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CHEMICAL MEDICINE
IN THE MEDICAL WRITINGS OF ARNAU DE VILANOVA

Over the last few years I have been increasingly interested in the application to medieval medical practice of what I think of as a new chemical technology in the late thirteenth century; I have come to perceive a growing enthusiasm among medical and surgical writers of that day for medicines produced by techniques they had learned from Arabic medical writings, techniques of distillation and sublimation in particular. When this *Trobada* was proposed, it seemed natural to me to extend my interest to Arnau de Vilanova's work, to see whether Arnau was aware of these recent developments and whether he put them to use in his practice, and that is the goal of this paper. I must insist that I am not looking ahead, to try to see whether one can connect this knowledge with a later alchemical tradition; I am deliberately attempting to look at Arnau as a medical figure, against the background of earlier medical thought, and within the context of the knowledge of some of his contemporaries at Montpellier.

I

First, however, I would like to present and defend certain assumptions about the chronology of Arnau's medical writings during the last decade of his life, because this chronology is the scaffolding for my argument about his intellectual development. It has been well established, to begin with, that his *Medicationis parabole* were finished at the end of 1300, when they were presented to Philip IV of France.¹ It has also been established that his *Repetitio* or commentary on the first Hippocratic aphorism, «Vita brevis, ars vero longa», was completed at Montpellier in 1301.² I would like to suggest that the *Antidotarium*, or at least its first part, was composed at about the same

1. ARNAU DE VILANOVA, *Medicationis parabole*, ed. J. A. PANIAGUA, *Arnaldi de Villanova Opera Medica Omnia* [hereafter *AVOMO*] vol. 6/2 (Barcelona, 1993), pp. 251-252.

2. Arnau's summary of the first two books of GALEN'S *De interioribus* (inc., «Quoniam diversitas...») was completed in May 1300 (see *AVOMO* 15 [Barcelona, 1985], p. 32). But in the *Repetitio*, Arnau speaks of this version as having been finished «anno preterito» (M.R. McVAUGH, *The authorship of the Galenic compendium de interioribus*, 'Quoniam diversitas...' in «Dynamis», 1 [1981], 228; the *Repetitio* must thus date from 1301.

time. At the I Trobada, ten years ago, I contended that this work is, at its core, genuinely Arnaldian.³ Some would accept the genuineness of the entire treatise; my own belief is that the first portion of the *Antidotarium* is Arnau's own draft of an unfinished work, but that the second portion, a list of recipes for compound medicines that implies the author's familiarity with the *Antidotarium Nicolai*, may have been added later by a disciple. I propose that the first portion's repetition of two anecdotes told by Arnau in his commentary on «Vita brevis» (one about a dead toad in a cistern, one about clothing contaminated with verdigris) not only supports his authorship of this part of the work but suggests that it too should be dated to the opening years of the fourteenth century.⁴ On this view, the *Antidotarium* would have had the same fate as the works that Arnau intended to accompany the *Parabole*, the 'aphorismi particulares' and the commentary on the *Parabole*—they are all works that he began but did not have the time to finish.

It is still more important to establish a date for Arnau's *Speculum medicine* if we are to understand the development of his medical thinking in the last years of his life. Here it is crucial to study the language of two famous letters. At the beginning of July 1308, King Jaume II wrote to Arnau to ask him

«that you send us the new work you have completed, called, *Speculum medicine*, to preserve our health... we ask that you pass on to us the aforesaid work, the *Speculum medicine*, so that we may maintain our health, which you must surely de-

3. *Two Texts, One Problem: The Authorship of the Antidotarium and De venenis attributed to Arnau de Vilanova*, in «Arxiu de Textos Catalans Antics», 14 (1995), 75-94. [Also published as *Actes de la I Trobada Internacional d'Estudis sobre Arnau de Vilanova*, 2:75-94.]

4. *Vita brevis*: «Alii contingit medico quod propinavit decoctionem capil. ve. cuidam patienti et qualibet vice vomebat cum terribilibus accidentibus et tandem plus diligens scrutinium invenit quod capil. ve. fuerat collectum in quadam cisterna communi et antiqua et modicum in fundo continente. Ivit ergo illuc quia curiosus erat et fecit sibi ostendi locum collectionis et cum diligenter aspexisset invenit cadaver buffonis sub illo loco in fundo cisterne ex quo inficiebatur non solum humiditas qua planta nutriebatur sed aer circum positus ei.

