magen, nicht wie die lebern, sonder für den leib heraus. den frauen ist das nicht geben, drumb seind sie den mannen befolen, sie seient dan von der natur eunuchae, oder got erhalt sie mit zwangnus art, nicht nach irem fuergeben." Although *beschneiden* does not normally have the sense of "castrate," the parallel passage using *verschneiden* (*De homunculis,* p. 336) ensures that Paracelsus does have castration in mind. See Jacob Grimm and Wilhelm Grimm, *Deutsches Wörterbuch* (Leipzig: S. Hirzel, 1956), ser. 1, 12:1132–1133.

60. Paracelsus, *De praedestinatione et libera voluntate,* in his *Theologische und Religionsphilosophische Schriften,* ed. Kurt Goldammer (Wiesbaden: Steiner, 1965), 2:114: "unser freier will ist anderst denn der erst und scheidet sich vom ersten also: der erst steht in der nahrung des menschen, der ander steht in aufenthaltung des bluts im samen. . . . also du magst in reinigkeit leben, in unkeuschheit, welches du wilt."

61. Paracelsus, *Buch von der Geberung,* pp. 252–253.

62. Ibid., pp. 258–260.

63. Ibid., p. 253: "wo aber der same in der natur ligt, da ist das liecht der natur nit, sonder es ist tot"; p. 254: "denn er wil einen lautern menschen haben und nit ein verenderten, als der same tut so er in der natur ist."

64. Paracelsus, *Astronomia magna,* p. 315.

65. Gerhild Scholz-Williams, "The Woman/The Witch: Variations on a Sixteenth-Century Theme (Paracelsus, Wier, Bodin)," in *The Crannied Wall: Women, Religion, and the Arts in Early Modern Europe,* ed. Craig A. Monson (Ann Arbor: University of Michigan Press, 1992), pp. 119–137. See also Ute Gause, "Zum Frauenbild im Frühwerk des Paracelsus," in *Parerga Paracelsica,* ed. Joachim Telle (Stuttgart: Steiner, 1991), pp. 45–56.

66. Newman, "Technology and Alchemical Debate," pp. 439–442.

67. Roger Bacon, *Opera hactenus inedita Rogeri Baconi,* ed. Robert Steele (Oxford: Clarendon, 1920), 5:173: "Sciendum tamen quod scire producere argentum et aurum, verum

est impossibile: quoniam non est possibile equipari Deo Altissimo in operibus suis propriis."

68. Henry More, *Enthusiasmus Triumphatus* (London: J. Flesher, 1656), p. 46.

69. Margaret Cavendish, *Poems and Fancies* (London: F. Martin and F. Allestrye, 1653), p. 176.

70. Ibid., p. 177.

71. John Edwards, *A Demonstration of the Existence and Providence of God, from the Contemplation of the Visible Structure of the Greater and the Lesser World,* part 2 (London: Jonathan Robinson, 1696), p. 124.

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11

Natural Particulars: Medical Epistemology, Practice, and the Literature of Healing Springs

Katharine Park

In the prologue of his *On the Causes of Wonders* (ca. 1370), Nicole Oresme drew a clear distinction between the causal knowledge of the philosopher or medical theorist and that of the practicing physician. "One thing I would note here is that we should properly assign to particular effects particular causes," he wrote, "but this is very difficult unless a person looks at effects one at a time and their particular circumstances. . . . Why Sortes is poor and Plato is rich, why an animal died at such a time, why pepper in small quantities is a laxative and a diuretic in large quantities, . . . why Sortes heard such a voice or saw such a marvel—how could we render their particular and direct causes and how could we know their particular circumstances? As I have said then," Oresme concluded, "I shall only show in a general manner that such things occur naturally, as do learned physicians who compose general rules in medicine and leave specific cases to practising physicians. For no physician would know how to say—if Sortes were ill—what kind of illness he has and how it will be cured, except by seeing him and considering the particulars."[1]

In this passage, Oresme recapitulated one of the truisms of Aristotelian natural philosophy: although particular natural effects undoubtedly had particular causes, the investigation of those effects and those causes lay outside the purview of the natural philosopher, who concerned himself only with necessary, certain, and universal knowledge (*scientia*). This exile of particulars from natural philosophical reflection marked the work not only of philosophers who subscribed to the traditional idea of demonstrative science found in thirteenth-century writers such as Albertus Magnus or Thomas Aquinas,[2] but also of later philosophers influenced by the particularist ontology and empirical epistemology developed by William of Occam. In fact, as John Murdoch has argued, that particularist ontology "did not mean that natural philosophy then proceeded by a dramatic increase in attention being paid to experience and observation (let alone anything like experiment) or was suddenly overwrought with concern about testing or matching its results with nature; in a very important way natural philosophy was not about nature."[3]

Thus insofar as natural processes or phenomena appeared at all in works of fourteenth-century natural philosophers, they tended to do so in a highly abstract manner: either as part of a speculative discourse, concerning (for instance) the imagined behavior of bars dropped through the center of the earth or wheels of ice rotating in ovens, or in the form of stock examples, such as the presumed behavior of the clepsydrae, bellows, and bottles of water that testified to nature's abhorrence of a void.[4] Neither of these kinds of appeals to experience had anything to do with actual, observed particulars, in the sense referred to by Oresme. Indeed, as Oresme noted, philosophers like himself tended to deal with problems of natural causation only in what he called "a general manner," just as professors of theoretical medicine left the management of particular cases to "practicing physicians." In this sense, as philosophers from Albertus Magnus to Jean Buridan had previously acknowledged, most actual natural phenomena lay—in practice if not in theory—outside the sphere of philosophical reflection: the result was what Murdoch has described as a "natural philosophy without nature."[5]

But does this mean that no one was interested in the causal study of particular natural phenomena? In this paper, I shall argue that the later fourteenth century in fact saw the appearance of a sustained tradition of inquiry and a coherent body of literature devoted to the causal analysis of individual phenomena based on meticulous and repeated sense experience. As Oresme suggested, the men who produced this literature were not philosophers but practicing physicians. My paper deals with a particular genre of medical writing: the monographic treatises on healing springs produced by Italian physicians in the period between about 1350 and 1450. Unlike many other contemporary works on medicine, these treatises did not reflect in the first instance a university context, though some of their authors did teach medicine at various northern Italian universities; they grew instead out of medical practice, and one kind of practice in particular: the attendance of physicians on noble and princely patrons. I shall propose that these treatises reflect, albeit hesitantly and defensively, one of the first attempts by philosophically trained European writers to develop a method of natural inquiry based on the study of particular natural phenomena: in this case, individual natural mineral springs.

This project was not an easy one. As their works testify, the physicians who pursued it were confronted by obstacles of very different kinds. In the first place, they had to develop new methods of empirical investigation—or borrow them from other contexts, such as medical diagnosis and prognosis, and from nonuniversity and nonphilosophical disciplines, such as alchemy. These methods involved not only experimental techniques such as distilla-

tion and alembification but also the habit and discipline of close sensory observation of natural phenomena—of what Oresme called "paying sufficient attention" (*advertere satis*) to particular natural effects.[6] At the same time, these physicians had also to wrestle with the traditional hierarchy of value that privileged the demonstrative and certain knowledge of the natural philosopher over the probable knowledge of the *artifex,* which was branded with the epistemological stigma of uncertainty and the sociological stigma of the mechanical arts. As Jole Agrimi and Chiara Crisciani have shown, this hierarchy of value lay at the heart of the ideology that informed the medieval university and the intellectual world of what they have called *doctrina*.[7] In what follows, I shall argue that this new tradition of empirically based knowledge was both motivated and legitimated by the patronage relationships of medical practitioners to their aristocratic patients, and that it reflected a different cultural and institutional context from that of the university.[8]

Mineral springs had long been a staple of Italian therapeutics, as we know from Pietro da Eboli's early-thirteenth-century poem *On the Baths of Pozzuoli,* dedicated to Emperor Frederick II.[9] But it was only in the mid–fourteenth century that such springs began to capture the serious attention of professional medical writers in central and northern Italy.[10] This new interest formed part of, and was clearly a response to, the dramatic and accelerating revival of lay interest in thermal medicine, which had figured prominently in Etruscan and ancient Roman therapeutics. The fourteenth and fifteenth centuries saw the rapid development of a kind of spa culture, organized around Italy's many thermal springs.[11] Located in the countryside outside major urban centers, these springs became important sites not only of medical pilgrimage, on the part of both rich and poor, but also of a kind of social season (in May and then again in September) for Italy's ruling elites. Extended visits to baths appear repeatedly in the correspondence of fifteenth-century Italian noble and patrician families such as the Medici, who especially favored Bagno a Morba near Volterra, and the Gonzaga, who patronized Petriolo, near Siena.[12]

Spurred by this growing interest in thermal medicine, physicians, municipal officials, and local entrepreneurs scoured the countryside looking for promising new springs. As a result, though early-fourteenth-century medical authors such as Pietro da Tossignano or Gentile da Foligno knew of relatively few such sites—Porretta, near Bologna, and Abano, near Padua, were the most famous northern Italian examples—early-fifteenth-century writers on mineral springs, such as Ugolino da Montecatini or Michele Savonarola, were familiar with literally hundreds of individual springs. Some of the newly rediscovered ones were Roman, surrounded by classical ruins, which were

often rebuilt; others were previously completely unknown, except, sometimes, to locals.

Both municipalities and wealthy individuals—for example, Lorenzo de' Medici and his mother Lucrezia Tornabuoni in Florence, and Pietro Gambacorta, lord of Pisa—engaged in elaborate exercises in real estate development around these springs, constructing complexes of inns and palaces around newly discovered sites or refurbishing the buildings of old ones.[13] In preparation, they frequently sent their own physicians to investigate the properties of the bath in question. For example, when Florence annexed the territory of Volterra, it acquired a group of springs called Bagno a Morba; the government saw the baths as a valuable asset, and on several occasions between 1388 and 1391 sent Cristofano di Giorgio, a prominent young Florentine physician, to analyze the water in order to determine its special properties and to recommend how the area might best be developed.[14] In the same way, Giovanni Dondi, a famous Paduan physician and author of one of the earliest monographs on thermal medicine (in the 1370s), was instrumental in developing the nearby new bath of Casanova, near Abano, and may well have had a financial interest in it.[15]

It was in this context that we see not only a revival of interest in Pietro da Eboli's *Baths of Pozzuoli,* which produced a number of beautiful illuminated manuscripts of the work for various princely patrons,[16] but also the appearance, in mid- to late-fourteenth- and early-fifteenth-century Italy, of a series of learned medical monographs on hot springs and natural baths. These included Gentile da Foligno's *On Baths* (before 1348);[17] Tura di Giacomo da Castello's *On the Baths of Porretta* (1351);[18] Jacopo Dondi's *On the Cause of the Saltiness of Waters* (1355);[19] Francesco da Siena's *On Baths* (1399), dedicated to Duke Galeazzo Visconti;[20] and, in the first half of the fifteenth century, Antonio Guaineri's *On the Baths of the Very Ancient City of Aqua* and Bartolomeo da Montagnana's *On the Appearance, Location, Powers, and Operations of the Baths Discovered in the Paduan Countryside,* composed for Lord Giovanni of Pesaro.[21] Some of these were actually written in response to the explicit requests of princely patrons, and all took as their principal frame of reference the kind of elite medical practice to which the most ambitious physicians aspired. They bristle with specific and highly respectful references to individual noble patients—their illnesses, their travels to one spring or another, and the outcomes of their treatment. This is particularly true of the three longest and most interesting treatises that form the basis of this paper. Giovanni Dondi's *On the Hot Springs of the Paduan Countryside* (ca. 1372) grew out of a year's attendance on Duke Galeazzo Visconti.[22] Ugolino da Montecatini compiled most of the information for his *On Baths* (1417, expanded in 1420)

while in the service of Pietro Gambacorta and Malatesta de' Malatesta, lords of Pisa and Pesaro respectively.[23] And Michele Savonarola dedicated his *On Baths and Natural Spas* (1448–1449) to Borso, son of the Marquis Niccolò d'Este, who had hired him as court physician for the impressive annual salary of four hundred florins.[24]

This medical literature on baths formed part of the flowering in Italy of a particular branch of medical learning called *practica,* which concerned the diagnosis, description, and treatment of individual diseases; *theorica,* in contrast, dealt with more general and abstract questions concerning physiology and the nature of health and illness.[25] In the thirteenth and early fourteenth centuries, medicine as an academic and intellectual discipline had modeled itself on natural philosophy—its unique claims to certainty located epistemologically in the logic of deduction and institutionally in the university.[26] By the middle of the fourteenth century, however, the Italian city-states were witnessing an astounding development of the marketplace for professional medical services.[27] This produced an explosion of opportunities for physicians (and to some degree also surgeons) for highly lucrative employment not only by a wide variety of large and wealthy institutions—hospitals, monasteries, confraternities—but also by the growing class of patrician families and small princely dynasties that monopolized power in the highly urbanized but politically fragmented world of early Renaissance Italy.

As a result, the later fourteenth and early fifteenth centuries saw intense interest and rapid development in the area of medical learning that had its roots outside the universities and looked for rewards that were not simply academic: large salaries, lucrative contracts, and high prestige. This intellectual arena was largely coextensive with that of the field called *practica,* which, though itself a regular part of the medical curriculum in northern Italian universities, was oriented not toward elaborating causal explanations but toward developing an effective diagnostics and therapeutics. It is in this large body of literature, produced by physicians trained at the university and sensitive to epistemological issues, that we begin to see the elaboration of a philosophically informed and experience-based study of natural phenomena grounded on the consideration of particulars—not only natural springs but also the plants, animals, and minerals that formed the mainstay of contemporary therapeutics.[28]

This process appears especially clearly in the treatises on healing springs, in large part because each individual natural spring had long been thought to have unique properties, stemming from its particular location and topography; this topographical uniqueness arose not only from the particular subterranean arrangement of mineral deposits and heat sources that was

thought to give each bath its own composition and temperature, but also from the unique constellation of planetary influences that each place on earth received. That the rays from the heavenly bodies strike different latitudes at different angles and are received differently depending on the particular arrangement or responsiveness of the matter there was already a commonplace idea in the thirteenth century: Albertus Magnus had stressed it in two very influential works, *On the Nature of Places* and *On Minerals,* where he related it specifically to the appearance of minerals and of springs with special properties.[29] Writing two hundred years later, Michele Savonarola reiterated this idea, noting that many effects in the natural world were purely local, like the appearance of gold and silver deposits in certain regions, or the fact that Tartars, with their wide, flat faces, were born in only one part of the world.[30]

The power of place and the consequent uniqueness of particular mineral springs had a number of important implications. From a commercial point of view, of course, they raised the crucial question of whether healing water could be bottled and marketed away from its place of origin, a controversy specifically addressed by Savonarola.[31] But the epistemological implications were even more serious. For if each spring was unique—so that even directly adjacent springs could have wildly different temperatures and properties—then the properties of each could not be deduced from first principles but had to be carefully derived from experience of the individual case. As a result, as Savonarola put it, referring to the mineral properties of the bath of Monte Grotto (first studied by Jacopo Dondi), "all these things are probable, lacking logical demonstration. But experience is the mistress of all these discords."[32]

Here, Savonarola was carefully and explicitly using the language of probability and opinion. He believed not that the properties of individual springs had no causes, only that the particularities of place meant that those causes could not be known with certainty and therefore those properties were not amenable to demonstrative or "scientific" knowledge. As a result, each spring had to be studied individually and with the utmost attention, using all the information available to the senses: the color of the water, its smell and taste, the nature of the illnesses it cured. Often this process required relatively elaborate experimentation; there was, for example, a standing debate over whether the minerals of a spring were best extracted by boiling, distillation, or evaporation (the method developed by Dondi at Monte Grotto).[33] Savonarola even described a dispute he had with one of his noble patients—the famous condottiere Francesco Busson, count of Carmagnola—over the relative heat of the baths of Abano and Sant'Elena. The matter was resolved by filling vials from both at exactly the same time, by the clock, and com-

paring the temperatures once the two samples were brought together, which showed them to be virtually the same—an experiment that vividly illustrates the difficulties of contemporary instrumentation. As Savonarola himself put it, "to measure (*mensurare*) the degree of heat with the degree of coldness is not easy."[34]

But how were learned physicians to identify promising new springs for testing, and how might their properties initially be known? Here Ugolino da Montecatini and Michele Savonarola both emphasized the utility of lay observation and the importance of nonelite informants. For example, Ugolino reported that local women used one of the baths of Abano to "clean out their uteruses" and another, very cold one in the Pisan countryside to treat infertility; following the example of the latter, his own wife, who had been unable to conceive in twenty years of marriage, was pregnant within the year.[35] Writing of another spring discovered recently near his home town of Montecatini, he noted that "it was frequented mainly by peasants suffering from pains in the joints . . . and they go there without following any rules [presumably of physicians]. They receive great benefit from its use. And they take certain plants and make a hollow and enter it, mixing the water with mud. And they say that water is more effective when mixed with mud."[36] Similarly, Michele Savonarola described a newly discovered spring near Carpi, "the [healing] power of which was first pointed out by animals," as he put it;[37] he explained that in 1448, when the local cattle became sick and began to urinate blood, they sought out the spring, drank from it, and were cured. The cowherds, who had observed this, notified the authorities in Carpi, who concluded that its water was generally good for disorders of the urinary tract.

Despite acknowledging the utility of lay experience, Ugolino and Michele both emphasized (presumably especially for the benefit of their noble patrons) that this was never sufficient and might in fact be misleading. Ugolino noted that mineral springs could be harmful if not used properly, and he recommended that a physician's advice be followed at all times. Savonarola also stressed that the indiscriminate use of baths, without expert attention to the patient's individual complexion, time of year, and proper mode of application, might be downright dangerous.[38] In this way, the singularity of the patient—which was constantly emphasized in elite practice—interacted with the singularity of the spring, producing a unique situation that was wholly unamenable to demonstrative analysis.

While repeatedly stressing the special competence of the learned physician, his deep theoretical knowledge supplemented by broad experience, fourteenth- and early-fifteenth-century Italian writers on thermal medicine expressed nonetheless a pervasive concern about the shaky epistemological

status of their conclusions, in contrast to the demonstrative and deductive ideal of natural philosophy. We already find an explicit statement of this problem in the treatise of Giovanni Dondi, who commented, after giving his own explanation of the cause of heat of thermal baths, "I have not promised to demonstrate perfectly that this is the certain and proper cause, since it is difficult to promise any certainty concerning these things that are perceived by conjecture. . . . Whoever doesn't like [this cause] can seek out one more probable, because everyone possesses the free faculty of inquiring and forming opinions, as long as he supports his opinion with reasoning."[39] By the middle of the fifteenth century, Michele Savonarola appeared even more defensive: "I have described in positive terms this way of investigating the cause of the heat of thermal baths," he wrote, "[although] I judge that this material is not conducive to demonstration and cannot be defended from contradiction. But it has seemed to me the most expeditious [mode of investigation] and the most consonant with human minds. On account of this let no one criticize [literally, 'bite'] me, since I have thus [at least] supplied [the basis] for investigating another and perhaps truer cause."[40]

These defensive statements make sense in the context of the intense competition that characterized elite medical practice.[41] But they also illuminate the difficulty and insecurity of naturalists attempting to craft an alternative model of natural knowledge to that found in university-based natural philosophy, sacrificing the limpid certainty of *scientia* for the muddy waters of sensory experience and probable opinion. The epistemological status of medicine, part practical skill and part learned theory, had long presented itself as problematic. Late-thirteenth- and early-fourteenth-century scholastic writers such as Taddeo Alderotti, attempting to carve out for medicine a stable place in the map of academic knowledge, had struggled to relate their procedures to Aristotelian methodology and to stake their claims to scientific status. As Nancy Siraisi has shown for the University of Bologna, such questions were fundamental to the establishment of medicine as a university discipline, on the model of law, with all of the associated authority, prestige, and statutory protection.[42] The anxious remarks of Michele Savonarola, writing in the mid–fifteenth century from the point of view of practice, testify to the continuing effects of those epistemological and political struggles.

At the same time, however, fourteenth- and fifteenth-century medical writers also elaborated aspects of Aristotelian logic and epistemology that differentiated their work from that of contemporary natural philosophers. They explored the method of "resolution" (proceeding from phenomena to their first principles)[43] and emphasized the importance of cumulative experience and progress in the area of therapeutics. In this last connection, they also

drew on Aristotelian methodology, which acknowledged the legitimacy of probable opinion and identified it with approval by a community of learned experts.[44]

This collaborative and cumulative process also informed the literature on mineral springs, where, for example, Giovanni Dondi cited the discoveries of his own father Jacopo in his treatise on the hot springs of Padua. Writing early in the 1370s, Dondi in fact relied primarily on textual evidence, although he occasionally referred to his own observations—for instance, concerning the small black particles found in those baths.[45] In contrast, fifteenth-century writers such as Ugolino da Montecatini and Michele Savonarola were much more likely to cite their own observations concerning newly discovered springs, or at least to collect information orally from local medical experts who had studied the phenomena themselves. Thus Ugolino noted that because he had never visited the springs at Siena, he was relying on the testimony of two Sienese physicians, Marco and Francesco; and when he went to Viterbo to check out the baths there, he wrote, "I wanted for the day that I was there to inform myself from the local doctors and others."[46]

Such remarks hint at the emergence of a nascent community of inquirers working together to accumulate and collate new information derived from the direct experience and observation of natural phenomena. This new development cannot be attributed to humanism or a self-conscious rejection of medieval methods: Savonarola invoked Dondi repeatedly and with great respect. Rather, it appears to have grown naturally out of both the earlier tradition of text-based *experimenta* and the professional demands of contemporary practice. Furthermore, as it appears in late-fourteenth- and fifteenth-century texts on thermal medicine, this process was a pale forerunner of the mid-sixteenth-century developments that Paula Findlen describes later in this volume: the references to collaboration are incidental and unsystematic, and the treatises reflect as clearly the bitterly competitive world of elite medical practice, so vividly described by Ugolino da Montecatini, who found himself locked in conflict with his implacable enemy Giovanni Baldi.[47] In this sense, we can hardly talk of a highly developed collaborative model for the kind of empirical inquiry sketched in the treatises on baths.

In addition to their colleagues, the authors of these treatises found an even more potent source of legitimation in their noble patients. It is striking how often fifteenth-century writers on baths stressed the impetus they received from their patrons and patients for the study of the properties of newly discovered springs. Ugolino noted that Malatesta de' Malatesta, lord of Pesaro, had pressed him to investigate the water of Bagno ad Aqua, near Siena.