Aliud etiam contingit cuidam medico qui fecerat de consilio cuiusdam alterius fieri colirium ad delendum albuginem oculorum; et prima nocte qua stillavit oculus patientis, obthalmiam incurrit ita quod eminentia et timore ac intolerabili dolore vexatus fere amisit oculos. Cucurrit ergo mater et notificavit medico principali, qui respondit quod non erat propter naturam collirii, et in testimonium huius precepit quod recepta eiusdem collirii faceret iterum cum diligentia, quod in domo sua taliter et taliter prepararet ipsum sicut aliquis fuerat informatus et de secundo fuit instillatum oculis patientis eiusdem et in nullo vexavit eum, et de primo fuit per diligentem inquisitionem inventum quod ille qui preparaverat pridie pulverizaverat multam quantitatem viridis eris et eisdem vestibus indutus quibus pulverizaverat illud preparavit collirium.» *Opera Arnaldi* (Lyons, 1520), fol. 281rb. All my subsequent references to Arnau's *Opera* will be to this edition.

Antidotarium: «Comperit etiam quod colirium suaviter dolorum mitigativum oculorum tritum ab apothecario induto veste qua die precedente indutus trituerat viride eris inmisit oculo patientem cruciabat. Et aqua decoctionis capillorum ven. collecti in cisterna in qua buffo submersus putruerat potanti terribiliter sincopim inducebat.» *Opera*, fol. 244.

sire; and be certain that we will show that work to no one, except that with your prior consent we will disclose it to our physician, Master Marti de Caliga Rubea, who cares assiduously for our body's health».⁵

Six weeks later, the king repeated the request:

«we ask... that you send us the *Speculum medicine*, since we are anxious to have it, and we promise that we will show it to no one unless you wish it and tell us so».⁶

In my view, these letters show that in the summer of 1308 Arnau had finished a new work (‘novellum opus’) which was titled *Speculum medicine*, perhaps on the model of Vincent of Beauvais’ famous trilogy, and that the king knew of it by this title, which he used three times. The king wanted it sent to him in case it might be of use to his health. It was not written ‘for’ the king, who certainly does not express the feeling that he deserves to have it—rather, he thinks that he has to promise not to show it to anyone except his personal physician if he has a chance of receiving it. On the surface, it would seem that these letters are speaking of the very work that we know today as the *Speculum medicine*, and that it therefore dates from 1308.

But Juan Antonio Paniagua has presented serious arguments for rejecting this identification. Let me give you his words:

«Ce livre que le roi réclame si avidement devait être un écrit d’allure pratique, prophylactique compréhensible et strictement personnel: ce sont des qualités qu’on trouve au *Regimen sanitatis ad regem Aragonum*, ouvrage qui, selon le témoignage de son traducteur hébreu, fut réalisé vers ces dates [1307-8]. Il ne semble pas possible qu’un traité si théorique et systématique que le *Speculum* aurait été intelligible pour un profane en médecine, ni qu’il puisse donner de réponses aux préoccupations de celui qui le demandait; peut-être le roi l’a-t-il appelé ainsi pour être générique cette dénomination ou par confusion avec le traité étendu.

Si l’on admet cette distinction, je ne vois aucune difficulté pour avancer la date du *Speculum medicinae* jusqu’à la fin de la période de dédicacion universitaire du Maître: 1300 ou 1301... Je pense qu’un volume si dense et structuré que le *Speculum medicinae* ne semble pas faisable dans ces années au cours desquelles l’auteur est pris par d’autres préoccupations; il est mieux de le placer à la fin de cette autre période pleine de production scientifico-médicale, le connecter donc avec