Malatesta had already performed his own distillation of the water and, according to Ugolino, begged him to amplify those findings.[48] I have already mentioned Michele Savonarola's discussion with his patient the count of Carmagnola about the relative heat of the baths of Abano and Sant'Elena. Savonarola also cited another example of the involvement of local nobles in the study of new springs: when Galasio, a noble from Carpi, heard that the physician was writing a book about baths, he sent him a sample of a local spring—the one that had been so efficacious for the epidemic of bovine cystitis in 1448—and asked him to investigate it.[49]

Writers such as Michele Savonarola and Ugolino da Montecatini invoked their noble patients at every opportunity, hoping no doubt that their patrons' prestige and support would discourage other authors from "biting" them for venturing into the elusive and uncertain territory of particular phenomena and probable opinion. The result was not only a very different epistemological model of natural inquiry from the demonstrative ideal advocated by university-based natural philosophers; it was also informed by a very different sensibility from the impassive and distanced stance of the professor of *scientia,* engaged in transmitting to his students the certain causal knowledge he had received in turn from his own teachers. The language of the thermal treatises is autobiographical, at times confessional—this is particularly true of Ugolino's work—and shot through with the rhetoric of surprise and wonder. Giovanni Dondi's treatise is a case in point. "And so," he wrote,

> when I first saw these waters and considered their properties, . . . I wondered not a little and, not finding causes that were wholly satisfactory, I was for a long time in doubt on many points. But now I have learned . . . from long experience that there is nothing that is not marvelous, and that the saying of Aristotle in the first book of the *Parts of Animals* is true, that in every natural phenomenon there is something wonderful—indeed many wonders. Thus indeed it is, brother: among wonders are we born and placed and surrounded on all sides, so that to whatever object the eye first turns, the same is a wonder and full of wonder, if only we examine it for a little.[50]

This passage immediately placed Dondi outside the tradition of demonstrative natural philosophy, where wonder was a taboo emotion, the hallmark of the nonphilosopher, who was ignorant of causes and therefore marveled at unusual natural effects (*mirabilia*).[51] Instead, it relates Dondi's work to courtly writing and the literature of romance, the aim of which was to evoke wonder by the description of exotic and unfamiliar natural phenomena: petrifying springs, fountains of youth, city walls made of lodestones,

castles lit by carbuncles.[52] In this way, Dondi and his fellows must have hoped, if they could not lay claim to the authority of the natural philosopher, cloaked in the certainty guaranteed by demonstrative *scientia,* they could at least cash in on the prestige of their courtly patrons and the associated glamor and charisma of romance.

In addition to clothing their epistemologically shaky enterprise in borrowed splendor and recalling their princely connections, the discourse of wonders also served another purpose: to focus the attention of observers on the phenomena at hand. It was all very well for Oresme to note that the causes of natural effects were divinable if one "paid sufficient attention"; but the habit of paying attention to natural phenomena, particularly relatively unprepossessing natural phenomena such as a pool of stinking, muddy water, required a special discipline of the senses and the mind.

To some degree, that habit of paying attention to the data of sense already informed the practice of the physician, who regularly inferred the illness and chances of his patients from minute and subtle changes in the color of their urine, the smell of their excrement, the sound of their breathing, the rhythm of their pulse.[53] From this point of view, all investigators such as Ugolino or Michele Savonarola had to do was transfer those techniques from the body of the patient to the physical phenomenon—from the urine to the water of a spring. Thus, in a chapter called "How to Investigate the Minerals of Natural Baths," Savonarola explained that you could determine the mineral contents of water by sight, taste, touch, and hearing: water with a predominance of *nitrum* was more transparent and much sharper in taste than water with a predominance of salt, while a predominately salty distillate could be identified because it was softer to the touch than *nitrum* and crackled when thrown into a fire. These kinds of determinations, Savonarola noted, were by their very nature subjective and required "exquisite familiarity with the forms of minerals, particularly concerning those parts that pertain to the senses. Whence," he concluded, "let them be silent who perhaps would wish to criticize (*mordere*) me."[54]

Savonarola's remarks here suggest another possible model for this habit of attention to particular sensory phenomena: the alchemical tradition, which in northern Italy had strong ties to fourteenth- and fifteenth-century medicine.[55] Like a number of contemporary physicians, including Guglielmo Fabri, whom Chiara Crisciani discusses elsewhere in this volume, Ugolino da Montecatini and Michele Savonarola both had alchemical interests. Savonarola had even written a treatise on *aqua ardens,* or ethyl alcohol, and he and Ugolino repeatedly invoked distillation and other techniques for determining the mineral composition of water—techniques that were also

regularly used in the preparation of contemporary medicines.[56] Furthermore, as the example of Fabri underlines, alchemy had a long tradition of courtly associations, embodied in works like the influential *Secret of Secrets,* purportedly composed for Alexander the Great.[57] From an epistemological point of view, too, alchemy had much in common with medicine. Composed, like medicine, of both a theoretical and a practical part, and rooted in a vision of nature compatible with Aristotelian principles, it had nonetheless an uneasy relationship to the demonstrative ideal of philosophy, since an important part of alchemical knowledge, like medical knowledge, was constructed through contact with matter, mediated through the senses. Both Michela Pereira and Chiara Crisciani have called attention to its liminal status, suspended between art and science, mechanical and philosophical knowledge, the material and the spiritual world.[58] The tentative, autobiographical, even confessional tone of some of the passages in the medical treatises on baths, while certainly owing something to humanism and the influence of Dondi's friend Petrarch, also recalls the self-representation of the alchemist as apprentice or pilgrim, humbly making his way through the confusing world of sensory phenomena.[59]

But neither alchemy nor the discipline of diagnostics could offer much to the physician in the way of conventional intellectual legitimation. From an institutional point of view, alchemy was marginal to the world of university culture, unrepresented in the official curriculum; and it further labored under the stigma of late-thirteenth- and early-fourteenth-century ecclesiastical condemnations and a penumbra of associations with heterodoxy and fraud.[60] Practical medicine, in contrast, was well established as a university subject, but few claims could be made for the intellectual or social dignity of diagnostics, whose sensory discipline centered on examining the effluvia of the human body. As Petrarch had written in his *Invectives against a Doctor* (1350s), "you look into soiled basins, you examine the urine of the sick, and you think about gold. Why is it surprising that you, who have so much to do with things that are gloomy, dark, and yellow, should yourself be gloomy, dark, and yellow?"[61] In Petrarch's eyes, the practicing physician was mired in the realm of the senses and involved in what he characterized as a mechanical art.

Thus one of the functions of the discourse of wonder in treatises on thermal medicine was to elevate its objects, and therefore its investigators, by associating them with natural marvels; the aim, no doubt, was both to lay claim to their courtly associations and to confirm their remarkable healing powers. Dondi worked hard to redescribe the properties of the springs of Padua as "wonderful accidents" (*accidentia mirabilia*): their repellent taste, their unpleasant smell, the small worms that inhabited them, and the green and

grey slime that accumulated at the bottom of their pools.[62] Such rhetorical strategies were at best stopgaps; they in no way lessened the difficulty and uncertainty of the enterprise in which Dondi was engaged. Anomalous, particularistic, and unassimilable to necessary and universal demonstrations, mineral springs demanded a new model of natural inquiry—one that did not turn its back when faced with novel and chance phenomena, but tried to craft a new set of procedures, rooted in experience, for untangling the complicated strings of causes involved. In contrast to natural philosophical teaching, this form of inquiry was progressive and open-ended; its practitioners did not envisage themselves as merely interpreting or transmitting a largely complete body of knowledge, but instead saw themselves as part of an ongoing enterprise of discovery. This enterprise was coordinated and validated by a new community of learned experts: physicians trained in academic natural philosophy but active in the contingent world of practice and legitimized by the approval of their noble clients. Such clients were familiar with the long history of wonders as the aristocracy of natural phenomena, rooted in the literature of romance and courtly recreation. Thus they accepted the proffered treatises not only as potential repositories of healing wisdom but also as offerings fit for a prince.

Although the world of the courts and of aristocratic practice was an increasingly important site for the production of medical learning in fourteenth- and fifteenth-century Italy, it is important to emphasize the continuities between it and the academic world. Most of the writers on thermal medicine taught in one or more Italian universities at some point in their careers: some, like Dondi and Savonarola, converted a notable academic reputation into princely patronage; others, like Ugolino, began in courtly and private practice, later moving into a university post. Thus their works on baths in no way repudiate fundamental scholastic assumptions concerning methodology, epistemology, or the structure of the physical world. But they did mobilize a clear set of rhetorical and literary strategies to underline their illustrious social connections and legitimize their immersion in the domain of contingency, sense perception, and particular effects. The treatises on thermal medicine reveal a fluid social and intellectual environment, marked by the interpenetration of medical, philosophical, and alchemical interests, as well as by easy communication between the worlds of university and court. Equally striking are the continuities with late-thirteenth- and early-fourteenth-century medical and pharmacological learning. Despite his friendship with Petrarch, Dondi's own medical work shows no sustained influence of humanism, and the same is true of Ugolino and Savonarola (though Savonarola's *On Baths* was translated into Greek by Theodore of Gaza).[63] Rather, their interests in contingent natural phenomena appear to

have grown naturally out of the existing tradition of writing on therapeutics, as well as the exigencies of elite practice itself.

I would also stress the strong discontinuities between the empiricism of fourteenth- and fifteenth-century Italian balneologists and the modern idea of empiricism, which ultimately came to rest on phenomena that were replicable, classifiable, countable, and homogeneous. The healing springs studied by learned physicians and frequented by both peasants and princes were not phenomena of this sort but were natural wonders. They belonged to the world of the anomalous, the remarkable, and the bizarre, and their value resided in their singularity. Compared with contemporary natural philosophers, or even writers on theoretical medicine, Dondi, Ugolino, and Savonarola shied away from generalizations, even about the small class of thermal springs, preferring to focus on the properties of each bath: its temperature, its peculiar mix of dissolved minerals, and the diseases it was known to cure.

Unique phenomena of this sort resisted induction, much less deduction; they demanded rather what William Eamon, following Carlo Ginzburg, has called a "venatic epistemology," modeled on the hunt, which focused on tracing backward the complicated causal chains that produced particulars by reading the fragmentary evidence of natural signs.[64] Michele Savonarola specifically invoked the idea of sign when he wrote:

> The signs of doctors are never found to be definitive and infallible; rather they give knowledge approaching the truth. This is the source of judgment based on sense (*iudicium extimativum*), since different people judge differently concerning diseases and cases that occur. The same thing applies to untangling the minerals in baths, since because the signs are not altogether certain and definitive, it happens that people writing about those minerals may disagree. Thus you must flee doctors without good judgment, and thus one should not consider only one sign, but all signs or several and the most important ones, which should produce belief in matters of this sort.[65]

In this passage, as in others, Savonarola struggled to formulate explicitly the epistemological process that lay behind the judgments he and his fellow physicians made when they wrote about thermal springs, using both the medical language of sign, derived from the activities of diagnosis and prognosis, and the philosophical language of judgment and opinion. His efforts were at best halting, reflecting the rudimentary state of the enterprise. But they represent the aspirations of physicians writing on *practica* to forge an intellectually respectable study of particulars.

This endeavor came into its own in the next century, when natural history began to achieve disciplinary autonomy and when a whole range of

fields related to the teaching of medicine, most notably anatomy and botany, began to develop a solid empirical base.[66] But it is wrong to see these developments as wholly novel, without roots in the earlier period. As Vivian Nutton has recently emphasized, the medical culture of the fifteenth century—the "missing century," as he calls it—was vigorous and innovative, marked by a growing rejection of traditional medical authorities and a strong emphasis on medical practice; the latter gave rise to an increasing clinical emphasis in teaching and a large and original body of writing on topics ranging from *materia medica* through surgical techniques and instruments to the nature and management of epidemic disease.[67] The early Italian medical literature on springs was part of this flowering, and it shows some of the first attempts to engage in the detailed study of individual natural phenomena, based on the carefully collated data of the senses. The dissectors and collectors of the sixteenth century developed these leads in important new directions, but they followed in the steps of their fourteenth- and fifteenth-century colleagues, who wrestled with the elusive and frustrating world of natural particulars, as well as with the difficult epistemological issues that such inquiry raised.

NOTES

1. Nicole Oresme, *De causis mirabilium,* prologue, in Bert Hansen, *Nicole Oresme and the Marvels of Nature: A Study of His "De causis mirabilium" with Critical Edition, Translation, and Commentary* (Toronto: Pontifical Institute of Mediaeval Studies, 1985), pp. 137–140.

2. See Benedict M. Ashley, "St. Albert and the Nature of Natural Sciences," in *Albertus Magnus and the Sciences: Commemorative Essays, 1980,* ed. James A. Weisheipl (Toronto: Pontifical Institute of Mediaeval Studies, 1980), pp. 85–94; William A. Wallace, "Albertus Magnus on Suppositional Necessity in the Natural Sciences," in ibid., pp. 102–126; and in general Eileen Serene, "Demonstrative Science," in *The Cambridge History of Late Medieval Philosophy,* ed. Norman Kretzmann, Anthony Kenny, and Jan Pinborg (Cambridge: Cambridge University Press, 1982), pp. 496–517.

3. John Murdoch, "The Analytic Character of Late Medieval Learning: Natural Philosophy without Nature," in *Approaches to Nature in the Middle Ages,* ed. Lawrence D. Roberts (Binghamton, N.Y.: Center for Medieval and Renaissance Studies, 1982), p. 174.

4. The example of the rod is from Swineshead and that of the wheel from Gaetano da Thiene: John E. Murdoch and Edith Sylla, in *Dictionary of Scientific Biography,* ed. Charles Coulston Gillespie (New York: Charles Scribner's Sons, 1981), s.v. "Swineshead, Richard"; and Murdoch, "Analytic Character," p. 200 n. 9. For the stock examples, see Edward Grant, *Much Ado about Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution* (Cambridge: Cambridge University Press, 1981), pp. 77–100.

5. Murdoch, "Analytic Character"; see in general the literature in note 2.

6. Oresme, *De causis* 3, pp. 270–272.

7. Jole Agrimi and Chiara Crisciani, "Per una ricerca su *experimentum-experimenta:* riflessione epistemologica è tradizione medica (secoli XIII–XV)," in *Presenza del lessico greco e latino nelle lingue contemporanee,* ed. Pietro Janni and Innocenzo Mazzini (Macerata: Università degli Studi di Macerata, 1990), pp. 9–49; eaedem, *Edocere medicos: Medicina scolastica nei secoli XIII–XV* (Naples: Guerini, 1988), esp. pp. 49–74, 137–156.

8. For a related set of reflections concerning the mechanical arts, see Pamela O. Long, "Power, Patronage, and the Authorship of *Ars:* From Mechanical Know-how to Mechanical Knowledge in the Last Scribal Age," *Isis* 88 (1997): 1–41.

9. Latin text and English and Italian translations are in Pietro da Eboli, *De balneis puteolanis,* trans. Carlo Marcora and Jane Dolman (Milan: Il Mondo Positivo, 1987).

10. See Domenico Barduzzi, *Ugolino da Montecatini* (Florence: Istituto Micrografico Italiano, 1915), p. 71.

11. See in general Federico Melis, "La frequenza alle terme nel basso medioevo," in *Congresso Italiano di Studi Storici Termali* (Salsomaggiore Terme, 1963), 1:38–49; Richard Palmer, "'In our Lightye and Learned Tyme': Italian Baths in the Era of the Renaissance," in *The Medical History of Waters and Spas,* ed. Roy Porter (London: Wellcome Institute for the History of Medicine, 1990), pp. 14–22; Ralph Jackson, "Waters and Spas in the Classical World," in ibid., pp. 1–13; and, especially, D. S. Chambers, "Spas in the Italian Renaissance," in *Reconsidering the Renaissance: Papers from the Twenty-First Annual Conference,* ed. Mario A. Di Cesare (Binghamton, N.Y.: Medieval and Renaissance Texts and Studies, 1992), pp. 3–27. This last is an excellent introduction to the subject.

12. See Yvonne Maguire, *The Women of the Medici* (London: George Routledge and Sons, 1927), esp. pp. 83–87, 101–109; Gaetano Pieraccini, *La stirpe de' Medici di Cafaggiolo,* 2nd ed. (Florence: Vallecchi, [1947]), 1:57–59, 63–68, 86–92, 128–133; Janet Ross, *The Lives of the Early Medici as Told in Their Correspondence* (London: Chatto and Windus, 1910), esp. pp. 112–116, 179–186; L. Guerra-Coppioli, *Il Bagno a Morba nel Volterrano e Maestro Pierleone Leoni da Spoleto, medico di Lorenzo il Magnifico* (Siena, 1915); and Attilio Portioli, *I Gonzaga ai bagni di Petriolo di Siena nel 1460 e 1461* (*documenti inediti*) (Mantua: Eredi Segna, 1869).

13. Chamber, "Spas," pp. 18–20. For Lorenzo and Lucrezia, see also Maguire, *Women of the Medici,* pp. 106–109; Ross, *Lives of the Early Medici,* pp. 113–114. For Gambacorta, see Barduzzi, *Ugolino,* p. 32.

14. Florence, Archivio di Stato: Provvisioni-Registri 84, fol. 100r; 85, fol. 104v. At the same time, the councils elected six "officials of the baths" to administer the site. For evidence of municipal interest in baths as early as the later thirteenth and early fourteenth century, see Francesco Raspadori, "Legislazioni termali senesi nel Medioevo," in *Atti del XXI Congresso Internazionale di storia della medicina* (Siena: n.p., [1969?]), 1:35–39; Giulio Gentili, "I più antichi documenti sulle terme di Porretta (secoli XIII–XIV)," in *Congresso Europeo di Storia della Medicina* (Montecatini Terme: n.p., 1962), 1:236–244.

15. Michele Savonarola, *De balneis et thermis naturalibus omnibus Italiae* 1.3, in Tommaso Giunta, ed., *De balneis omnia quae extant apud Graecos, Latinos, et Arabas . . .* (Venice:

Giunta, 1553), fol. 17v. I base my discussion of Savonarola's treatise on the text in this edition, aware that it has been revised by Giunta.

16. See C. M. Kauffmann, *The Baths of Pozzuoli: A Study of the Medieval Illuminations of Peter of Eboli's Poem* (Oxford: Bruno Cassirer, 1959); Jonathan J. G. Alexander et al., *The Painted Page: Italian Renaissance Book Illumination, 1450–1550* (Munich: Prestel, 1994), p. 65.

17. Gentile da Foligno, *Tractatus de balneis,* in Antonio Cermisone, *Consilia Cermisoni* (Venice: [Bonetus Locatellus for Octavianus Scotus, ca. 1495–1497]); see Lynn Thorndike, *A History of Magic and Experimental Science* (New York: Columbia University Press, 1923–1958), 3:236. I have not seen this edition. A survey of the medical literature appears in Chambers, "Spas," 4–8.

18. Tura di Giacomo da Castello, *Trattato delle terme di Porretta* (Vicenza: Giovanni di Reno, 1473); see Barduzzi, *Ugolino,* p. 71, for additional bibliographical references. I have not seen this edition.

19. Jacopo Dondi, *Tractatus de causa salsedinis aquarum et modo conficiendi sal artificiale ex aquis thermalibus euganeis,* in Giunta, *De balneis,* fol. 109r–v. As in the case of Savonarola's treatise, I use Giunta's edition with some trepidation, not having access to earlier versions. Discussion and bibliographical details in Thorndike, *Magic and Experimental Science,* 3:386–387, 392–393; and Tiziana Pesenti, "Dondi dall'Orologio, Iacopo," in *Dizionario biografico degli italiani* (Rome: Istituto della Enciclopedia Italiana, 1960–), 41:104–111.

20. Francesco da Siena, *Tractatus de balneis,* Paris, Bibliothèque Nationale, MS 6979, fols. 1r–19v; cited in Thorndike, *Magic and Experimental Science,* 3:537–538. Francesco also served Urban V and Malatesta de' Malatesta, lord of Pesaro, another heavy user of mineral baths, for the six years between 1400 and 1406; see Thorndike, 3:537, and Ugolino da Montecatini, *Tractatus de balneis,* ed. and trans. Michele Giuseppe Nardi (Florence: Olschki, 1950), p. 47.

21. Antonio Guaineri, *De balneis Aquae civitatis antiquissimae commentariolus,* in Giunta, *De balneis,* fols. 43r–47r; see Thorndike, *Magic and Experimental Science,* 3:214–231. Bartolomeo da Montagnana, *De aspectu, situ, minera, virtutibus, et operationibus balneorum in comitatu patavino repertorum,* in Giunta, fols. 37r–43r.

22. Giovanni de' Dondi, *De fontibus calidis agri patavini consideratio,* in Giunta, *De balneis,* fols. 94r–108r. On Giovanni, see Tiziana Pesenti, "Dondi dall'Orologio, Giovanni," in *Dizionario biografico degli italiani,* 41:96–104; and, on this work, Thorndike, *Magic and Experimental Science,* 3:392–397.

23. Ugolino, *Tractatus,* based on the version of 1420. For the manuscript and early printed history of this work, see Barduzzi, *Ugolino,* pp. 72–74; Ugolino composed it in 1417, while practicing in Città di Castello, and augmented it with additions concerning Pietro da Eboli and the baths of Pozzuoli in 1420 (while lecturing on medicine at the University of Perugia). The version printed in Giunta, *De balneis,* fols. 47v–57v, is incomplete and modified by Pier Candido Decembrio, who restructured it and edited the Latin in order to offer it to Borso d'Este, who was also the dedicatee of Michele Savonarola's treatise on baths. On Ugolino's life and career, see Barduzzi, *Ugolino,* and Katharine Park,

Doctors and Medicine in Early Renaissance Florence (Princeton: Princeton University Press, 1985), ad indicem.

24. Savonarola, *De balneis;* for a discussion of this work, including problems in dating, see Thorndike, *Magic and Experimental Science,* 3:197–214. Biographical references in Danielle Jacquart, "Médecine et alchimie chez Michel Savonarole (1385–1446)," in *Alchimie et philosophie à la Renaissance,* ed. Jean-Claude Margolin and Sylvain Matton (Paris: Vrin, 1993), pp. 109–122; and Tiziana Pesenti Marangon, "Michele Savonarola a Padova: L'ambiente, le opere, la cultura medica," *Quaderni per la storia dell'Università de Padova* 9–10 (1976–1977): 45–102.

25. On the development of *practica,* see Nancy G. Siraisi, *Medieval and Early Renaissance Medicine: An Introduction to Knowledge and Practice* (Chicago: University of Chicago Press, 1990), p. 152; Luke Demaitre, "Theory and Practice in Medical Education at the University of Montpellier in the Thirteenth and Fourteenth Centuries," *Journal of the History of Medicine and Allied Sciences* 30 (1975): 103–123; and Danielle Jacquart, "Theory, Everyday Practice, and Three Fifteenth-Century Physicians," in *Renaissance Medical Learning: The Evolution of a Tradition,* ed. Michael McVaugh and Nancy G. Siraisi, Osiris 2nd ser., (Philadelphia: History of Science Society, 1990), pp. 140–141.

26. Michael McVaugh, "The Nature and Limits of Certitude at Early Fourteenth-Century Montpellier," in McVaugh and Siraisi, *Renaissance Medical Learning,* pp. 62–84; and Michael McVaugh, "The Development of Medieval Pharmaceutical Theory," in Arnald of Villanova, *Opera medica omnia,* vol. 2, *Aphorismi de gradibus,* ed. McVaugh (Granada: Seminarium Historiae Medicae Granatensis, 1975), esp. pp. 9–29, 89–120. See also Chiara Crisciani, "History, Novelty, and Progress in Scholastic Medicine," in McVaugh and Siraisi, *Renaissance Medical Learning,* pp. 118–139; Nancy G. Siraisi, *Taddeo Alderotti and His Pupils: Two Generations of Italian Medical Learning* (Princeton: Princeton University Press, 1981), pp. 118–146; and the literature in note 7 above.

27. See Park, *Doctors and Medicine,* pp. 85–116.

28. For sixteenth-century developments in this area, see Paula Findlen's essay in this volume, as well as Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150–1750* (New York: Zone Books, 1998), chap. 4.

29. Albertus Magnus, *De natura locorum* 1.4–5; *De mineralibus* 1.1.7–8. For a fuller account of this theory, see Katharine Park, "The Meanings of Diversity: Marco Polo on the 'Division' of the World," in *Texts and Contexts in Ancient and Medieval Science: Studies on the Occasion of John E. Murdoch's Seventieth Birthday,* ed. Edith Sylla and Michael McVaugh (Leiden: Brill, 1997), esp. pp. 140–142.

30. Savonarola, *De balneis* 2.1, fol. 11r.

31. Ibid. 2.3, fol. 16v; Savonarola concluded that the water was more efficacious on the spot, before it had been allowed to cool. By the sixteenth century, the interests of commerce over tourism seem to have decided the question in favor of commodification; see account book entries from 1507 in Florence, Archivio di Stato: Santa Maria Nuova 5806, fols. 4v–5r, 117v–118r (purchases of bottled water from the springs at Montecatini and Porretta); and Palmer, "Italian Baths in the Renaissance" p. 20.

32. Savonarola, *De balneis* 2.3, fol. 18v: "Haec omnia sic probabilia sunt, demonstratione logica carentia, sed experientia est omnium harum discordiarum magistra."

33. Ibid. 2.7, fol. 36v; see Thorndike, *Magic and Experimental Science,* 3:392–393.

34. Savonarola, *De balneis* 2.1, fol. 10v: "Nam videmus cavernarum aerem tempore aestatis per antiperistasim infrigidari, et tempore hyemis calefieri, sed mensurare gradum calidatatis cum gradu frigiditatis non est facile." For the temperature comparison described above, see 2.3, fol. 20r.

35. Ugolino, *Tractatus,* pp. 85 (quotation), 88–89.

36. Ibid., p. 95: "Adhuc ad istud accedunt maxime rustici qui vexantur a doloribus iuncturarum . . . et vadunt nullis regulis observatis. De cuius usu maximum sepe recipiunt iuvamentum. Et tollunt illas herbas et fatiunt ibi foveam et intrant fatiendo permixtionem luti et aquae et dicunt quod magis conferat illa aqua sic permixta cum luto."

37. Savonarola, *De balneis* 2.3, fol. 27r: "balneum hoc in tempore inventum est, brutis eius virtutem aliquam primo indicantibus."

38. Ibid. 2.3, fol. 19r–v; Ugolino, *Tractatus,* p. 92.

39. Dondi, *De fontibus* 4, fol. 99r: "Nec tamen promiserim perfecte demonstrare hanc esse certam et propriam illius causam, cum sit arduum de his, quae coniectura percipienda sunt, aliquid certi promittere. . . . Cui autem non placet, aliam ipse magis probabilem investiget, quoniam cuilibet est liber inquirendi facultas et opinandi, dummodo opinonem suam fulciat ratione."

40. Savonarola, *De balneis* 2.1, fol. 11v: "Hic autem modus investigandi caliditatis thermarum causam sic positive a me descriptus est, quoniam id iudico materia demonstrationem non patiente, a contradictione defendi non posse. Nam mihi expeditior et mentibus hominum consonantior visus est. Quare me quisquam non mordeat, cum sic ad investigandam aliam et forte veriorem causam dederim."

41. See Park, *Doctors and Medicine,* pp. 39–41, 114–117, 216–218, and note 47 below.

42. Siraisi, *Taddeo Alderotti,* esp. pp. 10–13, 121–137. See also McVaugh, "Nature and Limits of Certitude."

43. See Siraisi, *Taddeo Alderotti,* pp. 128–135; William A. Wallace, *Causality and Scientific Explanation* (Ann Arbor: University of Michigan Press, 1972–1974), 1:28–47, 65–86, 117–127.

44. See Ian Hacking, *The Emergence of Probability* (Cambridge: Cambridge University Press, 1975), pp. 21–23.

45. Dondi, *De fontibus* 7, fols. 105v–106r.

46. Ugolino, *Tractatus,* p. 123: "Et quia ego iam fui in Viterbio volui pro illa die qua steti cum illis medicis et aliis informari." The Francesco named by Ugolino (p. 49) was presumably the same Francesco da Siena who composed his own treatise on baths (see note 20 above). In his methods, Ugolino was following the example of Francesco da Siena

himself, who was sent by Urban V with seven other physicians to study the baths in Viterbo and who also consulted with local physicians concerning their properties; see Thorndike, *Magic and Experimental Science,* 3:537–538.

47. See Ugolino, *Tractatus,* pp. 46, 48, for descriptions of his competition with Giovanni Baldi to direct the medical care of Niccolò di Vieri de' Medici and Raimondo Massimo degli Albizzi.

48. Ibid., p. 111.

49. Savonarola, *De balneis* 2.3, fol. 27r.

50. Dondi, *De fontibus* 2, fol. 95v: "Ita et ego a principio videns has aquas et considerans praescripta accidentia que apparent in eis quae videntur extra naturam aliarum aquarum et aliorum fontium, non mediocriter admiratus sum, et non occurentibus [sic] causis illorum quae apparent quae plene satisfacerent, longo tempore in multis dubitavi, sed iam docentibus annis didici et experientia longa collegi nihil non esse mirabile verumque esse dictum Aristotelis primo de partibus animalium scribentis quod in unoquoque naturali inest aliquid mirabile, immo vero mirabilia multa. Sic profecto frater est: inter mirabilia nati et positi sumus et undequaque circundati adeo ut ad quodcunque primum oculos vertimus, id mirabile sit et mirabilibus plenum, si parumper profundimus intuitum." Cf. Aristotle, *De partibus animalium* 1.5, 645a16–23.

51. Daston and Park, *Wonders and the Order of Nature,* chap. 3.

52. On the literature of romance, see especially Edmond Faral, "Le merveilleux et ses sources dans les descriptions des romans français du XIIe siècle," in his *Recherches sur les sources latines des contes et romans courtois du Moyen Age* (Paris: Librairie Ancienne Honoré Champion, 1913), pp. 307–388; and Daston and Park, *Wonders and the Order of Nature,* chap. 1.

53. For some preliminary reflections on the sensory discipline of premodern European medicine, see the essays in W. F. Bynum and Roy Porter, eds., *Medicine and the Five Senses* (Cambridge: Cambridge University Press, 1993), especially Vivian Nutton, "Galen at the Bedside: The Methods of a Medical Detective" (pp. 7–16), and Jerome Bylebyl, "The Manifest and the Hidden in the Renaissance Clinic" (pp. 40–60).

54. Savonarola, *De balneis* 2.7, fol. 36v: "Quibus accipiatur quantum necessaria est indagatori minerarum, formarum mineralium exquisita notitia, praecipue ad eas partes, quae sensibus comprehenduntur. Ob quam rem taceant, qui fortassis me mordere voluerint." *Nitrum,* William Newman tells me, is either sodium carbonate or saltpeter.

55. Chiara Crisciani, "From the Laboratory to the Library: Alchemy According to Guglielmo Fabri," in this volume; Michela Pereira, *The Alchemical Corpus Attributed to Raymond Lull* (London: Warburg Institute, University of London, 1989), pp. 25–28.

56. Jacquart, "Médecine et alchimie"; Michela Pereira, *L'oro dei filosofi: Saggio sulle idee di un alchimista del Trecento* (Spoleto: Centro Italiano di Studi sull'Alto Medioevo, 1992), p. 12. Savonarola composed his *Libellus de aqua ardenti* in 1440 and produced a vernacular translation several years later, edited by Luigi Belloni in *I trattati in volgare della peste e dell' acqua ardente* (Milan: n.p., 1953); see Jacquart, "Médecine et alchimie," p. 111 n. 11.

57. See Agostino Paravicini Bagliani, *Medicina e scienza della natura alla corte dei papi nel Duecento* (Spoleto: Centro Italiano di Studi sull'Alto Medioevo, 1991), esp. pp. 34, 78, 228, 263–264, 351; Chiara Crisciani, "The Conception of Alchemy as Expressed in the *Pretiosa Margarita Novella* of Petrus Bonus of Ferrara," *Ambix* 20 (1973): 179–180.

58. Chiara Crisciani and Claude Gagnon, *Alchimie et philosophie au Moyen Age: Perspectives et problèmes* (Quebec: L'Aurore/Univers, 1980), pp. 64–74; Pereira, *L'oro dei filosofi,* pp. 136–140.

59. Crisciani and Gagnon, *Alchimie et philosophie,* pp. 73–74; Pereira, *L'oro dei filosofi,* pp. 91–92. For Dondi's friendship with Petrarch, see Park, *Doctors and Medicine,* p. 222.

60. Crisciani, "Conception of Alchemy," pp. 177–178.

61. Francesco Petrarca, *Invective contra medicum: Testo latino e volgarizzamento di Ser Domenico Silvestri,* ed. Pier Giorgio Ricci (Rome: Storia e Letteratura, 1950), p. 57; see also Coluccio Salutati, *De nobilitate legum et medicinae,* ed. Eugenio Garin (Florence: Vallecchi, 1947), 87.

62. Dondi, *De fontibus* 1, fol. 94v.

63. Jacquart, "Médecine et alchimie," pp. 114–115.

64. William C. Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton: Princeton University Press, 1994), esp. 281–284; Carlo Ginzburg, "Clues: Roots of an Evidential Paradigm," in his *Clues, Myths, and the Historical Method,* trans. John and Anne C. Tedeschi (Baltimore: Johns Hopkins University Press, 1989), pp. 96–119. See also Hacking, *Emergence of Probability,* pp. 27–29.

65. Savonarola, *De balneis* 2.7, fol. 36r: "Nam cum signa medicorum sic efficacia et non fallentia non inveniantur, sed notitiam sunt dantia veritati propinqua, hinc surgit iudicium extimativum, quare diversi cum diversitate extimativae de occurrentibus aegritudinibus et casibus diversa deponunt iudicia. Ita et in explicanda minera thermarum fit, quoniam cum sic signa non habeantur omnino certa et efficacia, contingit in mineris thermarum scribentes variare. Quo loco accipias medicum non bonae extimativae fugiendum esse. Sic itaque non est de uno signo considerandum, sed omnia vel plura et potentiora illa sint, quae in consimilibus nobis fidem facere debent."

66. On these developments, see in general Harold J. Cook, "Physicians and Natural History," in *Cultures of Natural History,* ed. N. Jardine, J. A. Secord, and E. C. Spary (Cambridge: Cambridge University Press, 1996), pp. 91–105; Paula Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (Berkeley: University of California Press, 1994); and Daston and Park, *Wonders and the Order of Nature,* chap. 4.

67. Vivian Nutton, "Medicine in Medieval Western Europe, 1000–1500," in *The Western Medical Tradition, 800 BC to AD 1800,* by Lawrence I. Conrad et al. (Cambridge: Cambridge University Press, 1995), esp. pp. 198–202. For a sense of some of the riches of this material, see Roger French et al., eds., *Medicine from the Black Death to the French Disease* (Brookfield, Vt.: Ashgate, 1998).

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12

The Formation of a Scientific Community: Natural History in Sixteenth-Century Italy

Paula Findlen

I. "This Profession of Simples"

In 1573 the archbishop of Bologna, Gabriele Paleotti, asked the Bolognese naturalist Ulisse Aldrovandi (1522–1605) to prepare a report on the state of knowledge in the Faculty of Medicine at the University of Bologna. Paleotti, one of the most prominent of the reforming bishops who defined the new religious and intellectual culture of post-Tridentine Italy, was eager to know what students were being taught, which lectures they preferred to attend, and finally what changes Aldrovandi himself recommended in the medical curriculum. After surveying what Aldrovandi termed "this Encyclopedia"—the length and breadth of the studies pertaining to medicine—he at last turned to his preferred subject, natural history, which he had taught for twenty years. Natural history, he wrote, was one of the "new classes that were not instituted in ancient times." Praising it as the first of the new subjects (*la più antica di queste Classi novamente introdotte*) to enter the Renaissance curriculum in medicine and natural philosophy, Aldrovandi noted that for fourteen years its teaching had been assigned to the third hour of the afternoon classes (in fact, it competed directly with the ecclesiastic historian Carlo Sigonio's lectures that year—tough competition indeed). Responding to Paleotti's question—"What should be changed?"—Aldrovandi's advice was simple: natural history should be taught all by itself, competing with no other discipline. Having clawed its way through the medical curriculum, out of the realm of practice and into the highest reaches of theoretical medicine (at least as Aldrovandi taught this subject), natural history ought to become the centerpiece of the academic study of nature, a fully independent field of knowledge that was required rather than optional for Bolognese students.[1]

Along with anatomy, natural history was perhaps the most widely discussed and hotly debated discipline among Renaissance natural philosophers. While fields such as astronomy and mathematics underwent important revisions during the same period, they did not change as quickly as natural history, nor did their curricular changes at the university level have as

widespread ramifications for the way a generally learned public practiced and thought about science in the sixteenth century.[2] Between the 1530s and 1560s natural history experienced a remarkable resurgence in western Europe. Prior to that epoch, there had been only one short-lived attempt to reinvent the ancient discipline of natural history in the Italian universities, when Leo X assigned Gentile da Foligno to teach this subject at the University of Rome (La Sapienza) in 1513. However, the Sack of Rome in 1527 quickly aborted this initiative, leaving more established and less politically troubled centers of learning such as Bologna and Padua to take the lead in the 1530s.

During the 1540s newer universities such as Pisa and Ferrara had added natural history to the curriculum of their faculties of medicine; later in the century we can even find professors teaching natural history, or "medicinal simples" as the subject was initially called,[3] in Pavia, Parma, Siena, and Salerno. Those cities that did not have universities, such as Mantua, hired ducal botanists to tend their gardens (and guard the ingredients for antidotes in times of plague) and began to prefer town physicians who had benefited from this new form of training.[4] By the end of the century natural history was an established part of the medical curriculum, with special professorships, distinct locations in which to teach and work (botanical gardens and museums), a flourishing tradition of publications (ancient as well as modern), and a growing community of scholars who identified this way of studying nature as their primary goal.

The initial success of natural history in the university curriculum of late Renaissance Italy, as a largely medical subject that emphasized botany over other forms of natural knowledge, emboldened the second and third generations of naturalists to declare natural history central to the definition of natural philosophy itself. Such a move not only enhanced the intellectual status of natural history but began the process of gradually separating such fields as zoology, botany, and geology from medicine, as distinct but complementary forms of knowledge that could serve medical and nonmedical purposes. Of course such a change had not yet occurred in the sixteenth century, nor would Renaissance naturalists have discussed their goals in these terms. Instead they debated the extent to which natural history belonged to theory, focusing on questions of causality and classification, and to practice, concentrating on the uses of nature for humanity. Put simply, Renaissance naturalists wished to give an ancient discipline—the *historia* of Aristotle's animals and Theophrastus' plants, the *materia medica* of Dioscorides, Galen, and Avicenna, and to a lesser degree the *historia naturalis* of Pliny—a permanent place in the university curriculum by presenting it as the connective tissue that linked

medicine to natural philosophy, making the study of terrestrial nature in the broad sense as important as the study of man.[5]

For Aldrovandi, arguably the most important and influential Italian naturalist of this period, natural history was the very thing that defined and completed the education of physicians and natural philosophers. Writing to the Bolognese nobleman Camillo Paleotti in 1585 about the necessity of convincing the Senate of Bologna to invest more money in the teaching of his subject, Aldrovandi declared: "Perhaps they do not know that by the maxim of Aristotle, Hippocrates, Galen, and all the other ancient writers, anyone who is deprived of this part of philosophy, so sensory and so useful, is not numbered among the philosophers and the physicians."[6] Paleotti, who had spent a good number of his leisure hours botanizing with Aldrovandi between Bologna and Trent when his brother the archbishop was at the Council of Trent, understood the significance of Aldrovandi's contention that natural history lay at the core of natural philosophy. Fourteen years later, on the eve of Aldrovandi's retirement from his professorship of natural history (*lectura philosophiae naturalis ordinaria de fossilibus, plantis et animalibus*) at the University of Bologna, Paleotti eulogized his friend for teaching "the philosophical history of natural things" for almost half a century.[7]

Retrospective assessments of a long and productive career such as Aldrovandi's inevitably omit a few details. In fact, Aldrovandi had held several different positions at the University of Bologna. For the early part of his career, Aldrovandi had been *lector de simplicibus,* a position that in no way specified the philosophical content of the natural history he subsequently taught upon his promotion to professor *ordinarius* in 1559. The terms of his initial position were quite typical for many Renaissance professors who were hired primarily to teach plant knowledge to aspiring physicians and little more; by contrast, as Charles Schmitt remarked in passing more than twenty years ago, the changing terms of Aldrovandi's later position signaled the move from medical botany to natural history.[8] In short, Aldrovandi, with his spectacular career at the University of Bologna, had been personally responsible for the intellectual elevation and expansion of natural history in the Italian universities.

By the end of the sixteenth century, natural history had been transformed from a form of writing, defined and shaped by the ancients, into an early modern discipline.[9] Its disciplinary status was marked by the use of such terms as "faculty" (*facoltà*) to describe its reappearance in the university curriculum and "profession" (*professione*) to identify the community of participants.[10] Increasingly the community of naturalists identified themselves through their shared commitment to the reform of the medical curriculum

and their belief that studying nature was a calling in its own right; the former, in a medical culture that emphasized noninvasive herbal medicines, made botany the primary subject around which discipline formation occurred, while the latter placed botany in a continuum of studying nature that gave greater weight to the study of animals over plants and minerals because Aristotle had begun with fauna rather than flora. Naturalists also made room for topics we might nowadays label as mineralogy, geology, and paleontology on the presumption that inanimate objects (things dug up) were the least studied and most paradoxical parts of nature. Active efforts to reform medical botany and to expand the scope of and information constituting *historia naturalis* intertwined fruitfully, creating a self-consciousness among sixteenth-century scholars that they were on the verge of writing a new history of nature whose tangible results would be both intellectual and practical.

The disciplinary status of natural history did not rest solely on curricular innovations at a handful of universities. Often changes in curriculum made official activities that had already occurred outside of any specific institutional framework. The debates on Pliny's *Natural History* in Ferrara during the 1490s are an excellent example of how natural history became a topic of public debate and contention prior to the transformation of the university medical curriculum.[11] Such episodes shaped the discipline *through books:* the visibility and endurance of natural history during the Renaissance was due in no small part to the success of its publications and to the discussions that arose because of them as well as to the copious collections of natural objects, near and far, that demanded closer scrutiny in order to be known.

This essay will discuss the emergence of natural history as a discipline from the perspective of community formation. As I shall argue, the disciplinary status of natural history rested neither on a clearly defined topic nor on an agreed-upon set of procedures. Natural history continued to be an ungainly, encyclopedic enterprise that contained within it a cornucopia of diverse and often conflicting projects. If anything, its intellectual genealogy constantly called into question its disciplinary status; there are good reasons why botany enjoyed a sense of cohesion that natural history, or any other specific aspect of studying nature, never quite had until well into the eighteenth century. Despite a certain agreement that the empirical study of nature (what Aldrovandi, following Aristotle, called "sensory philosophy") was the primary goal, no one was really sure—at least prior to Linnaeus—what the point was of studying nature in this way, save to contextualize medical knowledge. In other words, the status of natural history as a discipline inhabited the unmarked terrain that included the more secure though intellectually con-

tentious field of botany and the encyclopedic abyss of the project Pliny had defined as including just about everything. What factors contributed to the identification of botany and, from it, natural history as a distinctive subject—"this profession of simples" as Costanzo Felici called it in 1555, "our profession" as Francesco Calzolari termed it in the same year?[12] Given the important differences between, say, the collecting projects of Aldrovandi and the philosophical taxonomy of Andrea Cesalpino, what exactly bound the community of naturalists together?

In what follows, I examine one of the major episodes that contributed to the transformation of medical botany from a form of inquiry into a discipline that roughly approximated the one Aldrovandi had in mind by 1573: the publication by the Sienese physician Pier Andrea Mattioli (1501–1578) of a commentary on and translation of Dioscorides' *De materia medica*. It may seem strange to return to an ancient book as a means of describing an early modern community. Yet natural histories were, like encyclopedias, cosmographies, geographies, and other forms of compendia, collective projects whose success relied on the cooperation of many individuals. They were dynamic products whose constant revisions in terms of content reflected not only the fundamentally important developments in empirical knowledge but also the shifting parameters of an emerging scholarly community. In a world that still placed great weight on ancient authorities and that increasingly embraced printing as a means of communicating information, the editing and reediting of one text provides an unusual glimpse of the relationship between those with new knowledge and those who managed and controlled a form of knowledge that had its origins in a canonical text.[13] Mattioli's efforts to create the most authoritative version of Dioscorides' *De materia medica* provide a fascinating instance of how one especially influential naturalist portrayed the scholarly community of his day not only in light of the intellectual transformations it underwent in the mid–sixteenth century but also in light of his own ideas about how to define the very notion of a community.