5. «... Ut ad nos novellum opus per vos conditum, medicine speculum nuncupatum, pro conservatione salutis nostre mittere debitis... precamur quatenus opus predictum seu speculum medicine ad nos pro conservacione nostre salutis, quam ut tenemus certissime tenere cupitis... transmitatis, scituri nos opus ipsum nemine communicaturos nisi previo consensu vestro magistro Martino de Caliga Rubea nostro phisico id pandamus, qui de salute et sanitate corporis nostri sollicitam curam gerit.» Antoni RUBIÓ I LLUCH (ed.), *Documents per a la Història de la Cultura Catalana Medieval*, vol. 1 (rpt. Barcelona 2000), p. 45; doc. 36

6. «Rogamus... ut mitatis nobis speculum medicine cum ipsum habere affectemus, pollicemur etenim vobis quod nulli persone illud ostendemus nisi eum cui volueritis et nobis duxeritis intimandum.» *Ibid.*, p. 49; doc. 38.

ces autres écrits de même genre qui sont cités dans son texte et ne pas l'éloigner d'eux par une parenthèse de sept ans». ⁷

I have thought long and hard about these arguments, and I recognize their force. They could perhaps be bolstered still further by pointing out that in chap. 25 of the *Speculum* Arnau uses the same examples of the toad in the cistern and the verdigris that I have shown above were fresh in his mind in 1301.⁸ Yet I have eventually come back to the conclusion that the completion of the *Speculum* should be dated to 1308.

To begin with, we have testimony from Arnau himself that bears upon the matter. In chap. 77 of the *Speculum* he speaks of three obstacles to medical certainty that he says were described by Hippocrates in his first aphorism, as (Arnau goes on) «is explained in [our] exposition of that aphorism ,iam diu communicata'.⁹ That exposition, we have just seen, was published in 1301, so the *Speculum* was written after that—,long' (diu) after. How much time is meant by «diu» we cannot of course say, but I would think certainly more than a year or two is implied, and that means that all the difficulties Paniagua has identified must come into play: from what we know of Arnau's career after 1301, I find it hard to believe that he could have had the time to write a dense and structured work like the *Speculum* before 1305 or 1306, which makes it much more plausible that King Jaume had that work in mind in 1308.

And if we look carefully at the king's letters, I think Paniagua's other doubts can be answered. There is really no reason to believe from the king's language that he thought of the *Speculum medicine* he refers to as a practical work meant strictly for him; it need have been no more than a work that he hoped might prove to be of use to him (it is not hard to believe that Arnau had spoken of his *Speculum* with pride, and that King Jaume could have had great expectations of it, even knowing that it was a work on medical theory). It does not seem to be a book that he plans to read personally, rather it is one that he says his learned physician Master Martí will study for him and apply to the governance of his health.

I am arguing, therefore, that the *Speculum medicine* as we have it is indeed a witness to Arnau's medical thinking as of 1308, and I will use it that way in the study that follows. Nevertheless, I do not want to minimize its occasional echoes of his earlier academic life, which for Paniagua were a further indication that it had been written in 1301, and I would suggest cautiously that, while the *Speculum* was certainly finished in 1308, it might have been

7. Juan A. PANIAGUA, *Arnau de Vilanova, Maître-régent à l'École de Médecine de Montpellier*, in «110e Congrès National des Sociétés Savantes, Montpellier, 1985», reprinted in *Studia Arnaldiana* (Barcelona, 1994), p. 312.

8. *Speculum*, in *Opera*, cap. 22, fol. 12rb.

9. «Hec autem tria impedimenta certitudinis acquirende Ypo. comprehendit in primo am-phorismo sub vita brevi et arte longa et ideo in expositione illius am-phorismi iam diu communicata plenius istud elucidatur.» *Ibid.*, cap. 77, fol. 22rb.

begun in 1301—it might have been one more of the many projects we know Arnau had in hand in his last year at Montpellier (like the *Parabole*-commentary or, on my argument, the *Antidotarium*). It would not be surprising, then, if this had been the work he was most concerned to complete in what little time he had for medical writing, if he had sacrificed the other projects in order to bring the *Speculum* triumphantly to an end.

II

Let us begin by looking at Arnau's *Antidotarium*, which, as I have already said, contains a discursive introduction followed by a list of recipes for compound medicines; the list may not be genuinely his, but the introduction seems authentic. This first, assuredly Arnaldian, portion of the *Antidotarium* is organized around a discussion of the kinds of circumstances that can cause variability when a medicine is compounded out of simples, and the circumstances to which Arnau gives most attention are the factors that can alter the basic properties of those simples. He first explains how medicines' properties vary depending on how they have been stored, and on how old they are. Then he discusses a series of procedures that can be applied to these medicines in order to change their behavior: he describes at some length washing a medicine; steeping it in a liquid like water or vinegar; grinding it to a powder in a mortar; boiling it; and roasting it (,assatio').¹⁰ He not only explains the procedures, however, he also describes the effects they have on individual simples (most of those he mentions are vegetable drugs, though a few are mineral remedies). Some things, like lettuce, are rendered harmful by washing; other substances, like ,es ustum, spuma argenti, calx, et similia,' lose something of their harshness when they have been washed. Grinding can intensify a drug's effect, or it can cause it to act more rapidly. Boiling a medicine like squill or scammony can concentrate its purgative powers in the resulting liquid. Roasting a medicine has a particularly wide range of effects: it can make a drug easier to administer (as happens with hazelnuts or gum arabic); it can reduce its ,acuitas' (as is the case with ,rubeum seu realgar' and ,viride seu capparos') or its ,iniquitas' (roasting scorpions in a luted vessel heated in a furnace for a day and night, and then injecting them, mixed in oil, into the bladder, renders them capable of destroying bladder or kidney stones immediately). Let me emphasize that it is the different techniques that hold Arnau's attention, techniques that can be applied to change the properties of any kind of substance, whether animal, vegetable, or mineral; he shows no particular interest in changing the properties of mineral substances per se.

10. *Antidotarium*, in *Opera*, fol. 245ra-va.

This list of procedures, which concludes the first portion of the *Antidotarium*, closes with two brief chapters each of which is devoted to a technique used to produce what Arnau seems to consider a new medicine, not a qualitative modification of an old one. The first, very short, concerns ,distillatio':

«Of medicines, some are distilled; so that from old red wine an ,aqua ardens' is distilled, powerfully dispelling paralysis, lessening plethora, and rapidly heals fresh wounds. Sometimes a variety of drugs is put into the alembic, as required by the illness being treated».¹¹

The second describes ,sublimatio,' providing a little more detail about the process—above all as it applies to arsenic, though Arnau says that ,sal armoniacum', ,sulfur', and ,argentum vivum' can be sublimed as well. He explains that, to make sublimate of arsenic, a combination of yellow arsenic, ,sal gemma', iron shavings, and quicksilver is to be mixed with vinegar and allowed to dry, and the resulting material is to be sealed into an alembic (of the kind, he says, that rose water is made in), heated for a day, and allowed to cool; the white powder that has sublimed and has collected on the top of the alembic, Arnau explains, is an extremely effective cauterizing agent.¹² The somewhat different character of these two chapters as compared with the preceding ones, and their position tacked on at the end of what I believe was Arnau's unfinished composition, suggests to me that distillation and sublimation were aspects of the new chemical technology that he knew about, certainly, but that he was still unsure how to integrate with traditional pharmacy as he knew it.¹³

III

There is some evidence to suggest that Latin awareness that these procedures could have medical applications had originated in the surgical tradition. By the middle of the thirteenth century, surgical writers were revealing their knowledge that the works of Avicenna and Rhazes described procedures

11. «Distillantur quedam ex medicinis unde ex vino rubicundo antiquo distillatur aqua ardens pellens potenter paralysim plectoria diminuta et vulnera recentia celeriter sanat, in cuius alambico immittuntur aliquando medicine varie prout invitat necessitas morbi curandi.» *Ibid.*, fol. 245va.

12. *Ibid.*, fol. 245va-b.