II. THE TENTACLES OF MATTIOLI

Natural history emerged most clearly not through the accretion of university chairs in medicinal simples but through the activities surrounding what was probably the most well-read scientific book in the sixteenth century, Mattioli's Dioscorides. First published in Italian in 1544 and in Latin in 1554, it went into numerous editions in these languages as well as being the subject of singular translations in German, French, Spanish, and Czech. It comprised the vast majority of the seventy-eight editions of Dioscorides published in the

sixteenth century and was republished through the middle of the eighteenth century, making it one of the few texts that spanned the entire early modern evolution of natural history.[14] Travelers reported back to Mattioli, not without amazement, that they had seen copies in Syria, Persia, Egypt, and among the Arabs. Allegedly there was even a Hebrew manuscript translation in Thessalonika.[15] In the 1560s Mattioli's publisher, the Venetian printer Vincenzo Valgrisi, estimated that he had printed 32,000 copies of the Italian editions alone, while Mattioli himself boasted in the preface to the 1568 Italian edition of sales of over 30,000 copies from the first ten editions.[16]

Such an astronomical level of success made Mattioli not only the most well-known naturalist of his generation but surely one of the most often read authors of his age. To put his publication record in perspective, Mattioli's book was less read than Erasmus' *Colloquies* and Luther's German Bible but better known than Thomas More's *Utopia,* many individual translations of Scripture, and of course the works of Copernicus and Vesalius.[17] Mattioli's self-consciousness about his success knew virtually no bounds, and he, not unlike his predecessor Erasmus, actively promoted his image as scholar with universal status in his field. Not without justification did the physician Girolamo Donzellino state: "there is no one in any corner of Europe, no man living today, to whom the name of Mattioli is not in some way known."[18]

Prior to the publication of his "Dioscorides," as contemporaries often called it, Mattioli had been one of many physicians collecting plants in his spare time. Neither his medical degree in Padua (1523), nor his short stint in the Roman hospitals (1523–1527), nor even his years as personal physician and political advisor to the bishop of Trent, Bernardo Clesio (1528–1539), had offered any hint of the important role he was about to play in the evolution of medical botany. Bereft of his patron with the death of Clesio in 1539, Mattioli accepted the post of town physician in Gorizia (Görz), a town north of the Friuli in the regions of Italy that still owed strong allegiance to the Holy Roman Emperor.[19] It was here, removed from any immediate contact with the activities of university professors at Bologna and Padua and in a somewhat remote but very interesting corner of the Holy Roman Empire, that Mattioli completed the first version of his Dioscorides.

Undoubtedly Mattioli himself did not fully anticipate the success of his work (though given what we know of his later ambitions, surely he had high hopes that it would eventually get him out of Gorizia). He was one of numerous humanists who, since the late fifteenth century, had aspired to translate and comment on the ancients. As Tiziana Pesenti demonstrates in her detailed study of Mattioli's publications, the earliest version of Mattioli's commentary was a fairly modest work, devoid of the Galenic additions, il-

lustrations, extensive commentary, and lengthy pointed criticisms of the errors of others that emerged in the editions of the 1550s and 1560s.[20] At that stage, Mattioli was still a relatively obscure *protomedico,* perfecting his abilities to transform Jean Ruel's 1516 Latin edition of Dioscorides into a Tuscanized Italian that would do honor to the Greek physician's observations about the natural world. He was not yet the "author" of the text, actively competing with Dioscorides and Renaissance naturalists for the right to proclaim himself Europe's greatest naturalist. Instead he presented himself as a botanist who had entered a vast and long-neglected garden, filled with broken, tangled, and unappreciated plants, and had begun to weed it. Dioscorides, "the most faithful and diligent writer on simples," would be his guide.[21]

The initial response to the 1544 edition encouraged Mattioli to acquire a new publisher, Valgrisi, who added greater prestige to the project and placed it within a growing list of natural histories that he was printing when he brought forth the second edition in 1548, adding a sixth book—a treatise on poisons—to the original five. A pirated edition, with some rudimentary illustrations, appeared in Mantua the following year; both Mattioli and Valgrisi were so incensed that they not only mustered their political connections with the Gonzaga to have any subsequent printings halted but also set to work on a countertext: the edition of 1550. By then, Mattioli and his printer were already contemplating the possibility of a bigger audience. They translated Ruel back into Latin, thereby making the Latin version Mattioli's to sell to European medical students, and introduced illustrations into the book to conform to standards set by the German herbals of Otto Brunfels and Leonhart Fuchs; by 1554 they had created the "best" edition of Dioscorides, virtually cornering the market in *materia medica* textbooks.[22] In the process, they had begun to diminish the status of Dioscorides so that by 1565, Mattioli could state that he had outstripped Dioscorides in his knowledge of nature. So great was the contest between Mattioli and his chosen ancient that by the time his portrait appeared in the 1568 Italian edition (figure 12.1), it was accompanied by the following statement: "If the mind could be portrayed as the body, a portrait of Dioscorides will be of Mattioli."[23]

Mattioli's growing fame initially made him the definitive interpreter of Dioscorides, surpassing all other Renaissance physicians and philologists who had attempted to translate those words. It also secured his status as the foremost commentator on natural history texts of his generation. By 1549 Giovanni Odorico Melchiori called Mattioli's commentary "your Dioscorides." He elaborated: "I want to call it this because it seems to me that not only have you made it yours by having brought it into your native language . . . but by having made clear to all Italy, with most ample discourses, that which was

Figure 12.1
"If the mind could be portrayed as the body, a portrait of Dioscorides would be of Mattioli." Source: Pier Andrea Mattioli, *I discorsi di M. Pietro Andrea Matthioli sanese* (Venice: Vicenzo Valgrisi, 1568). By permission of the Bancroft Library, University of California, Berkeley.

known here by few before."[24] Mattioli, never hesitant to heap praise upon himself, was quick to concur. By the 1552 edition, he described himself as the restorer of ancient learning, inheritor of the task set out by luminaries such as the Ferrarese physician Niccolò Leoniceno (great commentator on and critic of Pliny), who wrenched knowledge from barbarian hands. "I found myself among all others best-suited to bear upon my shoulders . . . the burden of interpreting in Italian Dioscorides's five books on the history and faculty of Simples." In his discourses, as his new version of commentary was called, Mattioli "with measured reasons and faithful authority" corrected the errors of the past and the present.[25] Soon naturalists gave up the pretext of referring to it as a work by a long-dead author and began to call it the "Mattioli." Writing to Aldrovandi in March 1561, the Veronese apothecary Francesco Calzolari noted, "Again a Mattioli has appeared."[26]

Between 1554 and 1577 Mattioli's Dioscorides emerged as the undisputed natural history of its day. "[A]nd when will his book appear?" queried Luca Ghini (1496–1556), the most distinguished naturalist in Italy before Aldrovandi, in December 1553.[27] Within a decade, it had become the talk of the papal and imperial courts, the one book that *any* aspiring naturalist ought to have read.[28] Naturalists recommended that princely patrons examine their hand-illustrated copies of Dioscorides to know more about the latest and most remarkable bits of nature, just as physicians, humanists, and learned apothecaries thumbed through more workaday versions designed more for use than for show. As the most published natural history next to Pliny's *Natural History* and the only ancient natural history that constantly changed to incorporate new information, Mattioli's Dioscorides became the book of record in which to revise scholarly knowledge of plants and a few select animals and minerals included in the final books. Scholars described objects that they sent to each other by referring to specific illustrations and descriptions in Mattioli's commentaries. "I saw that plant that Mattioli calls *androsaces* . . . ," wrote Ambrosio Mariano to Aldrovandi in May 1555. "I am certain that I did not see it among your plants when I was with you. This [specimen] conforms properly to Mattioli's picture."[29] Seeing nature and reading Mattioli's commentary became an ongoing, interactive process that epitomized in many ways the humanist ideal of a living text.

Mattioli's stature grew by leaps and bounds, and with it grew the science of simples. After sending the Holy Roman Emperor Ferdinand I a sumptuously decorated exemplar of his 1554 Latin edition—one that he bragged was more expensive than any book ever before sold or published in Venice[30]—he was rewarded with the post of imperial physician, caring for the emperor's second son of the same name. The Habsburgs so enjoyed Mattioli's presence in Prague that they bankrolled the addition of more notes and

illustrations to the commentaries, allowing the pictures of Dioscorides' 600 plants and animals to grow to 1,200. At the same time, they ennobled Mattioli, his brother, and his eldest nephew and awarded him the post of imperial councillor. When Maximilian II became emperor in 1564, he made Mattioli his personal physician, further enhancing the stature of medical botany within the courtly medical hierarchy through the person of Dioscorides' most famous commentator. Thus from 1554 until 1571, when he retired to Trent, Mattioli participated in the Italian community of naturalists from afar. Nonetheless, it continued to be his primary point of reference. In April 1555, we find him asking to be remembered to "all his Italian friends."[31]

Throughout Italy, naturalists eagerly awaited the next edition—by this time they were appearing almost yearly—and circulated letters among themselves about the virtues and faults of the text. "Give me news of this other Mattioli," wrote the Riminese physician Costanzo Felici to Aldrovandi in 1557. "Will there be anything new when it has come out?"[32] The act of discussing and participating in the continued perfection of Mattioli's commentary became one of the most important communal activities engaging the attentions of Italian naturalists. Indeed, the ability to know, critique, and contribute to the book became a defining feature of this particular scholarly community, quickly elevating Mattioli's Dioscorides above such works as Brunfels's *Living Images of Plants* (1530–1536), Conrad Gesner's *History of Plants* (1541), and Leonhart Fuchs's *History of Plants* (1542) as *the* exemplary publication in natural history. In comparison to Mattioli's fast-paced revisions, all other texts seemed to have a static quality about them, since many were lucky to be published even once. Indeed the lack of news of Mattioli's latest additions to botanical knowledge essentially made one an intellectual outcast. "Mattioli's book with the addition of 135 herbs has not yet spread here," wrote Bartolomeo Maranta with some poignancy from Naples in 1558, "where beautiful things do not come until all the other famous cities have finished with them, which give them to us like the excrement of their wonderful concoctions."[33]

Mattioli himself encouraged these conversations when, in the 1550s, he began to acknowledge in print the assistance of fellow naturalists in the accumulation of material for his new and improved Dioscorides. At the same time, the choleric author sharpened his criticisms of other Renaissance naturalists—not only of previous commentators on Dioscorides such as Ruel, Fuchs, and the Portuguese physician Amatus Lusitanus (1511–1568) but eventually of virtually anyone who *dared* to disagree with him. Perusing the latest edition, one never knew where an acerbic comment—*lapsus Fuchsii, error Ruelli, calumniae Amathi*—might appear. Successive editions of Mattioli's

Dioscorides became a particularly important and visible location in which to define who really belonged to the emerging community of naturalists, at least as it was publicized in those writings, and what the terms of their relationships might be. His Dioscorides became the public document of record in which to inscribe one's presence in this particular sector of the learned world. Mattioli's own egotism about the role his work played in furthering knowledge and forging a sense of community was virtually boundless. When one friend did not thank him immediately for a copy of his book, Mattioli hypothesized that it was solely because he had neglected to include the recipient's name in the acknowledgments (never once entertaining the notion that the friend was mortally ill and therefore unconcerned about the contents of Mattioli's book!).[34]

Judging by the virtual absence of discussion of Mattioli's Dioscorides in the correspondence of naturalists prior to 1553, it seems reasonable to conclude that the preparation of the first Latin edition offered Mattioli the initial opportunity to define what he (and later Linnaeus) would call the botanical "republic." In July 1553 we find him thanking a youthful Aldrovandi for defending his writings "against those rabid dogs who seek to tear them apart."[35] Clearly Aldrovandi had been inscribed within the newly formed botanical republic as a loyal soldier in the battle against intellectual heretics, unchaste minds, and, worst of all, bad botany. Mattioli cultivated Aldrovandi's friendship with a level of craft that might have made even Machiavelli blush. Within months, he had persuaded Aldrovandi to part with two hundred of his most precious simples. Not only did Mattioli neglect to give Aldrovandi a written opinion of them, he also took the entire collection from Gorizia to Prague when he became an imperial physician in 1554, not hesitating to ask for more simples whenever his young colleague could spare them. In return, Mattioli offered Aldrovandi the prospect of being thanked in the preface to his commentary; with his name appearing in the dedicatory letter to the Holy Roman Emperor, Mattioli assured Aldrovandi, he would be "praised and celebrated throughout the world."[36] Surely immortality—and Mattioli had no doubt about the lasting value of his work—was ample compensation for the loss of a couple of hundred specimens?

In the early years of their relationship Aldrovandi was too much Mattioli's junior (and, in a sense, professional inferior) to complain. In 1553 Aldrovandi had not yet received his medical degree from Bologna; he was simply a particularly promising student who happened to possess a lot of natural objects. He shipped his simples and said very little, other than to complain privately to Mattioli's secretary, Giovan Odorico Melchiori, that such treatment did no honor to the meaning of friendship—the bedrock of the

sort of *communitas* that defined intellectual relations among humanists. (To his credit, Melchiori responded that he "blushed at not being able to make good on Mattioli's promise.")[37] In the ensuing decades, as Aldrovandi's fame as a professor and collector grew, he began to insist that Mattioli offer him adequate recognition in the editions of Dioscorides and an occasional mineral or two from the rich deposits within reach of Prague.

By the late 1550s younger naturalists began to actively challenge Mattioli's erratic and imperious citation practices. After sending Mattioli an illustration of a sycamore in 1558, Aldrovandi observed that he had received no specific acknowledgment in the latest edition of the commentaries. Mattioli rushed to respond that he was not "eager to appropriate others' things"—the very accusation Paduan naturalists hurled against him in those same years—and suggested that he thought Aldrovandi was already famous enough to have no need of his praise. He assured his Bolognese colleague that this omission would be remedied in subsequent editions and began the process of moving Aldrovandi's name up through the ranks in his ever-lengthening letter of dedication, displacing other naturalists in turn. Thus by the 1568 edition, one could find praise of Aldrovandi appearing immediately after the encomium of the Habsburgs, botanical elders (Luca Ghini in Pisa and Gabriele Falloppia in Padua), and the first imperial physician (Giulio Alessandrini). Initially thanking Aldrovandi for sending him "hundreds and hundreds of plants"—belated recognition of much of the material that allowed the content of his Dioscorides to swell—Mattioli invoked his name again, a few pages later, when he specifically mentioned the sycamore illustration in question.[38] Mattioli's attentiveness to Aldrovandi's criticisms suggest that he understood well the emerging hierarchy of naturalists within the Italian universities. With Ghini and Falloppia dead, Aldrovandi had become the most important naturalist in Italy and deserved his rightful place in the "paper republic" Mattioli created every time he rewrote his acknowledgments.

III. THE BOTANICAL REPUBLIC

What was the character of Mattioli's botanical republic?[39] First and foremost, it was an *Italian* republic, created to restore glory to Italy in the spirit of Petrarch's and Machiavelli's famous statements to the same effect. While also placing his work in an international context that reflected the permeable borders of the republic of letters, Mattioli nonetheless privileged Italian contributors to the reformation of medical botany. In the preface to his 1557 edition, Mattioli expressed his pleasure at "having known that my lengthy efforts were appreciated by the Italians."[40] Knowledge may have known no

boundaries—indeed, its parameters seemed to expand daily in an age of increased trade, travel, and conquest—yet Mattioli was quite sure where the best knowledge-makers could be found. Attacking the condescension of foreign scholars who honed their intellects in Italy without appreciating the talents of the Italians, he self-consciously echoed the long literary tradition of pitting the Italians against the barbarians. "These Barbarian traitors cannot suffer us Italians raising our heads. Nonetheless what good things they know, they learned in Italy, where they come as beasts and leave as men."[41] The Italy Mattioli envisioned was still the absolute measure of civilization, just as it had been for Pliny in his *Natural History* fifteen hundred years earlier.

Let us consider Mattioli's origins. A member of a leading Sienese family, he strongly identified with the lineage of intellectuals who saw writing in the *volgare* as a political and cultural statement. Hence his Dioscorides was first for Italians and next for the rest of the world. We might even argue that it was primarily for Tuscanized Italians who accepted the assumptions of the Sienese about the superiority of their language, culture, and nature. Although Mattioli spent, at most, two years of his life in Siena, it remained the center of his universe. "You pulled me out of my Tuscan nest, even though it was worth more than any other beautiful country," he wrote in his poem on Bernardo Clesio's palace. Mattioli sent his eldest son to Siena to be educated and boasted of meeting his famous compatriot, the papal banker Agostini Chigi, in Rome. When Giovanna de' Medici married Archduke Ferdinand, a happy fusion of Medici and Habsburg interests, Mattioli immediately rededicated the 1568 Italian edition of his Dioscorides to her.[42]

Coupled with these obvious statements of political allegiance to Tuscany was a strong sense of the natural superiority of this region of Italy. At various points, Mattioli praised "our most magnificent city of Siena" and the "sweet-smelling herbs of those delightful Tuscan hills." He also frequently invoked the natural knowledge of the Tuscans as a counterbalance to the faulty claims of foreigners. When Fuchs attempted to conflate "white thorn" (*Spina bianca*) with thistle (*Cardo*), for example, Mattioli howled at the idea that a plant that grew in the mountains could be the same plant found in the plains, "as all Tuscany bears witness."[43] Tuscany was the first model of nature, followed by the Trentino where Mattioli had spent the better part of his life. It was the source of the best plants, the best language, and the best citizens of the republic of letters. By contrast, foreigners had to earn their academic laurels by sitting at the feet of the Tuscans, most notably Mattioli himself. When the Salernitan physician Maranta dared to criticize Mattioli, Maranta was indicted for "Neapolitan arrogance" and immediately demoted from the status of colleague to disciple (as Mattioli moved his name down in the ranks of the

acknowledged in the preface).[44] Clearly Maranta had not understood the place of the Neapolitans—Spanish subjects rather than free Tuscans—in the botanical republic.

Mattioli's political sensibilities about what it meant to be Italian emerged quite strongly in his description of his book as a garden, for it was not just any sort of garden, an *orto,* but the *orticello di Mattioli.* Given the politicized nature of Mattioli's other statements about what it meant to be Italian, it is not unreasonable to suppose that Mattioli envisioned his work as an improvement on Bernardo Rucellai's Florentine *orti oricellari,* those gardens in which everyone from Machiavelli to Benedetto Varchi had had interesting conversations about nature and politics in the first half of the sixteenth century. Mattioli borrowed liberally from the tradition of describing encyclopedias as gardens and forests when he described his version as "an expanded and amplified garden whose doors will stay perpetually open to anyone."[45] Indeed Mattioli may have tried to re-create this role during his years of service as Bishop Clesio's physician and advisor. We know that Mattioli traveled from Trent to Naples in 1536 to accompany the cardinal to an important meeting with Charles V. He also lived in the bishop's palace in Trent and in the cardinal's family home in Val di Non. Both settings provided Mattioli with the ideal ingredients for the creation of a pastoral enclave in which princes such as Clesio, the de facto ruler of Trent and the first Italian to win this appointment from the Habsburgs, could see studying nature as the perfect complement to the *vita activa.*[46]

Mattioli's community was also a Christian republic, tinged with the language of Tridentine reform that one might expect from a physician working in the vicinity of Trent precisely during those years when the Council (1545–1563) first met. Non-Catholics held no place in the interior of this world, existing instead on the margins to sharpen its definition. Here again Mattioli's personal circumstances undoubtedly had a great deal to do with the strength of his convictions. He had survived the Sack of Rome and arrived in Trent only shortly after the Peasants' Revolt of 1525 had brought rabble-rousing Lutherans to the doorstep of his beloved patron Clesio. Trent initially provided a haven for Mattioli from the troubles of Tuscany, which itself had suffered foreign invasion in the early sixteenth century. But it was not immune from the political and religious battles of the day. Cardinal Clesio's own concerns about the imminent invasion of the Protestants and his prominence in the efforts at church reform paved the way for the arrival of the Council in Trent. As it turned out, it was the Catholic Germans that the bishop-prince of Trent needed to fear. After the Holy Roman Emperor Ferdinand I died his son the Archduke Ferdinand began an aggressive policy of invasion, forcing

Clesio's successor Cristoforo Madruzzo to flee Trent for the safety of Rome between 1568 and 1578.[47] These were difficult times indeed in which to constitute an intellectual community whose boundaries changed with every shift of the political order. Mattioli found himself between two patrons who had once been allies and were now enemies.

What Mattioli's precise views on these events were is hard to say. But we can again discern a marked preference for the Italian side of things in ways that evoke Mattioli's other translation of an ancient text: Ptolemy's *Geography.* At some point during his stay in the Trentino, he sketched a watercolor of the Valli di Non and Sole that depicted the regions, beloved by Clesio, where he had botanized for many years. In it and in his Dioscorides commentaries, he clearly distinguished the Trentino from neighboring Tyrol, in explicit contradistinction to the very policy Archduke Ferdinand attempted to imposed in the 1560s and 1570s.[48] Once again, Mattioli's image of nature reveals his own perspective on the political and religious tensions that divided and shaped the republic of letters. Political experience had taught him to be suspicious of the Germans and other invading foreigners; religious circumstances intensified his distaste for anyone who threatened the integrity of the Catholic faith. One wonders how much of this contemporaries who traveled through Mattioli's chosen parts of Italy understood, since he offered one of the most powerful literary depictions of Italian nature in the sixteenth century. Long after his trip to Trent to visit Camillo Paleotti in 1562, Aldrovandi recalled how they had "visited all those places that Mattioli mentions in his histories."[49]

Drawing on his experiences, Mattioli envisioned the botanical republic as a godly community whose moral equilibrium he constantly assayed. Viewed from this perspective, Mattioli's commentary echoed the language of reform and renewal then popular among Catholic intellectuals such as Carlo Borromeo and Gabriele Paleotti. Describing himself in one of his later editions as someone with the "soul of a Christian physician," Mattioli presented his assessment of the status of various naturalists as a selfless act, done not out of personal spite and a desire for revenge against his detractors "but only to discover the truth for the benefit of the Republic."[50] This republic was implicitly a community of good citizens—worthy men who supported Mattioli's efforts through equally selfless acts. "[T]he chain of virtues and sciences [is] of such value that it binds the hearts so that even those who neither see nor know each other, love each other," he wrote in the preface to his posthumous 1581 edition of Dioscorides, thanking those anonymous donors who had helped Mattioli out of their love for his project and not for his person.[51]

Clarifying the behavior of good citizens in the botanical republic entailed identifying those unworthy souls who lived on the margins of this imagined community. Following such predecessors as Leoniceno, who had viciously attacked Arabic commentators on ancient natural histories in order to exalt the Greeks, Mattioli identified Muslims as a source of unruly and unreliable knowledge. To a certain degree, there was an intellectual basis for such criticisms, for Mattioli successfully corrected numerous errors and ambiguities that plagued medieval accounts of the content of Dioscorides. Yet it was often unclear, as with Pliny, how much the errors lay with Dioscorides, his medieval editors, and the presuppositions that all had brought to bear in assuming that a Mediterranean nature was equivalent to a more global conception of nature. Such ambiguity, however, did not serve Mattioli's own sense of the urgency of separating the damned from the saved. In this and many other instances, political and religious definitions of community strongly influenced the concept of an intellectual community.

Prior to his success with the Holy Roman Emperor in 1554, Mattioli dedicated several Italian versions of his Dioscorides to the bishop of Trent, Cristoforo Madruzzo. Describing how he had found natural knowledge, "from wild animals to the final remains of the last roots of those most noble plants, . . . in the dominion of Moors and Turks, men truly deprived of every gentility and politeness due to the coarseness of their nature," Mattioli neatly linked the barbarisms of foreigners to the barbarisms of the infidel.[52] As he argued, accepting simples from these pagans entailed nothing less than trusting the infidel with the truth of nature; instead, good Catholic naturalists needed to travel east in order to collect specimens themselves. In 1556 Mattioli heeded his own advice when he accompanied the Holy Roman Emperor to Hungary in the war against the Turks. Subsequently he relied on the Habsburg ambassador to the Ottoman court, Ogier Ghiselin De Busbecq, to provide a steady supply of plants and the famous sixth-century Codex Constantinopolitanus of Dioscorides that he consulted for his 1565 edition.[53] Implicitly, Mattioli acknowledged that valuable information about nature, as well as ancient exemplars of the text that he edited, lay in the East. But such materials needed to pass through Christian hands before they could become authoritative.

Mattioli reserved his most vicious criticisms for scholars nearby rather than for unnamed Moors in the distant East. Their disagreements tore more deeply at the fabric of the community he attempted to shape because they revealed the high level of internal dissent among European naturalists about the conclusions to be drawn from new specimens, as well as the confrontation between specimens and descriptions. So contentious was the field of natural

history that shortly after Aldrovandi had accepted his promotion to teach the philosophy of natural history at Bologna, the famous Paduan anatomist Gabriele Falloppia wrote to Aldrovandi attempting to discourage him from moving away from other forms of medical teaching into the full-time teaching of natural history. "[Y]ou will enter a playing field in which there are nothing but angry people who contradict each other, who continuously upset each other and write against each other," he warned in 1561.[54] Mattioli was one of those who figured prominently on Falloppia's list of malcontents, though the surrounding names—essentially a who's who of zoology and botany at that time—suggested that the entire community was deeply divided over the intellectual and empirical outcomes of their work.

Taking Mattioli as our case study, let us examine how he dealt with detractors who enjoyed a similar degree of authority as learned commentators in possession of crucial empirical information. At every opportunity, he sought to discredit their intellectual conclusions by pointing to their flawed moral existence. Foreign naturalists such as Amatus Lusitanus (additionally suspicious as a Jewish *converso*) and the German prefect of the Paduan botanical garden, Melchior Wieland (1520–1589), both of whom publicly disagreed with Mattioli over various plant identifications in the 1550s and 1560s, were incontrovertibly barbaric, the very model of the "bad citizens" whom Mattioli wished to expunge from his botanical republic. So ferocious were their battles that even a century later, botanists still remembered them as a key episode in the history of their discipline. When the engraver chose to portray the history of botany on the frontispiece of Jean Bauhin's *Universal History of Plants* (1650), he included a vignette with the portraits of these three naturalists (figure 12.2). Below it lay one revealing word: *Dissentimus* (We disagree). By then few people read the works of Amatus and Wieland, leaving Mattioli the uncontested champion in the struggle for control of botanical knowledge.

In 1536 Amatus Lusitanus had published a Latin translation of Dioscorides, preceding both Ruel's 1546 translation and Mattioli's subsequent editions. This gave him the authority to comment on Mattioli's work, which he did in his *Enarrationes* (1553); there he noted some twenty mistakes of Mattioli among those of other naturalists. Mattioli now became the object of the sort of printed marginalia that he had used with great effect against others: "Mattioli contradicts himself," "Mattioli errs," and "Mattioli ineptly reproves Theophrastus." Mattioli's fury at Lusitanus, who publicly challenged his position among Renaissance commentators, seemed to increase with every passing year.[55] By the time he published his *Defense against Amatus Lusitanus* (1558), he had uncovered ten items to correct in the latter's work and

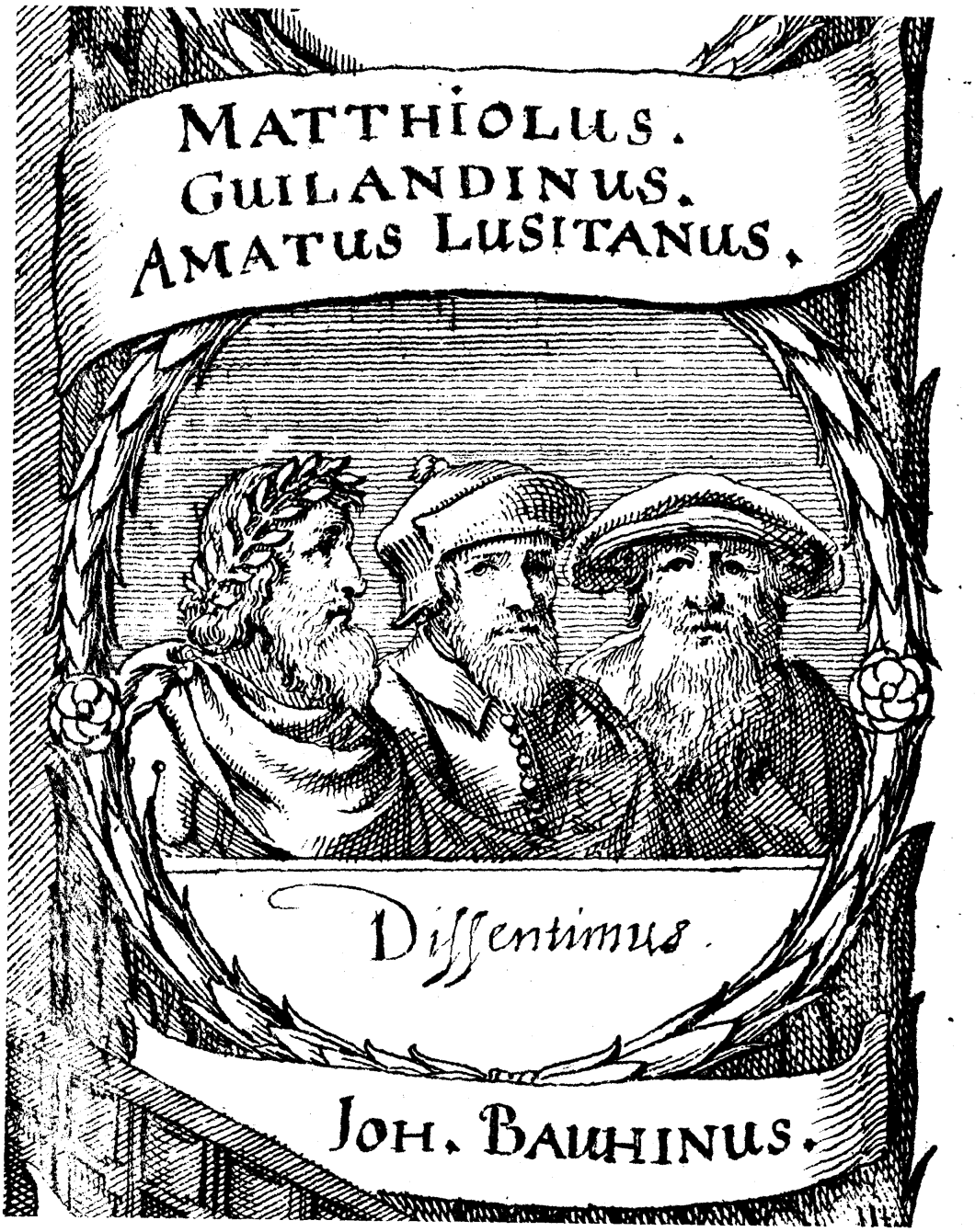

Figure 12.2
Mattioli, Wieland, and Amatus: "We disagree." Source: Jean Bauhin, *Historia plantarum universalis* (1650). By permission of the Research Library of the Getty Research Institute for the History of the Arts and Humanities.

one hundred mistakes to censure. Deliberately misspelling "Amathus" in order to rename Amatus "the Ignorant," Mattioli leveled the full weight of his authority in the medical circles of Catholic Italy against a Portuguese immigrant of dubious Christianity who had attempted to usurp Mattioli in defining the state of botanical knowledge.

In his *Defense,* Mattioli presented himself as working for the republic of letters, whose members demanded censure of Amatus—a judgment of a community rather than an individual. Accusing his Portuguese rival of everything from crypto-Judaism to heresy and apostasy, Mattioli linked criticism of himself to an abuse of the Catholic faith. Indeed, absence of faith became a precondition to dissent: "Just as there is no faith and no religion within you," he accused Amatus, "so in truth you are completely blind as to the medical art which you unworthily profess." He warned Amatus that further criticism would only elevate his, Mattioli's, standing among discerning readers: "Beware that your envy and calumnies do not still further increase and elevate my glory among learned readers and critics."[56] These words proved to be prophetic. Very quickly Amatus found himself out of a job and under suspicion of heresy. Unable to publish his own rebuttal in the face of Mattioli's strong influence among the Venetian printers and his extensive networks of allegiance, Amatus gradually faded from prominence in the botanical republic.

As the debate between Mattioli and Amatus concluded in the late 1550s, Mattioli found a new heretic on whom to lavish his attentions: Wieland. The Prussian botanist acquired knowledge at first vaunted by Mattioli in his earlier attacks against the infidels: he traveled in Greece, Syria, and Egypt during 1558 to 1560, returning to Padua laden with specimens for the university botanical garden. Such information, combined with Wieland's expertise in Greek, emboldened him to challenge Mattioli. The very year Mattioli attacked Amatus, Wieland published his own *Defense against Pier Andrea Mattioli* (1558), critiquing the Italian's translation of Dioscorides. Paper flew fast and furiously between the Venetian Republic and the Holy Roman Empire, as Mattioli attempted to demonstrate the superiority of his humanist skills. Linguistic competence soon became a matter of morality. Accusing Wieland of being nothing less than a "hermaphrodite," Mattioli implied that he had led his Paduan colleague, the anatomist Falloppia, down the path of moral decay through their alleged homosexual relations.[57] If Wieland could not be an apostate then he was surely a sodomite, banned from the botanical Eden of Mattioli's Dioscorides. So censorious was Mattioli of Wieland that when he heard the Prussian was off to Constantinople in search of plants from the East, he imagined this trip as a form of penitence that Wieland had

undertaken for his sins against his botanical superior. Of course, when Wieland returned only to publish further rebuttals of Mattioli's views, redemption became out of the question.

Not all foreign naturalists could be dispensed with through vicious personal innuendo; such tactics were effective only with scholars who shared the same scholarly, publishing, and patronage networks as Mattioli. Mattioli's attitude toward northern European naturalists who did not involve themselves as deeply in the Italian scholarly community suggests how much his strategies for criticism relied on an understanding of the sociology of the republic of letters. For instance, he found no appropriate way to attack Conrad Gesner, the leading zoological authority of the mid–sixteenth century, simply muttering angrily to friends when the Swiss naturalist turned his attention to plants.[58] While more critical of the German Lutheran botanists Fuchs and Brunfels and the French naturalist Pierre Belon, Mattioli launched no personal attack against them. Instead he used his marginalia as a means of highlighting their errors, depicting them as perpetually untrustworthy. Given the success of his commentary, the gradual expansion of this sort of scholarly apparatus surely had its effect on the reputations of his northern colleagues among the Italians; it further reinforced the canonical status of Mattioli's opinion in this realm. At the height of his fame, Mattioli's comments were more copious, his illustrations better, and his criticisms sharper than those of any other rival. No doubt he would have been pleased to hear Sebastiano Soavi's request for "a Mattioli with figures" from Aldrovandi in 1567: "because we have a Fuchs, but it doesn't help very much."[59]

The assaults of other Italians presented Mattioli with some difficulties. If the ideal botanical republic were truly Italian, then how could he expel anyone from that birthright? The solution, it appeared, was a moral one. Italians need never be fully expelled; they had only to repent their sins to be reinstated. Imitating the Renaissance popes, Mattioli issued public sales of indulgences: homage to Mattioli in one's own publications, excellent specimens for his next edition, or a well-crafted letter of praise in Latin for his *Medical Letters* (1561)—a work Mattioli began to prepare in 1553 to immortalize reports of his fame and skill for all time—could earn a naturalist complete forgiveness if he had unwittingly sinned against the monarch of natural history. This, for instance, saved Maranta from expulsion from Mattioli's Eden when the two men could not agree on the correct interpretation of certain statements about the plant *Lonchite aspra*. To avoid the full wrath of Mattioli, Maranta composed a letter "to save his honor without blemishing mine." By the 1581 edition of Mattioli's Dioscorides, all had been resolved;

Maranta appeared between Falloppia and Aldrovandi, praised fulsomely as "the most diligent cultivator of the faculty of plants."[60]

The only unforgivable act an Italian naturalist could commit was to refuse to acknowledge the primacy of Mattioli's Dioscorides. In contrast to Maranta, who was fully redeemed, Aldrovandi's senior colleague in the teaching of natural history at Bologna, Cesare Odone, was placed in the circle of the damned. Describing Odone as his greatest enemy, Mattioli labeled him "piggish, disgraceful, vice-ridden, inhuman, envious, and pugnacious"—all for the alleged crime of refusing to introduce Mattioli's Dioscorides into the Bologna university curriculum (i.e., the crime of preferring other commentaries). On hearing that Odone planned to return to Puglia, Mattioli tartly remarked to Aldrovandi that he hoped Odone would find himself "teaching to locusts."[61] Aldrovandi did not make the same mistake, undoubtedly because he belonged to a younger generation that had begun their apprenticeship in natural history with early versions of Mattioli's commentary. During the 1560s through 1580s, as he lectured on various books in Dioscorides' *De materia medica,* he praised and used his friend's editions. As late as 1595, Aldrovandi was still searching for a hand-colored copy of Mattioli's commentary to add to his library.[62]

The case of Luigi Anguillara (ca. 1512–1570), first prefect to the Paduan botanical garden, is particularly instructive. By 1554 relations between Anguillara and Mattioli were visibly strained. Mattioli collected instances of Anguillara's ignorance and wondered aloud how one of Italy's greatest universities could allow such a man, the "eel-skinner" (a pun on Anguillara's name), to pretend to teach students botany. As far as Mattioli could tell, they didn't even know the difference between basil and lettuce after attending his demonstrations.[63] In retaliation for Anguillara's attempts to publicly correct some of his statements about the natural world, Mattioli removed Anguillara's name from the acknowledgments of the 1554 Latin edition. Confidently he wrote to Aldrovandi, "he will sin and repent since that is always the state of the envious."[64] For the next seven years Mattioli hounded Anguillara, delaying the publication of his *Simples* (1561) with the Venetian printer Valgrisi and impugning his reputation at every opportunity. These activities evidently produced the desired effect, at least temporarily. In June 1559, Mattioli wrote with great satisfaction to Aldrovandi regarding the publication of his latest Italian Dioscorides: "If you have not seen it, try to see it because it has turned out beautifully and, reading the Prologue to the readers, you will be able to see what I have newly said about you and *how I have restored Messer Aluigi to his place*."[65] Mattioli's concept of community emerges

clearly in this final statement: the unfaithful had returned to the flock and order had been regained in the botanical republic. Of course Mattioli's anger would be unleashed again with the appearance of Anguillara's criticisms in print in 1561. But by then he was in the midst of fresh controversies with other naturalists and no longer made the barbarians in Padua the focal point of his attack.

IV. Defining a Scholarly Community

As we read through Mattioli's correspondence and successive editions of his Dioscorides, an interesting and highly idiosyncratic portrait of the community of naturalists emerges. Mattioli's acknowledgments were forms of patronage, but they also forged an image of contemporary natural history that reflected certain aspects of its structure at the middle of the sixteenth century. Mattioli highlighted several types of naturalists in these informal histories of his discipline and placed them in a well-defined relationship to each other. First were the *commentators* on the ancients, humanists such as Ermolao Barbaro, Leoniceno, Antonio Musa Brasavola, Fuchs, Brunfels, and Euricus Cordus—in other words, those scholars who had defined the genre that Mattioli now was perfecting. Even as he struck them down, he needed to maintain the dignity of the work they undertook in order to justify his own stature in the field. Next came the "excellent and most experienced Preceptors of Simples."[66] They were the *institutional* founders of natural history, most notably Ghini, who held the first chair in medicinal simples at both Bologna (1527–1544, 1555–1556) and Pisa (1544–1554), and subsequently Aldrovandi. While Mattioli did not particularly praise prefects of botanical gardens—workers rather than founders—he lauded the Great Council of Venice and the Barbaro family for having the foresight to imagine that the permanent acquisition and collection of plants would be important to the revival of natural history.

Finally Mattioli thanked those *empirical* participants in the study of nature who shared their knowledge with him so that the garden of Mattioli might soon resemble the garden of Eden, restored to perfection. This group was a dynamic entity, ever changing as Mattioli modified his views about who could best participate in the new natural history. In his earliest editions Mattioli excluded apothecaries from this universe "for the most part, for not understanding the Latin volumes of good authors."[67] By the mid-1550s he identified the community of collectors as primarily composed of Italy's most famous physicians (men capable of contributing to his *Medical Letters,* in other words). It was undoubtedly because of the succession of controversies in

which he ensnared himself and his broadened appreciation for the empirical aspects of natural history that Mattioli later relaxed this standard. By 1568 we find him thanking the "noble and virtuous men of talent" who understood the all-consuming importance of Mattioli's project. They included prominent apothecaries such as Francesco Calzolari of Verona and Giulio Cesare Moderati of Rimini as well as the imperial ambassador in Constantinople, Busbecq, who had returned to Prague bearing a Greek codex of Dioscorides for Mattioli.[68]

As the order of acknowledgment suggests, despite the image of natural history as an empirical discipline, it was not quite one yet. Mattioli continued to privilege words over things throughout his entire career; for him, being a commentator and ultimately the new Dioscorides represented the highest position in the botanical republic of letters. Things were ephemeral; but a natural history made of words might last a millennium, creating a true empire of knowledge. His obsessive reworking of his commentaries on Dioscorides indicates his commitment to this way of viewing knowledge.

Contemporaries enamored of the material culture of nature noted and were often appalled by Mattioli's utter disregard for the tangible stuff of their profession. The Venetian patrician Pietro Antonio Michiel, creator of the most famous private botanical garden in Venice during this period, claimed that he did not even want to waste his time reading Mattioli's 1554 Latin commentary: "the Mattioli is not well made and . . . no wonder." Contrasting his enterprise with Mattioli's, he remarked, "It is no novelty to me that with an engraving or dry page and through discourse (*parlare per relatione*) one can do good things. But it needs a labor similar to mine who with diligence and even madness has suffered in raising, nourishing, and seeing plants from their beginning to end."[69] Elsewhere he remarked that what few bits of nature Mattioli deigned to send him were often old and not fresh. Mattioli, in other words, did not tend to the true garden of nature, being ever preoccupied with the paper garden he had created with the help of artists, engravers, and printers.

Aldrovandi, the recipient of this letter, shared Michiel's frustration. Despite his many requests for plants and minerals from Mattioli, who had full access to the diplomatic networks of the Habsburgs in acquiring fresh material for his own work, he rarely received anything but praise from his friend in Prague. At times Mattioli suggested that Aldrovandi surely had enough specimens in his museum in Bologna—how could one more matter? Yet Mattioli also denied Aldrovandi his share of the imperial spoils because he felt that a collector would not do anything with them that truly constituted knowledge. "[Y]ou know," he reminded Aldrovandi in 1566, "that I have

never cared to observe dried plants, save for some of the rarest ones, having resolved that I do not wish to show them except in my commentaries where they are printed."[70] Such statements reflected not only Mattioli's optimism about his abilities to discern the truth of nature and record it in words and image, but also his sense that commenting on nature was surely a higher calling than collecting it.

From this perspective, Mattioli is seen to belong to a botanical republic that was in its twilight years as the sixteenth century came to a close. "[N]othing was ever greater in my prayers than to help the republic for posterity," he observed. Elsewhere he remarked that the costs of his project had been well worth it because it had been undertaken for the "profit of the entire community of the republic."[71] By the end of his long career Mattioli had probably acquired more detractors than admirers; few mourned his passing in 1577, as they had Luca Ghini's when he died in 1556.[72] By the time of Mattioli's death his project had run its course. Even Aldrovandi, who was Mattioli's logical successor in this enterprise, proclaimed himself a new Aristotle by writing his *own* natural history, based on the objects and books in his "theater of nature," rather than by commenting on Aristotle. In his philosophical history of nature—a project that Mattioli, with his preference for Dioscorides and for the *volgare,* surely did not share—Aldrovandi gave expression to a new vision of natural history as a discipline defined not by the world of one book but by the further institutionalization and expansion of an academic discipline. Nonetheless, Aldrovandi acknowledged the canonical status of Mattioli's publishing project when he instructed his own printer to produce his *Natural History* in the image of Mattioli's Dioscorides.[73]

Print culture, collecting practices, a new curriculum, humanist rhetoric, and epistolary consciousness all played important roles in the emergence of natural history in Renaissance Italy. No one activity defined what it meant for natural history to become a discipline, yet all of these factors shaped the process of interacting with new information. Contributing, reading, and reacting to Mattioli's Dioscorides was a formative experience for this early generation of naturalists. While others set the standard in the field and in the museum, Mattioli set the standard in print. And in print he stayed, throughout the sixteenth and much of the seventeenth century. His rapid and virtually unprecedented ascent in the world of courtly medicine did not transform natural history into natural philosophy; that was not his goal. But it surely provided a stronger foundation from which later naturalists such as Aldrovandi both made claims about the superiority of their chosen field and expanded that field from the narrow definition of medical botany to the more encyclopedic idea of natural history.[74]

Did Mattioli truly understand the botanical republic as a *disciplinary* community? That is a very hard question to answer. If we define discipline solely in terms of some sort of academic consciousness of the boundaries of knowledge, then we should probably begin our inquiry rather with Aldrovandi, who displayed a much greater self-consciousness about what it meant to be a *naturalist* and who actively created opportunities for himself to teach the whole of natural history. "I am pleased to hear of the high rank to which you have been elected to the chair in the natural philosophy of plants, animals, and fossils," wrote Maranta to Aldrovandi in 1561, "ordinarily teaching one and then the other intermittently, since they certainly are timely courses, worthy of every great and rare man." That same year others also marveled that Aldrovandi was teaching "Aristotle's history of animals, of metals, and who knows what else," when they heard about his latest promotion.[75] While Mattioli's expanded commentary on Dioscorides grew to include a few animals, it continued to emphasize botanical knowledge as the centerpiece of the Renaissance project in natural history. Yet in not excluding nonherbal materials, it created an important precedent for the work of later naturalists. Mattioli corresponded with and read a range of scholars who worked on many different parts of nature, so it is difficult to make hard-and-fast divisions between botanists and naturalists. He represented a crucial step in the process of transforming natural knowledge from an ancient form of learning into a kind of scientific inquiry that drew on the resources of an entire community to establish what was known.

Disciplines can emerge in many different ways. Certainly outsiders viewed Mattioli as one of the principal makers of a newly emerging field and identified it as a professional and intellectual pursuit that could be separated from other aspects of the medical profession. In his *Universal Piazza of All the Professions of the World* (1585), for example, Tommaso Garzoni included a chapter on "simples and herbalists" that described the revival of this ancient art in "modern times." Providing his readers with a list of its most distinguished participants, he highlighted "the work of Mattioli who, learning infinite things from Luca Ghini (in the science of simples undoubtedly the Prince), not many years ago commented in a most praiseworthy fashion on the work of Dioscorides, famous in this discipline."[76] In the eyes of Garzoni, an astute observer of the formation of identities, Mattioli belonged to an early modern profession that had brought an ancient discipline to its fruition.