13. Antoine CALVET, *Mutations de l'alchimie médicale au XV^e siècle*, in «Micrologus», 3 (1995), 209, uses this passage to suggest Arnau's «interest» in *aqua ardens*, whereas my point will be that because it is virtually unique in his writings one cannot generalize from it to a wider interest in the material.

of medicinal preparation which seemed to create new drugs.¹⁴ Bruno of Longoburgo, writing in his *Chirurgia* in 1252, is the first Western author to describe a caustic medicine that can be used in treating fistulas and cancers; he calls it 'sublimated arsenic' and explains how to make it in the following terms:

«Take sal ammoniac, yellow arsenic, sulphur, and flowers of copper, one and a half drachms of each; iron filings, vitriol, alum, antimony, two ounces of each; quicksilver, one ounce; quicklime, one-half pound; grind them up together thoroughly, and add the mercury. Then combine with sea water or water from ashes, make tablets and dry them in the sun or in an oven. When they are dry, powder them again, put the powder in an aludel and sublime it, and collect the sublimate in a glass vessel. This medicine cauterizes as well as fire does».

Bruno has built up this account from material in both Avicenna's *Canon* and Rhazes' *Almansor*.¹⁵ Sublimate of arsenic very soon established itself as a valuable addition to a surgeon's technical repertoire. In the 1260s Teodorico of Cervia extolled its value in treating fistulas of the tear duct¹⁶ or the jaw,¹⁷ cancer, herpes esthiomenus, and nolimetangere.¹⁸ Teodorico, like Bruno, thinks surgeons need to know for themselves the procedures involved in the preparation of such medicines (the techniques would probably still have been unfamiliar to apothecaries), and he waxes quite ecstatic when he explains how the sublimate is to be prepared. You are to grind up arsenic, burnt brass, sal gemma, and cerusa, mix them in vinegar, and, as he tells us in technical detail,

«... put the whole mixture in a vessel (that is in an aludel on a saucer). When the sublimation begins, increase the heat of the fire as much as you are able for

14. What follows is based on my unpublished study, «The Potential Cautery», delivered to the Fifth Annual Conference, Southern Association for the History of Medicine and Science, Durham-Chapel Hill, NC, 21 February 2003.

15. «Recipe salis armoniaci, arsenici citrini, sulphuris uiui, floris eris, ana dr. i et semis; limature ferri, draganti, aluminis iameni, antimonii, ana unc. ii; argenti uiui unc. i; calcis uiue, id est non extincte, libram semis; omnia terantur, et subtilissime puluerizentur et argentum uiuum extinctum in saliva eis amisceatur; deinde conficiantur cum aqua maris uel aqua cineris et fiant inde troscisci; deinde ad solem uel ad clibanum desiccentur, et cum desiccati fuerint iterum puluerizentur; et puluis eorum ponatur in aluthel et sublimetur; et quod ex eo sublimatum est in uase uitreo recondatur. Huiusmodi quidem medicamen erit tanquam ignis cauterium.» BRUNO, *Chirurgia* I.15; S.P. HALL, ed., «The *Cyrurgia Magna* of Brunus Longoburgensis: A Critical Edition» (dissertation; Oxford, 1957), p. 115. Cf. AVICENNA, *Canon* IV.4.3.11 (Venice 1507, fol. 456ra-b) and RHAZES, *Almansor* VII.5; *Opera parua... Arasi* (Lyons 1511), fol. 113v.

16. Eldridge CAMPBELL and James COLTON, tr., *The Surgery of Theodorico*, vol. 2 (New York, 1960), p. 19.

17. *Ibid.*, p. 22

18. *Ibid.*, p. 26; herpes or lupus is treated similarly on pp. 35-36.

six hours in summer and nine in winter, or thereabouts. And when you see that the arsenic is sublimated and the distillation is ceasing, remove the alembic with its saucer. Then close up the neck of the aludel with a bit of natron in quantity adequate to the neck. Then build up the fire a little for one hour, so that the material may not harden. Having done this, remove the vessel and allow it to cool all night. Then gently disengage it from the vessel; and as for the sublimate that remains in the aludel, put it to one side. Then take the dregs that are in the bottom of the lower vessel and grind them up very vigorously with the water called distilled. Do all things just as before, and repeat this with the residue five times... Then take 'all' the white material [that has been produced], and grind it up... and put it back on a very low fire until it is all sublimated, as before. This makes its sharpness soft and gentle, like the sweat of the Blessed Virgin when she gave birth to Christ.»¹⁹

This is not Avicenna's recipe for arsenic sublimate, passed on by Bruno, but just where Teodorico found it is uncertain; in any case, it again makes clear how technical knowledge was spreading among later thirteenth-century surgeons.