The unique and unheralded success of Mattioli's Dioscorides as a publishing phenomenon created an important forum in which to think about the state of a field of knowledge and to define its participants with great precision. Its monopoly over the reading lives of other naturalists indicates that they

pondered carefully what Mattioli said about who and what counted in the republic of letters as well as how to view and record nature. Mattioli's artificial delimitation of his botanical republic as a community of Italian Catholics did not have lasting value, though it certainly reflected the tensions between the ideal of an international scholarly community and the realities of local intellectual networks; at a minimum, he helped implant the notion among Italian naturalists that they had preceded their northern European counterparts in offering a new and better interpretation of the natural world, even if this was not exactly true. Yet he also did much more than that: by identifying repeatedly in print the participants in the Italian project of reforming nature to each other, and by describing them as a community that collaborated around his book, Mattioli memorialized a set of relationships that existed not purely as a paper fantasy of one individual but also as a thriving intellectual network that self-consciously managed natural knowledge in the sixteenth century. In this way, the experience of reading Mattioli actively shaped and disciplined the community of naturalists, forcing them to contemplate the paradoxes of a "republic" ruled by an aging and autocratic monarch, whose own sense of community reflected the unique political and intellectual situation in which Italians found themselves at the end of the Renaissance.

NOTES

Thanks especially to Daniel Brownstein, Alix Cooper, Tom Kaufmann, and the anonymous referee for helping to improve this essay.

1. Bologna, Biblioteca Comunale dell'Archiginnasio, s. XIX. B3803, Ulisse Aldrovandi, *Informazione del rotulo del studio di Bologna de Ph[ilosoph]i et Medici all'Ill[ustrissi]mo Card[inale] Paleotti* (27 September 1573), esp. cc. 4r–6v. On Paleotti's educational reforms, see Paolo Prodi, *Il Cardinale Gabriele Paleotti (1522–1597),* 2 vols. (Rome: Edizioni di Storia e Letteratura, 1959–1967).

2. The locus classicus for this sort of inquiry is Robert S. Westman, "The Astronomer's Role in the Sixteenth Century," *History of Science* 18 (1980): 105–147. See also the more recent work of Mario Biagioli, in particular "The Social Status of Italian Renaissance Mathematicians, 1450–1600," *History of Science* 27 (1989): 41–95. For an overview of the relative status of different scientific disciplines in the Italian universities, see Charles Schmitt, "Science in the Italian Universities of the Sixteenth and Early Seventeenth Centuries," in *The Emergence of Science in Western Europe,* ed. Maurice Crosland (London: Macmillan, 1975), pp. 35–56; and idem, "Philosophy and Science in Sixteenth Century Italian Universities," in his *Aristotelian Tradition and the Renaissance Universities* (London: Variorum, 1984), pp. 297–336.

3. "Simples" referred to those natural objects that formed the basic components of premodern medicaments; they were the object of the ancient art of *materia medica,* as prac-

ticed by Galen and Dioscorides, from which natural history emerged. In other words, the presentation of natural history in the Renaissance university curriculum initially stressed its medicinal value rather than its philosophical significance, *materia medica* over *historia naturalis*. Since *materia medica* was largely humoral, it emphasized herbal remedies over other treatments; this helps explain the dominance of botany as the primary and most distinctive form of disciplinary identity among Renaissance naturalists. Yet the category "simples" also included animals and minerals of medicinal value, which is one of the reasons I will use the terms "medical botany" and "natural history" alternately in this essay: the two subjects were closely intertwined.

4. I have discussed the genealogy of natural history in relationship to the growth of collecting in my *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (Berkeley: University of California Press, 1994).

5. For background to the intellectual development of natural history, see Roger French, *Ancient Natural History* (London: Routledge, 1994). There is considerably less work on medieval natural history, but see Jerry Stannard, "Natural History," in *Science in the Middle Ages,* ed. David C. Lindberg (Chicago: University of Chicago Press, 1976), pp. 429–466; and David C. Lindberg, "Natural History," in his *Beginnings of Western Science: The European Scientific Tradition in Philosophical, Religious, and Institutional Context, 600 B.C. to A.D. 1450* (Chicago: University of Chicago Press, 1992), pp. 348–353.

6. Bologna, Archivio Isolani, *Fondo Paleotti* 59 [F 30] 29/7; Ulisse Aldrovandi to Camillo Paleotti, Bologna, 11 December 1585.

7. Bologna, Archivio Isolani, *Fondo Paleotti* 59 [F 30] 30/2; Camillo Paleotti, *Memoriale del Dottore Aldrovandi* (1599). I have dated this by internal evidence in the text.

8. Schmitt, "Science in the Italian Universities."

9. For further discussion of natural history's disciplinary status at this time, see Agnes Arber, *Herbals, Their Origin and Evolution,* 3rd ed. (Cambridge: Cambridge University Press, 1986); Karen Reeds, *Botany in Medieval and Renaissance Universities* (New York: Garland, 1991); N. Jardine, J. A. Secord, and E. C. Spary, eds., *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996), pp. 57–75; and Paula Findlen, "Francis Bacon and the Reform of Natural History in the Seventeenth Century," in *History and the Disciplines: The Reclassification of Knowledge in Early Modern Europe,* ed. Donald Kelley (Rochester, N.Y.: University of Rochester Press, 1997), pp. 239–260. On the definition and emergence of scientific disciplines, Rudolf Stichweh's "Sociology of Scientific Disciplines: On the Genesis and Stability of the Disciplinary Structure of Modern Science," *Science in Context* 5 (1992): 3–15, is particularly interesting, though my conclusions on the historical emergence of disciplines differ somewhat from his.

10. Bologna, Archivio Isolani, *Fondo Paleotti* 59 [F 30] 29/7; Mario Cermenati, "Francesco Calzolari e le sue lettere all'Aldrovandi," *Annali di botanica* 7 (1908): 101.

11. On the debates about Pliny, see Lynn Thorndike, "The Attack on Pliny," in his *History of Magic and Experimental Science* (New York: Columbia University Press, 1923–1958), 4:593–610; Arturo Castiglioni, "The School of Ferrara and the Controversy on Pliny," in *Science, Medicine, and History,* ed. E. Ashworth Underwood (Oxford: Oxford University

Press, 1953), 1:269–279; Charles G. Nauert, "Humanists, Scientists, and Pliny: Changing Approaches to a Classical Author," *American Historical Review* 84 (1979): 72–85; and Giovanna Ferrari, "Gli errori di Plinio: Fonti classiche e medicina nel conflitto tra Alessandro Benedetti e Niccolò Leoniceno," in *Sapere e/è potere: Discipline, dispute e professioni nell'università medioevale e moderna* (Bologna: Istituto per la storia di Bologna, 1990), 2, ed. A. Cristiani: 173–204. For a more general discussion of natural history as a humanistic discipline that situates these debates within a broader context, see Karen Reeds, "Renaissance Humanism and Botany," *Annals of Science* 33 (1976): 519–542

12. Costanzo Felici, *Lettere ad Ulisse Aldrovandi,* ed. Giorgio Nonni (Urbino: Quattro Venti, 1982), p. 28 (Rimini, 8 September 1555); Cermenati, "Francesco Calzolari," p. 101 (Verona, 23 February 1555).

13. This process of interacting with texts is also explored in Anthony Grafton, *Commerce with the Classics: Ancient Books and Renaissance Readers* (Ann Arbor: University of Michigan Press, 1997).

14. On the editions of Dioscorides, see John M. Riddle, "Dioscorides," in *Catalogus Translationum et Commentarium: Medieval and Renaissance Latin Translations and Commentaries,* ed. F. Edward Cranz and Paul Oskar Kristeller (Washington, D.C.: Catholic University of America Press, 1980), 4:1–144. See also Sara Ferri, "Pier Andrea Mattioli dai discorsi sulla materia medica," *Atti dell'Accademia delle Scienze di Siena detta de' Fisiocritici,* ser. 16, 10 (1978): xxii–xxxiv.

15. Jerry Stannard, "Dioscorides and Renaissance Materia Medica," in *Materia Medica in the Sixteenth Century,* ed. Markus Florkin, Analecta Medico-Historica 1 (Oxford: Pergamon, 1966), p. 1; Giuseppe Fabiani, *La vita di Pietro Andrea Mattioli,* ed. Luciano Benchi (Siena: G. Bargellini, 1872), p. 29.

16. Pier Andrea Mattioli, *I discorsi d. M. Pietro Andrea Mattioli sanese* (Venice: Vincenzo Valgrisi, 1568), vol. 1, sig. **r; Tiziana Pesenti, "Il 'Dioscoride' di Pier Andrea Mattioli e l'editoria botanica," in *Trattati di prospettiva, architettura militare, idraulica e altre discipline* (Venice: Neri Pozza, 1985), p. 84. The following book appeared after this essay was completed: Sara Ferri, ed., *Pietro Andrea Mattioli, Siena 1501–Trento 1578, la vita, le opere* (Perugia: Quattroemme, 1997).

17. For some points of comparison, see Lucien Febvre and Henri-Jean Martin, *The Coming of the Book,* trans. David Gerard (London: Verso, 1984), pp. 218–219, 274–275; a more general overview is offered in Elizabeth Eisenstein, *The Printing Press as an Agent of Change,* 2 vols. (Cambridge: Cambridge University Press, 1979).

18. See Donzellino's letter in Pier Andrea Mattioli, *Epistolarum medicinalium libri V* (Prague, 1561), book 4. Quoted in Fabiani, *Vita,* p. 29 n. 1. On Erasmus' own strategies for success, remarkably parallel to those of Mattioli, see Lisa Jardine, *Erasmus, Man of Letters: The Construction of Charisma in Print* (Princeton: Princeton University Press, 1993).

19. For this period of Mattioli's life, see Franco Pedrotti, "Pietro Andrea Mattioli e il Trentino," in *I giardini dei semplici e gli orti botanici della Toscana,* ed. Sara Ferri and Francesca Vannozzi (Perugia: Quattroemme, 1993), pp. 193–200; Giulio Cenci, "Nel IV centenario della venuta di Pier Andrea Mattioli nel Trentino," *Studi trentini di scienze naturali* 9

(1928): 34–58; and Franco Ottaviani, "Quattro generazioni di medici trentini (1539–1658)," in *I Madruzzo e l'Europa, 1539–1658: I principi vescovi di Trento tra Papato e Impero,* ed. Laura Dal Prà (Milan: Charta, 1993), pp. 673–677.

20. Pesenti, "Il Dioscoride," pp. 67–70; Jerry Stannard, "P. A. Mattioli: Sixteenth Century Commentator on Dioscorides," *Bibliographical Contributions, University of Kansas Libraries* 1 (1969): 68.

21. Pier Andrea Mattioli, *Di Pedacio Dioscoride Anazarbeo libri cinque dell'istoria e materia medicinale, tradotto in lingua volgare italiana da M. P. Andrea Matthioli sanese medico, con amplissime annotationi et censure* (Venice: Niccolò de' Bascarini da Pavone di Brescia, 1544), preface.

22. As Karen Reeds suggests, this was no small market; see her "Publishing Scholarly Books in the Sixteenth Century," *Scholarly Publishing,* April 1983, 259–272. Creating a definitive textbook for medical students (hence the necessity of a Latin edition) immediately made Mattioli's commentaries an international bestseller. Of course Mattioli had already boasted prior to 1554 that foreign scholars were attempting to read the Italian version because it contained such important information. Typically, Mattioli gave very little credit to Jean Ruel for creating the template for his version of Dioscorides. Ruel was acknowledged briefly in his preface of 1554, where Mattioli claimed to have "modernized" the French author's Latin. See Riddle, "Dioscorides," p. 33.

23. This transition offers interesting parallels with Erasmus' attitude toward Saint Jerome in the early sixteenth century: "Though why should it any longer look like something borrowed rather than my own?" he wrote. Quoted in Jardine, *Erasmus,* p. 68.

24. Giovanni Odorico Melchiori to Mattioli, Venice, 20 October 1549, in Mattioli, *Discorsi* (1568), vol. 1, sig. ***3v.

25. Pier Andrea Mattioli, *Il Dioscoride dell'Eccellente Dottor Medico M. P. Mattioli da Siena* (Venice: Vincenzo Valgrisi, 1552), sig. a. 2v.

26. References to the book as the "Mattioli" appear as early as 1553; see G. B. De Toni, *Cinque lettere inedite di Luca Ghini ad Ulisse Aldrovandi* (Padua: Tipografia Seminario, 1905), p. 13. Calzolari's letter is reproduced in Cermenati, "Francesco Calzolari," p. 115 (Verona, 3 March 1561).

27. De Toni, *Cinque lettere,* p. 12 (Ghini to Aldrovandi, Pisa, 14 December 1553).

28. "Today it is rumored in the papal palace by men who delight in minerals, plants, and every sort of animal, and almost everyone says that the Mattioli is rare." G. B. De Toni, "Spigolature aldrovandiane XIV: Cinque lettere inedite di Antonio Compagnoni di Macerata ad Ulisse Aldrovandi," *Rivista di storia critica delle scienze mediche e naturali* ser. 6, 3 (1915): 48 (Antonio Compagnoni to Aldrovandi, Rome, 17 April 1563). Similarly in his *studio* in Bologna in the 1570s, Antonio Giganti had only one book that he placed on the table in the midst of his objects—*Il Dioscoride;* see Gigliola Fragnito, *In museo e in villa: Saggi sul Rinascimento perduto* (Venice: Arsenale, 1988), p. 165.

29. Bologna, Biblioteca Universitaria (hereafter cited as BUB), Aldrovandi MS 382, I, c. 260 (Macerata, 25 May 1555)

30. C. Raimondi, "Lettere di P. A. Mattioli ad Ulisse Aldrovandi," *Bullettino senese di storia patria* 13, nos. 1–2 (1906): 19 (Mattioli to Aldrovandi, Gorizia, 17 February 1554).

31. G. B. De Toni, "Spigolature aldrovandiane XXI: Un pugilio di lettere di Giovanni Odorico Melchiori Trentino ad Ulisse Aldrovandi," *Atti del Reale Istituto Veneto di scienze, lettere ed arti* 84, part 2 (1924–1925): 612 (Melchiori to Aldrovandi, Gorizia, 1 April 1555).

32. Felici, *Lettere ad Ulisse Aldrovandi,* p. 37 (Rimini, 30 September 1557).

33. BUB, Aldrovandi MS 382, I, c. 90v (Maranta to Aldrovandi, Naples, 6 March 1558).

34. Raimondi, "Lettere," p. 22 (Gorizia, 20 May 1554).

35. Ibid., p. 13 (Gorizia, 12 July 1553).

36. Ibid., p. 18 (Gorizia, 27 December 1553).

37. De Toni, "Spigolature aldrovandiane XXI," p. 608 (Venice, 17 October 1554).

38. Mattioli, *Discorsi* (1568), vol. 1, sigs. ⋆⋆2v, ⋆⋆⋆4r–v. Compare this dedication to the one in the 1557 edition, in which Aldrovandi appears *after* Andrea Lacuna (a Galenic commentator) and Bartolomeo Maranta, without any special mention.

39. The events surrounding Mattioli's work offer a bird's-eye view into the workings of the sixteenth-century republic of letters. Recently this subject has received renewed attention. See particularly Jardine, *Erasmus;* Ann Goldgar, *Impolite Learning: Conduct and Community in the Republic of Letters, 1680–1750* (New Haven: Yale University Press, 1995); and Hans Bots and Françoise Waquet, *La république des lettres* (Paris: Belin–De Boeck, 1977).

40. Pier Andrea Mattioli, *I discorsi di M. Pietro Mattioli Medico sanese* (Venice: Vincenzo Valgrisi and Baldassar Costantini, 1557), sig. A.4v.

41. Raimondi, "Lettere," p. 40 (Prague, 29 January 1558); see also p. 42.

42. Pier Andrea Mattioli, *Il Magno Palazzo del Cardinale di Trento* (1539), in Ferri and Vannozzi, *I giardini dei semplici,* p. 193. Mattioli's 1581 and 1585 Italian editions also were dedicated to Giovanna de' Medici.

43. Ferri, "Pier Andrea Mattioli," pp. xxviii–xxix; Mattioli, *Discorsi* (1557), p. 323.

44. Raimondi, "Lettere," p. 57 (Prague, 29 October 1561).

45. Mattioli, *Discorsi* (1568), vol. 1, sig. ⋆⋆v; Felix Gilbert, "Bernardo Rucellai and the Orti Oricellari," *Journal of the Warburg and Courtauld Institutes* 12 (1949): 101–131.

46. Pedrotti, "Pier Andrea Mattioli," pp. 193–197. On Clesio's role in sixteenth-century political and religious life, see Paolo Prodi, ed., *Bernardo Clesio e il suo tempo,* 2 vols. (Rome: Bulzoni, 1987); and Dal Prà, *I Madruzzo e l'Europa,* pp. 15, 30.

47. Klaus Ganzer, "Clesio e la riforma protestante," in Prodi, *Bernardo Clesio,* 1:149–175; and Marco Bellabarba, "Il principato vescovile di Trento e i Madruzzo: L'Impero, la Chiesa, gli stati italiani e tedeschi," in Dal Prà, *I Madruzzo e L'Europa,* pp. 29–42.

48. Mattioli's *Le valli d'Annone e Sole* (ca. 1527–1542), is preserved in the Biblioteca Communale of Trent and discussed in Bellabarba, "Il principato vescovile di Trento e i Madruzzo," p. 137. On Mattioli's geography, see Cenci, "Nel IV Centenario della venuta di Pier Andrea Mattioli," p. 47.

49. BUB, Aldrovandi MS 21, IV, c. 66v (*Trattato della utilità et eccellenza delle lettura dell'hist[oria] natur[ale] sensata,* n.d.).

50. Pier Andrea Mattioli, *I discorsi di M. Pietro Andrea Mattioli* (Venice: Vincenzo Valgrisi, 1581), sig. **6r. For a theoretical discussion of the moral status of scientific endeavor, see Lorraine J. Daston, "The Moral Economy of Science," *Osiris,* n.s. 10 (1995): 2–24.

51. Mattioli, *Discorsi* (1581), sig. **2v.

52. Mattioli, *Il Dioscoride,* sig. a2r.

53. Riddle, "Dioscorides," p. 92, and Ferri, "Pier Andrea Mattioli," p. xxviii.

54. Falloppia is quoted in Giovanni Fantuzzi, *Memorie della vita di Ulisse Aldrovandi* (Bologna, 1774), p. 210 (Padua, 23 January 1561).

55. All the material in this passage, including quotations, is taken from Harry Friedenwald, "Amatus Lusitanus," *Bulletin of the History of Medicine* 5 (1937): 617–623. Both Amatus' *Enarrationes* and Mattioli's *Apologia* were extremely popular. The former went into six editions between 1563 and 1565 and the latter enjoyed an even longer life; it was reprinted as late as 1674.

56. Pier Andrea Mattioli, *Apologia adversus Amatum Lusitanum cum Censura in eiusdam enarrationes* (Venice: Vincenzo Valgrisi, 1559), p. 20. I have used Friedenwald's translation in "Amatus Lusitanus," p. 621.

57. Raimondi, "Lettere," p. 41 (Prague, 26 November 1558). On Wieland's publications, see Riddle, "Dioscorides," pp. 86–87, and Giorgio E. Ferrari, "Le opere a stampa del Guilandino: Per un paragrafo dell'editoria scientifica padovana del pieno Cinquecento," in *Libri e stampatori in Padova: Miscellanea di studi storici in onore di Mons. G. Bellini* (Padua: Antiniana, 1959), pp. 377–463. For further discussion of Wieland's polemics against other humanists, see Anthony Grafton, "Rhetoric, Philology, and Egyptomania in the 1570s: J. J. Scaliger's Invective against M. Guilandinus's *Papyrus,*" *Journal of the Warburg and Courtauld Institutes* 42 (1979): 167–194.

58. Mattioli wrote: "I hate that now he writes about plants." Raimondi, "Lettere," p. 4.

59. Alessandro Tosi, *Ulisse Aldrovandi e la Toscana: Carteggio inedito testimonianze documentarie* (Florence: Olschki, 1989), p. 180 (Camaldolo, 25 April 1567). On the issue of trustworthiness, see Steven Shapin's *Social History of Truth: Civility and Science in Seventeenth-Century England* (Chicago: University of Chicago Press, 1994).

60. For the letter, see G. B. De Toni, "Nuovi documenti sulla vita e sul carteggio di Bartolomeo Maranta," *Atti del Reale Istituto Veneto di scienze, lettere ed arti,* ser. 8, 14, part 2 (1911–1912): 1554 (Naples, 7 January 1561).

61. Raimondi, "Lettere," pp. 31–32 (Ratisbon, 19 January 1557).

62. Aldrovandi wrote, "Remember that Signor Nicolò Manossi in Venice writes that he has Mattioli on Dioscorides with the plants colored naturally." BUB, Aldrovandi MS 136, XXV, c. 87r.

63. Raimondi, "Lettere," p. 26 (19 September 1554).

64. Ibid., p. 24 (n.d., ca. June/July 1554). "From my book by now they have been cancelled . . ."

65. Ibid., p. 47 (Prague, 12 June 1559), emphasis mine; see Pesenti, "Il Dioscoride," p. 87.

66. Mattioli, *Il Dioscoride,* p. 7.

67. Ibid., sig. i.2r.

68. Mattioli, *Discorsi* (1568), vol. 1, sigs. **2r–v, **4v. On the role of physicians, see idem, *Discorsi* (1557), sig. Br. For a more detailed discussion of Mattioli's changing attitude toward collectors, see Paula Findlen, "Possedere la natura," in *Stanze delle meraviglie: I musei della natura tra storia e progetto,* ed. Luca Basso Peressut (Bologna: CLUEB, 1997), pp. 25–48.

69. Quoted in G. B. De Toni, "Contributo alla conoscenza delle relazioni del patrizio veneziano Pietro Andrea Michiel con Ulisse Aldrovandi," *Memorie della Reale Accademia di scienze, lettere ed arti in Modena,* ser. 3, 9 (1910): 41 (Venice, 10 April 1554). For another example of this critical view of Mattioli's work, see BUB, Aldrovandi MS 382, IV, c. 42v (Antonio Anguisciola to Aldrovandi, Piacenza, 15 December 1565).

70. Raimondi, "Lettere," p. 58 (Prague, 25 February 1566).

71. Mattioli to Aldrovandi, in Fabiani, *Vita,* p. 39 n. 2; see Pesenti, "Il Dioscoride," p. 89.

72. Space does not permit me to explore the circumstances surrounding Ghini's death, but this was surely the other formative moment for this same community of naturalists; it raised all sorts of issues about intellectual and institutional genealogies, the concept of natural knowledge as a form of patrimony, and the image of the botanical community as a well-defined family.

73. Pesenti, "Il Dioscoride," p. 103.

74. The essays in Vivian Nutton, ed., *Medicine at the Courts of Europe, 1500–1837* (London: Routledge, 1990), provide a useful introduction to the sort of position that Mattioli held.

75. Fantuzzi, *Memorie,* pp. 186–187 (Maranta to Aldrovandi, Naples, 20 April 1561); p. 210 (Falloppia to Aldrovandi, Padua, 23 January 1561).

76. Tommaso Garzoni, *La piazza universale di tutte le professioni del mondo* (Venice, 1651), p. 155.

13

Empiricism and Community in Early Modern Science and Art: Some Comments on Baths, Plants, and Courts

Thomas DaCosta Kaufmann

Stressing the nonquantitative aspects of science, this collection challenges a traditional historiography of science. History of science of the early modern period has tended to concentrate on physics and astronomy, most familiarly in accounts of the "Scientific Revolution." Emphasis on figures such as Bacon, Descartes, Kepler, and Galileo has also led to concentration on mathematics, on processes of reasoning, on induction, and on the role of experiment. Because of this focus on the quantitative, which is sometimes said to have marked the shift from earlier modes of "pre-" or "nonscientific" thinking, the role in the development of "science" of other aspects of investigation that might be called qualitative has been little noted. As a result, other sorts of observational processes have been understudied, other aspects of empiricism or an empirical approach ignored, and, finally, other sciences marginalized.[1]

The present paper responds to these issues as epitomized by Paula Findlen's and Katharine Park's essays in this volume. Park directly challenges some traditional emphases in her assertion of the importance and priority of medicine at the dawn of the Renaissance. For, with certain notable exceptions,[2] medicine has not usually received its due. Where its relation to the Scientific Revolution has not been simply neglected, the role of medicine has vexed rather than attracted historians of science.[3]

Findlen offers another, albeit implicit, challenge to an older "internal" historiography of science that tended to limit concerns to issues of method, theory building, or the accumulation of knowledge as an independent process. She follows the current of a few earlier treatments of the social or sociological parameters of scientific investigation that had also suggested that the definition of what constitutes science itself may change according to the societal circumstances in which its activities are pursued.[4] In this way the self-definition of science can be linked to the development of a scientific community. Findlen suggests how the change in conception of science may be related to the establishment of a scientific community in sixteenth-century Italy and to specific modes of community building.

The scope of both arguments can be expanded. While Park's and Findlen's papers may be situated in a more general historiographic context, they can of course first be considered in relation to the challenging work that both scholars have already produced. For example, in her book on early Renaissance medicine, Park establishes a distinction between the practice of empirics and the creation of medical theory by scholars at universities.[5] She characterizes the medical profession as one that contained both a small group of university-trained, and accordingly theoretically oriented, doctors and a whole collection of folk healers and other sorts of empirics. The world of early Renaissance medicine provided many contacts between these two disparate groups, and in this world practical therapeutics outside of the accepted academic medical tradition were demonstrably important for the historical development of medicine.

In her essay in this collection, Park extends her examinations further in place and time. Examining physicians not in Republican Florence but at the courts of northern Italy ca. 1400, she finds traces of activities and interests that, while not the same as those of seventeenth-century science, seem to anticipate them. These include most significantly an interest in the causal study of natural phenomena, and therefore in actual observed particulars. According to Park a new tradition of empirically based knowledge is to be found already in "one of the first attempts by philosophically trained European writers to develop a method of natural inquiry based on the study of particular natural phenomena"—in balneological treatises. The study of baths was undertaken for aristocratic patrons: some treatises were written in response to explicit request. These circumstances provide a much different social context for the empirical study of natural phenomena than does either Republican Florence or the Italian university and the *doctrina* promulgated therein.

Park's concern with this sort of question not only provides a link between some of her interests and Findlen's approach but also opens up a further line for inquiry that draws near to Findlen's topic. Like Findlen, Park mentions a nascent community of inquirers working together to accumulate and collate new information. It was this community that would determine the empirical validity of observation. But this community and its court connections may be related to another sort of investigation of nature, one that took place in many of the same places, at much the same time, and involved many of the same sorts of scholars and patrons who were concerned with balneology. Moreover, those engaged in this enterprise also had an obvious interest in particulars, as well as in an accumulation of observations.

This was the tradition of the herbal book, which is in fact also central to Findlen's concerns. Physicians would have been interested in both sorts of

information, balneological and herbal. Both traditions represent and result from the approach of natural history, the study of matters that were not quantifiable but were, especially in the instance of herbals, nevertheless replicable, classifiable, and homologous. Both balneological and herbal sources provided information for medical practice that could have been derived from observation.

Most important, an ancient text that provided an authoritative source for the very *doctrina* on which that practice was based could have created a crucial connection between these interests. The book on plants (*Peri phytōn, De plantis*) associated with Aristotle in earlier times, though now usually attributed to the first-century-C.E. Greek philosopher Nicholas Damascenus, furnishes a link between the study of herbs and that of baths.[6] In a passage in 2.3, this Aristotelian treatise accounts for the composite constitution of wild herbs by reference to the origin of saltwater. The account entails an observation about the precipitation of salt and the condensation of vapors in baths.[7] Thus beyond the general empirical thrust that Aristotelian writings imparted to subsequent tradition, both balneological and herbal, this passage seems to establish a theoretical justification for combining an interest in baths and herbs. By calling attention to baths in the context of a discussion of plants, *De plantis* effectively creates a place for considerations of balneology within herbal doctrine that is founded in part on, as it were, Aristotelian as well as other ancient discussions of plants.

Although now regarded as pseudo-Aristotelian, *De plantis* belonged to the stock of traditional treatises of natural philosophy through the sixteenth century.[8] A translation from Arabic into Latin by Alfred of Sareshel was made probably before 1200, and it gained wide diffusion: at least 159 manuscripts containing *De plantis* have been identified.[9] Roger Bacon, Albertus Magnus, and Vincent of Beauvais all wrote commentaries on it. It was definitely used at the University of Paris in the thirteenth century, and we can assume that it would have been known at the northern Italian universities—especially at Padua, where instruction was given on the text of Dioscorides and where Aristotelian traditions were strong.[10]

In any event, associating an interest in plants with one in baths not only helps link the topic discussed by Park with that of simples, Findlen's topic, but has immediate pertinence for Renaissance science—and art. These realms are directly conjoined by Leonardo da Vinci, who also speaks of the importance of the use of pictorial images in the study of nature. Given what might be called the neo-Duhemian echoes of Park's arguments for the late medieval or early Renaissance origins of scientific empiricism, the absence of any mention of Leonardo in her paper, as in that of Findlen—as indeed anywhere else

in this collection—is striking. Can it be that the alternative tradition Leonardo represents would mount too great a challenge to a unified view of the scientific tradition? All the more, then, do Leonardo's comments about the empirical utility of painting to those investigating nature, including water and plants, call for quotation and discussion here:

> Whoever disparages painting loves neither philosophy or nature. If you disparage painting which alone is the imitator of all the works to be seen in nature, you most surely will disparage an invention which with philosophic or subtle speculations, examines all qualities of forms: the sea, lands, animals, plants, flowers, which are surrounded by shadow and light. This is truly science and the legitimate daughter of nature, because painting is born of nature herself or, to put it more correctly, let us say granddaughter of nature because all things we sense are born of nature and painting is born of all those things.[11]

Among other allusions, these lines play on a passage in Dante's *Inferno* (11.97–105) where Dante places a discussion of *arte* in the mouth of Vergil.[12] It is known that Leonardo read Dante closely and responded to him in his own writings.[13] Here he takes the larger sense of *arte,* or art as understood more generally in Renaissance contexts,[14] and relates it more specifically to the art of painting. In Dante human *arte* is a *nepote* of God (as nature): painting is a *nipota* of nature in Leonardo. Leonardo's use of this trope has a specific purpose in his defense of painting.[15] It is deployed as part of an effort to redefine the meaning of art.[16]

Because of the context from which the reference to art is drawn, however, Leonardo's text also seems to imply a specific understanding of science, or *scientia.* Leonardo speaks of *scientia* where Dante refers to *Fisica.* Hence Leonardo seems to be speaking not just of science with the significance of knowledge in general but, like Dante, of the science of nature, as in Aristotle's *Physics.* And in Aristotle's *Physics* (199a) there is a passage that closely conjoins art (*technē*) and nature (*physis*): *technē* either completes (*epitelei*) things that nature has not accomplished, or it imitates (*mimetai*) nature. Consequently Leonardo seems to be deliberately tying painting to *scientia* in the sense not just of knowledge but of something akin to contemporary notions of science.

Moreover, the conjunction of terms in Dante allows for a reading of Leonardo's play on his text as applying not simply to science in general but to natural philosophy in particular. Dante begins the passage in question with the word *Filosofia* and explicates philosophy as referring to nature: that is, it is natural philosophy that he is discussing. Leonardo's first line also couples philos-

ophy and nature. He goes on to describe just those sorts of subjects (including the sea, plants, animals) that might be associated with natural philosophy.

Citing the passage from Leonardo, in his own translation, James S. Ackerman thus seems justified in observing that Leonardo was able to refer to painting as a path to science or natural philosophy because of the dependence on visual evidence and observation implicit in nature studies. Ackerman claims that artists like Leonardo virtually preempted the fields of scientific investigation in many areas, including botany.[17] Although Leonardo is himself too late a figure to fall within Park's purview, both his comments reflecting Dante and his surviving drawings demonstrate that he continued earlier traditions. His interests in studies of plants and in studies of moving water, for example, are both abundantly represented in his drawings.[18] In them as in his anatomical studies, artistic techniques, such as the treatment of light and shadow that Leonardo specifically evokes in the passage quoted above, are developed to serve the investigation of nature, as a number of scholars have noted.[19] In turn, Leonardo's outspoken defense of the importance of painting for the study of natural phenomena establishes the visual arts as another manifestation of scientific learning.[20]

Leonardo thereby not only reminds us of the need to study visual sources as well as texts in the history of science, especially in its nonquantitative aspects, but he also leads us to reconsider another aspect of the implications of Park's paper for the study of herbals.[21] Herbals obviously involved an empirical concern with the growths found in nature and a focus on individual objects, as Leonardo's studies of individual plants and their particularities also suggest. Although herbal books did not necessarily impart their information in words, the collections of simples gathered together in the tradition of *materia medica* depended on illustration to disseminate their information. Hence the role of images depicting plants was central to the immediate—and empirical—concern of the herbal. The communication of the information they imparted depended on accuracy of representation: naturalistic verisimilitude came to be essential to establishing the identification of plants.

Herbals might seem to be about kinds, and their pharmacological properties were largely regarded as universal. But crucially, just as physicians studied individual springs, examining them as if they were individual patients, herbals also began to generalize from particular observations. While earlier, medieval artistic representations and illustrations of plants may have been copies of earlier pictures or composite idealizations, printed herbals of the sixteenth century, at least from the work of Brunfels on, in fact often depicted individual specimens, using them as the basis for illustrations.[22]

The development seen in printed herbaria had precedents, however, not only in the work of Leonardo, and of Albrecht Dürer,[23] but also in the work of illustrators of the period discussed by Park. While the dimensions and details of the change still require further investigation, art-historical researches have nevertheless long indicated that in the late fourteenth and early fifteen century, artistic practices changed from the use of the model book, in which previously existing types were recorded, to books with sketches, in which freely observed and executed drawings begin to be made.[24] And among these drawings there do exist studies of plants and animals made from observation of individual specimens.[25] These provided the basis for a transformation of the herbal, as they did for other sorts of natural historical compendia.

Already half a century ago Otto Pächt illuminated this development when he considered the importance of the relation of art to science in the herbal. Pächt thus pointed to another way in which the history of the visual arts is to be related to the concerns of the history of science. In an essay on early Italian nature studies and the origins of calendar landscapes in manuscript illumination, he demonstrated that some of the first new empirical studies of plants since antiquity presented in herbals, in the traditions of *materia medica* and of the *Tacuinum Sanitatis* in the late fourteenth and early fifteenth century, led to the creation of the new genre of landscape in painting. He argued specifically that the development of nature studies runs parallel to the growth of empirical science.[26]

Pächt's argument about these new creations has in turn implications for Park's thesis. The coincidences are striking. Pächt associated the new experiment, as he called it, in herbal illustrations with Padua, where there was present an important medical faculty at the university, where many other medical developments were made. But the exact context for the manufacture of the manuscripts discussed, and the origin of nature studies in model books, needs to be examined further. As in the instance of the work of Giovannino de' Grassi, workshops of illuminators of nature studies often seem in fact to have been associated with northern Italian courts.[27] The splendid illustrations turn the herbal books in question into luxury products that far surpass the practical needs (or means?) of a university physician; it is thus possible that these books, which Pächt first described as evincing an empirical turn, were related to, if not indeed created for, precisely the same milieus, and the same sorts of physicians, as those discussed by Park.

The herbal tradition also demands attention here, because herbals are central to Findlen's concerns as well. Like Park, Findlen has extended arguments from her earlier work, especially those in her book on scientific col-

lections.[28] Making more particular the characterization of early modern science, she urges closer attention to the context in which science was carried out. Emphasizing the notion of culture, she argues for the importance in scientific activities of the formation of a scientific culture that depended on sensory engagement. Findlen has thereby broadened the category of activities that are to be studied under the rubric of science, taking scholarship into new arenas by asking what contexts made it possible for science to thrive in early modern Italy. She argues that late Renaissance natural history was defined by its audience as well as by the books that outlined its shifting parameters; the knowledge that it sought and imparted was therefore a matter of self-knowledge as well as of social knowledge.

In her paper Findlen proposes that natural history was a locus where theory and practice could be conjoined, because the practice of medicine could be linked with the study of natural history. She argues that in sixteenth-century Italy a scientific community for natural history was formed. This is a process that involved what she describes as the emergent book culture of the time. The dissemination of knowledge through and by books becomes part of what makes the new science. This argument raises a number of issues of broader importance that are worth further examination in relation to issues of science and art: in particular, the definition of what makes a community and its location.

Let us first question the definition of what Findlen describes as "Italy." For location cannot be simply equated with matters of late-twentieth-century language or geography. Although employing the vernacular may to a degree have defined speakers and writers in the sixteenth century, the issue is much more complicated than that. The definition (or self-definition) of "Italian" as applied to Mattioli in this regard cannot be taken to correspond strictly to the nation of Italy, because the use of the Italian language did not serve as a marker of Italian nationality at the time: other "nationals" outside of present-day Italy also spoke Italian.[29] The nation-state of Italy as a country of Italian-speakers did not yet exist; and because Italy as such did not yet appear on the map, the actual location of the place where Mattioli worked before going north also needs to be considered more carefully.

Mattioli worked in the city of Gorizia, now situated within Italy on its border with Slovenia. But in the later sixteenth century, Gorizia was within the bounds of the Holy Roman Empire; more specifically, it belonged to Carniola, a part of what then constituted *Innerösterreich* (Inner Austria), one of the Habsburg hereditary lands.[30] Trent, another place where Mattioli was active before he journeyed north, was a disputed territory. As a prince-bishopric, it was *Reichsunmittelbar:* it recognized as its suzerain only the Holy

Roman emperor in his person as ruler thereof. A counterclaim was made, however, that it was a Habsburg land, and rather than being ruled ultimately by the emperor (then a Habsburg), it thus belonged to the Habsburg dynasty as such. From 1564 onward, Mattioli's quondam student and patient Archduke Ferdinand II, regent of the Tyrol, tried to annex Trent to the territories over which he ruled, and in 1568 it was occupied. The year 1571 was a key moment in the struggle with the Habsburgs for control over the city.[31]

Can the dispute over Trent, and the difficulties for inhabitants that it created, have provided an impetus for Mattioli's departure from the city? Does not the Tridentine-Habsburg debate provide a more specific historical context for an understanding of Mattioli's remarks about Italians and others, especially his pro-Italian and related anti-German comments? And in general, do such remarks not reflect the continuing, long-lasting dispute and antagonism on the borderlands between the *welsch* and the *deutsch,* the conflict between Italian and German speakers?[32] It may be remembered that this conflict would have disastrous consequences, eventually leading to much loss of life on the battlefields of the First World War.

In any event, in the sixteenth century the extremely close relationships that existed between Trent and the imperial court belie an exclusively national or nationalistic interpretation. It is no accident that a whole sequence of scholars passed on from Trent to Vienna and Prague to serve at the imperial court. Not only Mattioli but also Giulio Alessandrino and Ippolito Guarinoni, to mention but the most famous, served the imperial court as botanists and physicians.[33]

In Vienna and in Prague these men would have become members of cosmopolitan courts, where they could have joined an intellectual community that consisted not only of Italian-speaking scholars but of natives of many lands; it was a polyglot group.[34] Among those with interests similar to their own, people like Mattioli could have encountered in Vienna or later in Prague scholars such as the Lusatian Paulus Fabricius, university professor of medicine and court mathematician; the Viennese Johann Aicholz, professor of medicine at the university there; the Silesian Crato von Craftheim; the Flemish botanist Rembert Dodoens; and later his fellow Netherlander Carolus Clusius (Charles de l'Écluse).[35] Several of these men are indeed known to have been friendly with Mattioli.[36]

Interaction between figures at court and in the city also suggests that the cosmopolitanism of the court affected the cities in which it was located. The Latinate, humanist culture of the Renaissance (as of the antecedent period) was an international culture. In one instance, Clusius lived on Aicholz's lands in Vienna, in the *Alsergrund* (now the ninth *Bezirk*), where his garden

was located. The dual activity of Aicholz, who both owned a private garden and taught at the university, is typical of many in the Viennese group, such as Fabricius, who in addition to his court employment was, as remarked, also a university professor; they illustrate the multiple connections of this circle. Furthermore, the loci provided by the court for botanical activities in both Prague and Vienna would have attracted Mattioli as well as other figures in town. The imperial gardens that would have served botanists were located on Hradčany in Prague, in the castle precinct, as well as elsewhere in the city environs. At least as important were the gardens on the Prater in Vienna, about which Georg Tanner wrote in a poem; these also may have been helpful to Mattioli.[37]

Not only Clusius and Crato but many other figures in this group were writers on scientific matters, which pertained both to court and university concerns. Their publications, like those of writers who remained in the Italian peninsula, would also have disseminated their views. To follow Findlen, publications by authors at the imperial court would have helped make a community. Fabricius, for example, compiled a book, published in 1557, on plants found in the region of Vienna.[38] This was a work that would no doubt have been have interest to Mattioli when he came to Vienna, even if there is not yet evidence that he ever met Fabricius personally.

A further note about books and botanists in this community: the Netherlander Ogier Ghiselin De Busbecq, who brought the tulip to Europe, also brought back with him from Istanbul (Constantinople) a manuscript containing the text of Dioscorides—the famed Anicia Juliana Codex (also known as the Vienna Dioscorides), an ancient illustrated herbal that includes theriac illuminations.[39] Busbecq is probably that imperial ambassador to whom Findlen refers as having supplied material to Mattioli.[40] The Anicia Juliana Codex, perhaps one of those manuscripts, and in any event one that Mattioli knew, is of course a work of great interest to art history, the history of science, and history more generally. The time of contact between Busbecq and Mattioli, which fell between 1568 and 1569, suggests connections to other figures in a larger intellectual community. Because of the attention such a manuscript attracted, this community must also have included the imperial librarian Hugo Blotius (since not Prague but Vienna was then the seat of the imperial library).[41]

The Vienna Dioscorides was in fact but one of several manuscripts included in a trade in such materials. Manuscripts circulated back and forth from various centers. Italians such as Jacopo Ligozzi supplied nature studies for Rudolf II Habsburg as well as for the Medici and for private scholars such as Ulisse Aldrovandi.[42] Georg (Joris) Hoefnagel provided works for various

courts, and his materials were also used by Aldrovandi.[43] Giorgio Liberale illustrated Mattioli's commentary to the *Materia Medica* of Dioscorides and supplied illuminated nature studies for Archduke Ferdinand of the Tyrol.[44] It can now be demonstrated that the imperial court artist Giuseppe Arcimboldo was regarded as something of an expert on natural history as well. Arcimboldo supplied specimens for the imperial collections, and he also executed nature studies for Aldrovandi. These were in turn used both for elements in his paintings of composite heads (thus for works of art) and for compendia of illustrations of creatures from the world of nature (thus for natural history, or science).[45]

Another point of practice would have helped form a community of informants. For many of the figures that have been mentioned—Alessandrino (Alexandrinus), Fabricius, Crato—held the position of personal physician to the emperor (*kaiserlicher Leibarzt*). This concern with medical matters gave them reason to have had commerce with Mattioli as well.[46]

Contrary to some of the evidence adduced by Findlen for the Italian situation, it is doubtful that this intellectual community was predominantly Catholic. At the imperial court Mattioli would have encountered a situation that was much more complicated; there in the 1550s the man who helped bring the Jesuits to Central Europe, St. Peter Canisius, could examine the Lutheran Fabricius for a position as court mathematician.[47] While by no means intentionally ecumenical, and also deeply involved in issues of church and throne, the rulers held beliefs of uncertain tenor; their courts remained open to men with various shades of opinion. Ferdinand I (emperor 1558–1564), though at times wavering in his religious attachments and in any case relatively tolerant, strongly supported the Roman church, but his successor Maximilian II, the patron of the Vienna group of humanists and scientists (1564–1576), was suspected of crypto-Lutheranism; Maximilian II was certainly open to scholars of all persuasions, including many Lutherans and some Calvinists.[48] The personal beliefs of Rudolf II (1576–1612), the great patron of art and science, are unclear; a wide variety of confessions were represented at his court, and ultimately he signed a Letter of Majesty granting freedom of religious practice in Bohemia.[49]

Regardless of the ruler's beliefs, many of the scholars in the Vienna and Prague circles of humanists were Protestants of various stripes. To mention just those with botanical interests, Dodoneus (Dodoens), Crato, and later Clusius were certainly Calvinists. Aicholz and Tanner were Lutherans.[50] Fabricius seems to have been a moderate Lutheran of Melancthonian persuasion, and he wrote a tract against the Gneseo-Lutheran Flaccists.[51]

While Rudolf II was also interested in a host of occult and scientific pursuits, including natural history, Mattioli's patron Emperor Maximilian II was highly interested in botany.[52] Maximilian's interest was part of his broader

concerns with astronomy and other sciences.[53] We might therefore posit another definition of Mattioli's immediate scientific community. As noted, during Maximilian II's reign as well as during that of Rudolf II many connections existed between the imperial court and Italy; figures such as Aldrovandi employed court artists such as Hoefnagel and Arcimboldo along with Ligozzi, who in turn supplied materials to the imperial court. Moreover, Mattioli's son Ferdinando was one of the few individuals who were not dignitaries or members of the Habsburg family who were portrayed by Joseph Heintz, the court painter of Rudolf II.[54]

So, while Findlen suggests that Mattioli belonged to an Italian community from afar, we might focus instead on his connections with the community that he would have encountered more directly and immediately in Central Europe. This shift in attention applies even to the publication of books, for note must be taken of his work published in Prague by G. Melantrich. The republic of botanists was larger than the citizenry of any one nation. The community of scholars and scientists was much bigger, embracing all of Europe, as indeed the redaction and publication of editions of Mattioli's herbal book show. Several editions were published in Frankfurt am Main, and the Nuremberger Joachim Camerarius added illustrations and more text.[55]

Finally, a focus on court culture provides not only another link between Findlen's and Park's papers but also a further challenge to traditional historiography, and even to its revision as suggested in this collection. For the idea of the court servitor who is also a scientific innovator does not correspond to the current model of the scientific virtuoso found in England, or of his counterpart in Italy.[56] If however we examine the sites where scientific innovation actually occurred in the Renaissance, we may discover that they were located not only in the late trecento and early quattrocento duchies of northern Italy but also in Sforza Milan, and later in the northern and Central European courts—including most notably but by no means exclusively Rudolfine Prague. In both the period around 1400 and that around 1600, courts seem to have furnished important foyers for the sciences as well as the arts, and at both times an international court style may have existed in science as it did in art.

NOTES

1. See H. Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry* (Chicago: University of Chicago Press, 1994). A broader statement about the importance of quantification has more recently been made by Alfred W. Crosby, *The Measure of Reality: Quantification and Western Society* (Cambridge: Cambridge University Press, 1997).

2. As in the work of Nancy G. Siraisi, e.g., *Medieval and Early Renaissance Medicine: An Introduction to Knowledge and Practice* (Chicago: University of Chicago Press, 1990).

3. See Harold J. Cook, "The New Philosophy and Medicine in Seventeenth-Century England," in *Reappraisals of the Scientific Revolution,* ed. David C. Lindberg and Robert S. Westman (Cambridge: Cambridge University Press, 1990), pp. 397–436.

4. Most notably R. K. Merton, *Science, Technology, and Society in Seventeenth-century England* (Bruges, 1938; reprint, New York: H. Fertig, 1970); see also the discussion in Cohen, *Scientific Revolution,* pp. 328 ff.

5. Katharine Park, *Doctors and Medicine in Early Renaissance Florence* (Princeton: Princeton University Press, 1985).

6. See Bernard G. Dod, "Aristoteles Latinus," in *The Cambridge History of Later Medieval Philosophy,* ed. Norman Kretzmann, Anthony Kenny, and Jan Pinborg (1982; reprint, Cambridge: Cambridge University Press, 1988), p. 47, for the current attribution. The issues of authorship and diffusion of this text are discussed in S. D. Wingate, *The Mediaeval Latin Versions of the Aristotelian Scientific Corpus, with Special Reference to the Biological Works* (London: Courier, 1931), pp. 55–56. Wingate makes the point that even if "pseudo-Aristotelian," *De plantis* contains genuine Aristotelian doctrine. Wingate also gives a different span, fl. 37–4 B.C.E. for the lifetime of Nicholas Damascenus (p. 55).

7. *De plantis* is most conveniently available in Aristotle, *Minor Works,* ed. W. S. Hett, Loeb Classical Library (Cambridge, Mass.: Harvard University Press, 1936), pp. 198 ff.

8. See William A. Wallace, "Traditional Natural Philosophy," in *The Cambridge History of Renaissance Philosophy,* ed. Charles B. Schmitt et al. (Cambridge: Cambridge University Press, 1988), pp. 211–212. It also belonged to the stock of works to be associated with psychology; see Katharine A. Park and Eckhard Kessler, "The Concept of Psychology," in ibid., p. 455.

9. See Dod, "Aristoteles Latinus," p. 79. For the possibility of the availability of other versions of the *De plantis* in the Latin West, see Wingate, *Mediaeval Latin Versions of the Aristotelian Scientific Corpus,* and further Charles Lohr, "Medieval Latin Aristotle Commentaries," *Traditio* 23 (1967): 313–413.

10. For the commentaries, see Wingate, *Mediaeval Latin Versions of the Aristotelian Scientific Corpus,* pp. 67 ff. Karen Meier Reeds, *Botany in Medieval and Renaissance Universities* (New York: Garland, 1991), pp. 7 ff., discusses the use of *De plantis* in medieval universities and mentions instruction in Dioscorides at Padua (p. 16). For Padua, known for its "Averroistic" tradition, it is also important to note that a commentary by Averroës might have existed on *De plantis;* see Wingate, pp. 71–72.

11. Leonardo da Vinci's *Treatise on Painting,* introduction, as translated by James S. Ackerman, "Early Renaissance 'Naturalism' and Scientific Illustration," reprinted in his *Distance Points: Essays in Theory and Renaissance Art and Architecture* (Cambridge, Mass.: MIT Press, 1991). 185.

The original text (Leonardo da Vinci, *Treatise on Painting* [*Codex Urbinas Latinus 1270*], facsimile [Princeton: Princeton University Press, 1956], pp. 4 ff.) reads: "Se tu

sprezzarai la pittura la quale, e sola inuentrice de tutte le opere, euidenti de natura per certo tu sprezzarai una sottile inventione la quale con filosoficha, è sottile speculatione considera tutte le qualità delle forme, mare siti piante, animalie, herbe, fiori, le quali sono cinte d'ombra, e lumi et ueramente questa e scientia e legitima figlia de natura perche la pittura, è patorita da essa natura ma per dir più corretto diremo nipota de natura per che tutte le cose eviddenti sonno state partorita dalla natura delle quali cose, e' nata la natura, andonque nettamente la chiamaremo nipota d'essa natura, et prente d'Iddio."

12. Filosofia, mi disse, a chi la intende,
Nota non pure in una sola parte
Come natura lo suo corso prende
Dal divino intelletto e da sua arte;
E se tu ben la tua Fisica note,
Tu troverai non dopo molte carte
Che l'arte vostra quell, quanto puote
Segue, come il maestro fa il discente,
Sia che vostr'arte a Dio quasi è nepote.

Le Opere di Dante Alighieri, ed. Dr. E. Moore, rev. Paget Toynbee (Oxford: Oxford University Press, 1963), p.v.

13. See, e.g., Martin Kemp, *Leonardo da Vinci: The Marvellous Works of Nature and Man* (London: Dent, 1981), passim; on the *Divina Commedia,* see pp. 104, 162, 33.

14. See the paper by William Newman in this collection.

15. See most recently Claire J. Farago, *Leonardo da Vinci's "Paragone": A Critical Interpretation with a New Edition of the Text in the "Codex Urbinas"* (Leiden: Brill, 1991). Farago (p. 314), recognized that Leonardo's text in the *Trattato* might be a paraphrase of Dante's *Inferno,* canto 11, but made no further comment on the relation between the texts.

16. See the classic essay by Paul Oskar Kristeller, "The Modern System of the Arts," reprinted in his *Renaissance Thought II: Papers on Humanism and the Arts* (New York: Harper and Row, 1965), esp. pp. 176, 184, for Dante and Leonardo, and Anthony Blunt, *Artistic Theory in Italy, 1450–1600* (London: Oxford University Press, 1962), pp. 23 ff., for Leonardo.

17. Ackerman, "Early Renaissance 'Naturalism'."

18. These drawings have been frequently exhibited, and there is, as in all matters Leonardesque, an ever-increasing literature on them. A good starting point is the catalogue of an exhibition organized in London in 1989, *Leonardo da Vinci* (New Haven: Yale University Press in association with the South Bank Centre, 1989), with contributions by E. H. Gombrich, Martin Kemp, and Jane Roberts.

For Leonardo's water studies, see the essay by E. H. Gombrich, "The Form of Movement in Water and Air," in *The Heritage of Apelles,* Studies in the Art of the Renaissance 3 (Ithaca, N.Y.: Cornell University Press; Oxford: Phaedon, 1976), pp. 39–56.

19. See Martin Kemp, "Il concetto dell'anima in Leonardo's Early Skull Studies," *Journal of the Warburg and Courtauld Institutes* 34 (1971): 115–134; Ackerman, "Early Renaissance 'Naturalism.'"

20. These relationships between the visual arts and science are well discussed by Kemp, *Leonardo da Vinci*. An earlier essay in a similar direction by a historian of science is V. P. Zubov, *Leonardo da Vinci,* trans. David H. Kraus (Cambridge, Mass.: Harvard University Press, 1968).

21. For the subject of herbal illustration, see in general A. R. Arber, *Herbals, Their Origin and Evolution: A Chapter in the History of Botany,* 3rd ed. (Cambridge: Cambridge University Press, 1986 [1st ed., 1912]); Wilfried Blunt and Sandra Raphael, *The Illustrated Herbal* (New York: Thames and Hudson, Metropolitan Museum of Art, 1979).

22. I am grateful to an anonymous reader of this article for suggesting I may have missed Park's point, thus leading me to elaborate these arguments and ensure that Ackerman's point, summarized here, not be missed.

23. See, e.g., Fritz Koreny, *Albrecht Dürer and the Animal and Plant Studies of the Renaissance,* trans. Pamela Marwood and Yehuda Shapiro (Boston: Little, Brown, 1988); and for the link with herbaria, see the review of this book by Karen Reeds in *Isis* 81 (1990): 768.

24. See for this issue most recently and fully Robert W. Scheller, *Exemplum: Model-Book Drawings and the Practice of Artistic Transmission in the Middle Ages (ca. 900–1450),* trans. Michael Hoyle (Amsterdam: Amsterdam University Press, 1995), and Albert J. Elen, *Italian Late-Medieval and Renaissance Drawing-Books from Giovannino de'Grassi to Palma Giovane: A Codicological Approach* (Leiden: Elen, 1995), both with extensive bibliographies.

25. The relatively few examples on which judgments are based, as cited from the secondary art-historical literature by an author like Reeds, *Botany in Medieval and Renaissance Universities,* p. 185 n. 83, do not take into account the problem of survival of manuscripts and drawings from the period, and thus do not give an adequate picture of the problem. Already Otto Pächt (see note 26) considered the objects he was studying not as singular but as exemplary of a wider trend. This issue may be reconsidered in relation to information gathered in more recent studies and exhibitions, e.g., Marco Rossi, *Giovannino de Grassi: La corte e la cattedrale* (Milan: Silvana, 1995), and Paola Marini, ed., *Pisanello* (Milan: Electa, 1996); however, these works do not really tackle the question again.

26. Otto Pächt, "Early Italian Nature Studies and the Early Calendar Landscape," *Journal of the Warburg and Courtauld Institutes* 13 (1950): 13–47, especially pp. 25–31.

27. See ibid. and Rossi, *Giovannino de Grassi.*

28. Paula Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (Berkeley: University of California Press, 1994).

29. The general issue of how language and nation relate to the definition of the Renaissance is reviewed in Peter Burke, "The Uses of Italy," in *The Renaissance in National Context,* ed. Roy Porter and Mikulás Teich (Cambridge: Cambridge University Press, 1992), pp. 6–20, esp. pp. 13–14; see further now Burke, *The European Renaissance: Centres and Peripheries* (Oxford: Blackwell, 1998). For the question of the relation of the imperial court to Italy and Italians in the time of Mattioli, see Heinz Noflatscher, "Sprache und Politik: Die Italienexperten Kaiser Maximilians II.," *Kaiser Maximilian II: Kultur und Politik im 16. Jahrhundert,* ed. Friedrich Edelmayer and Alfred Kohler, Wiener Beiträge zur Geschichte

der Neuzeit 19 (Vienna: Verlag für Geschichte und Politik; Munich: Oldenbourg, 1992), pp. 143–168. For the continuing importance of Italian as a spoken language (and cultural determinant) at the imperial court through the seventeenth century, see Thomas DaCosta Kaufmann, *Court, Cloister, and City: The Art and Culture of Central Europe, 1450–1800* (Chicago: University of Chicago Press, 1995), p. 270.

30. For a variety of essays on the social and cultural history of this region, see *Innerösterreich 1564–1619,* ed. Alexander Novotny and Berthold Sutter, Joannea 3 (Graz: Universitätsbuchdruckerei Styria, [1968]); *Graz als Residenz: Innerösterreich 1564–1619,* ex. cat. (Graz: Steirermarkischen Landesbibliothek am Joanneum, 1964).

31. The essays by Bruno Passamani, "Ragioni e struttura della mostra: Un principato per l'impero," and Marco Bellabarba, "Il Principato vescovile di Trento e i Madruzzo: L'Impero, la Chiesa, gli stati italiani e tedeschi," in *I Madruzzo e l'Europa, 1539–1638: I principi vescovi di Trento tra Papato e Impero,* ed. Laura Dal Prà, ex. cat. (Milan: Charta, 1993), pp. 11–28, 29–42, provide an introduction to the political vicissitudes of Trent in this era.

32. This conflict provides an introduction to some of the discussion of period eye in Michael Baxandall, *The Limewood Sculptors of Renaissance Germany* (New Haven: Yale University Press, 1980); a somewhat different interpretation of these issues is offered in Kaufmann, *Court, Cloister, and City.*

33. For Mattioli in this context of Trent physicians, see Franco Ottaviani, "Quattro generazioni di medici trentini (1539–1653)," in Dal Prà, *I Madruzzo e l'Europa,* pp. 673–679.

34. For the presence of these Italians in the midst of a host of other physicians, and the description of the courts as cosmopolitan, see R. J. W. Evans, *Rudolf II and His World: A Study in Intellectual History 1576–1612* (Oxford: Clarendon, 1973), pp. 203–204; idem, *The Making of the Habsburg Monarchy, 1550–1700* (Oxford: Clarendon; New York: Oxford University Press, 1979), p. 22. For Mattioli at the imperial court, see now Maria Ludovica Lenzi, "Dal 'Regno di Iatria' alla corte di Praga," in *Pietro Andrea Mattioli (Siena 1501–Trento 1578): La vita, le opere,* ed. Sara Ferri (Siena: Quattroemme, 1997), pp. 83–104.

35. For a recent treatment of Fabricius, see Thomas DaCosta Kaufmann, "Astronomy, Technology, Humanism, and Art at the Entry of Rudolf II into Vienna, 1577: The Role of Paulus Fabricius," in his *The Mastery of Nature: Aspects of Art, Science, and Humanism in the Renaissance* (Princeton: Princeton University Press, 1993), pp. 136–150; for Crato, see Howard Louthan, *Johannis* [sic] *Crato and the Austrian Habsburgs: Reforming a Counter-reform Court,* Studies in Reformed Theology and History 2, no. 3 (Princeton: Princeton Theological Seminary, 1994); for Dodoens, see *Luister en rempspoed van Mechelen ten tijde van Rembert Doedoens,* ex. cat. (Brussels, 1985); for Clusius, *Carolus Clusius und seine Zeit,* Wissenschaftliche Arbeiten aus dem Burgenland 54 (Eisenstadt: Amt der Burgenlandische Landesregierung, 1974); for Aicholz and for the whole group, see Joseph Ritter von Aschbach, *Die Wiener Universität und ihre Gelehrten 1520 bis 1565,* Geschichte der Wiener Universität 13 (Vienna: Verlagder K. K. Universität, 1888).

36. For Fabricius' friendship with Mattioli, see Kaufmann, *The Mastery of Nature,* pp. 144, 275 n. 20. For Busbecq and Mattioli, see note 40 below.

37. See Kurt Mühlberger, "Bildung und Wissenschaft: Kaiser Maximilian II. und die Universität Wien," in Edelmayer and Kohler, *Kaiser Maximilian II,* pp. 203–230, and in general Evans, *Rudolf II and His World,* pp. 119 ff. Also see still Aschbach, *Die Wiener Universität,* with further references.

38. Paulus Fabricius, *Catalogus Stirpium circa Viennam nascentium* (Vienna, 1557); see for further references Kaufmann, *Mastery of Nature,* pp. 146, 278 n. 40.

39. Vienna, Österreichische Nationalbibliothek, cod. med. gr. 1; for the literature on this manuscript, see *Der Wiener Dioscurides (Codex Vindobonensis Med. gr. 1),* intro. H. Gerstinger (Graz: Akademische Drucke und Verlagsanstalt, 1965); Kurt Weitzmann, *Ancient Book Illumination* (Cambridge, Mass: Harvard University Press for Oberlin College and the Department of Art and Archaeology of Princeton University, 1959), pp. 12 ff., 15 ff. and *passim.*

40. For Busbecq and the court, see most recently Zweder von Martels, "On His Majesty's Service: Augurius Busbequius, Courtier and Diplomat of Maximilian II," in Edelmayer and Kohler, *Kaiser Maximilian II,* pp. 169–181. Busbecq's friendship with Mattioli is mentioned on p. 177. Findlen connects him with Mattioli on p. 384 above (with n. 53).

41. For Blotius and the imperial library, see Alphons Lhotsky *Die Geschichte der Sammlungen (Festschrift des Kunsthistorischen Museums 1891–1941)* (Vienna: F. Berger, 1941–1945), 1.1:164.

42. For Ligozzi and Rudolf II, see Thomas DaCosta Kaufmann, *The School of Prague: Painting at the Court of Rudolf II* (Chicago: University of Chicago Press, 1988), pp. 76, 95, 129 n. 28, and *Prag um 1600: Kunst und Kultur am Hofe Rudolfs II,* ex. cat., Kunsthistorisches Museum Wien (Freren: Luca, 1988) 2:138–143; for Ligozzi and the Medici, see *Palazzo Vecchio: Committenza e collezionismo medicei,* ex. cat. Firenze e la Toscana dei Medici nell'Europa del Cinquecento ([Milan]: Electa, [Florence]: Centro Di Alinari Scala, 1980), pp. 295 ff; for Ligozzi and Aldrovandi, see Giuseppe Olmi, "Osservazione della natura e raffigurazione in Ulisse Aldrovandi (1522–1605)," in his *L'inventario del mondo: Catalogazione della natura e luoghi del sapere nella prima età moderna* (Bologna: Il Mulino, 1992), pp. 61 ff.

43. An introduction to works done by Hoefnagel for the Habsburgs is found in Theadora Alida Gerarda Wilberg Vignau-Schuurman, *Die emblematischen Elemente im Werke Joris Hoefnagels,* 2 vols. (Leiden: Universitaire Pers, 1969), and Lee Hendrix and Thea Vignau-Wilberg, *Mira Calligraphiae Monumenta: A Sixteenth-Century Calligraphic Manuscript Inscribed by Georg Bocskay and Illuminated by Joris Hoefangel* (Malibu, Calif.: J. Paul Getty Museum, 1992); for Hoefnagel and Aldrovandi, see Olmi, *L'inventario del mondo,* p. 131 and note 25.

44. See most recently Alfred Auer and Eva Irblich, *Natur und Kunst: Handschriften und Alben aus der Ambraser Sammlung Erzherzog Ferdinands II. (1529–1595),* ex. cat., Schloss Ambras, Inssbruck (Vienna: Kunsthistorisches Museum Wien, 1995), pp. 64–78, and Eva Irblich, "Naturstudien Erzherzog Ferdinands II (1529–1598): zur Kunstkammer auf Schloss Ambras bei Innsbruck," in *Thesaurus Austriacus: Europas Glanz im Spiegel der Buchkunst Handschriften und Kunstalben von 900 bis 1600,* ed. Irblich, ex. cat. (Vienna: Nationalbibliothek, 1996), pp. 209–225, both with further references.

45. On Arcimboldo, see further Irblich, *Thesaurus Austriacus,* pp. 233–260, and Thomas DaCosta Kaufmann, "Caprices of Art and Nature: Arcimboldo and the Monstrous," in *Kunstform Capriccio: Von der Groteske zur Spieltheorie der Moderne,* ed. Ekkehard Mai and Joachim Rees, Kunstwissenschaftliche Bibliothek 6 (Cologne: König, 1998), pp. 33–51.

46. On court physicians and their various origins, see Noflatscher, "Sprache und Politik," pp. 155–156.

47. For this incident involving Canisius and Fabricius, see Kaufmann, *Mastery of Nature,* p. 144.

48. See most recently Mühlberger, "Bildung und Wissenschaft," pp. 209 ff., 217 ff.; and now Howard Louthan, *The Quest for Compromise: Peacemakers in Counter-Reformation Vienna* (Cambridge: Cambridge University Press, 1997). Also see Otto Helmut Hopfen, *Kaiser Maximilian II. und der Kompromißkatholzismus* (diss., Munich, 1895).

49. The best treatment of the problem of the emperor's beliefs and of the question of religion at Rudolf's court remains Evans, *Rudolf II and His World,* pp. 84–115.

50. In addition to Mühlberger, "Bildung und Wissenschaft," see Grete Mecenseffy, *Evangelische Lehrer an der Universität Wien* (Vienna: n.p., 1967).

51. See Kaufmann, *Mastery of Nature,* pp. 144–145, with nn.

52. For Rudolf and the occult, see Evans, *Rudolf II and His World,* pp. 196–242; for Rudolf and flowers, a starting point is Kaufmann, *The School of Prague,* pp. 75, 76, 229, 244, 245; for Arcimboldo, Rudolf II, and natural history, see "Caprices of Art and Nature."

53. See Mühlberger, "Bildung und Wissenschaft"; Kaufmann, *Mastery of Nature,* pp. 140 ff.

54. See Jürgen Zimmer, *Joseph Heintz der Ältere als Maler* (Weißenhorn: Konrad, 1971), pp. 38–39, 143–144; Kaufmann, *The School of Prague,* p. 196, cat. no. 7.42.

55. The Melantrich edition is *New Kreuterbuch,* trans. G. Handsch (Prague, 1563). Editions by Camerarius include *De plantis epitome* (Frankfurt a. M., 1586) and *Kreutterbuch* (Frankfurt a. M., 1600). Mattioli's *Opera omnia,* ed. C. Bauhinus, was also published in Frankfurt in 1598.

56. See, however, the alternative picture created by the essays—including one by Paula Findlen ("The Economy of Scientific Exchange in Early Modern Italy," pp. 5–24) and one by Pamela H. Smith ("Curing the Body Politic: Chemistry and Commerce at Court, 1664–70," pp. 195–209)—collected in *Patronage and Institutions: Science, Technology, and Medicine at the European Court, 1500–1750,* ed. Bruce T. Moran (Rochester, N.Y.: Boydell, 1991). Other Italian examples are provided by the exhibition catalogues *La corte, il mare, i mercanti: La rinascita della scienza. Editoria e società; Astrologia, magia e alchimia; Firenze e la Toscana dei Medici nell'Europa del Cinquecento* (Florence: Electa, 1980), and Dario A. Franchini [et al.], *La Scienza a Corte: Collezionismo eclettico natura e immagine a Mantova fra Rinascimento e Manierismo* (Rome: Bulzoni, 1979), to mention just a few of a growing number of works on this theme. See, e.g., Kaufmann, *Mastery of Nature,* esp. pp. 188 ff.

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