Perhaps a speculative parenthesis is justified here. Retrospective interpretation of medieval chemical procedures, like retrospective diagnoses of medieval diseases, is rarely easy to defend, but there is enough detail in the accounts by Teodorico and Bruno to let us at least guess at what they were doing. Yellow or citrine arsenic, orpiment, 'auripigmentum', is arsenic trisulphide, As_2S_3 ('realgar' is the disulphide, As_2S_2). What I think was happening is that they were carrying out a reaction that produced arsenic trioxide, which does indeed sublime as a white powder, and has produced skin lesions in twentieth-century workers exposed to much smaller quantities than a me-

19. «Arsenicum sublimatum secundum dominum Hug. sic fit. Re. arsenicum et exfolia, lib. s., deinde accipe aeris usti, salisgemmae, cerussae, ana lib. s. Deinde arsenicum exfoliatum tere fortissime, et passa per tamisum grossum. Quod remansit in tamiso tere donec totum sit passatum; postea fiat idem per omnia, de aere usto separatim, idem de salisgemma et cerussa separatim. Postea omnia sic trita commisce fortiter in aceto forti super marmor cum lapide suo; deinde totum commistum pone in vase, id est in disco cum alutel. Da sibi ignem quanto poteris plenior. In signum sublimationis sunt vi. horae in aestate et ix. in hyeme vel circa; et quando videris arsenicum sublimari, et distillationem cessare, remove alambicum [!] cum suo recipiente. Deinde foramen alutelli claude cum modico nitri quantitatis conformis foramini; deinde modicum vigora ignem per unam horam, ne materia aduratur. Quo facto remove, et vasa infrigidari tota nocte permitt; post suaviter vasa disiunge, et quod remansit sublimatum in alutello ad partem pone. Post accipe faeces, quae sunt in fundo vasis inferioris, et fortissime tere cum aqua dicta distillata fac omnia sicut prius. Hoc reitera de faecibus quinquies, post faeces reice, et vasa munda; post accipe totum album, et tere tantum salisgemmae ad spissitudinem unius digiti pone in fundo disci, post folium papyri eidem foramini superius pone, dando ei lentissimum ignem donec sublimetur totum sicut prius. Hec acus fiat mitis et suavis sicut sicut sudor beate mariae virginis quando peperit Christum»; TEODORICO, *Chirurgia*, III.8, in *Ars chirurgica* (Venice, 1546), fol. 183va; translation from Campbell and Colton, vol. 2, pp. 213-214.

dieval patient was.²⁰ But the precise chemical processes involved are not really essential to our story.

Like sublimation, distillation was a technical process that thirteenth-century surgeons learned from their new Arabic sources; but unlike sublimation, distillation led them to discover a new product.²¹ These developments began in the early 1260s, when the works of Rhazes in particular led writers like Peter of Spain and Teodorico Borgognoni to take a sudden new interest in the production of medicinal oils, especially ,oleum benedictum', the ,blessed oil' distilled from bricks.²²

Now when these writers of the 1260s and 1270s are describing the production of the exciting new ,oleum benedictum', they consistently make the analogy with the production of rose water (or, in Teodorico's case, to rose oil). Rose water was a fundamental drug for Western (and Eastern) apothecaries and physicians; it was a valuable medicament in its own right, but it was also widely used as a vehicle for applying other medicines. It had been produced in Islam for a very long time by distillation. The apparatus used for its production consisted typically of an open vessel, a cucurbit, over which was inverted another vessel, the alembic, containing an internal gutter draining out through an opening in its side; water and rose leaves were placed in the cucurbit, its contact with the alembic was luted with rags or clay, and the water was boiled; the steam and essential oils condensed in the alembic and ran out into a collector.

But what is the history of rose water in Western Europe? It is not at all certain that it was a distilled product there, at least in the twelfth and early thirteenth centuries. I have argued elsewhere that in early thirteenth-century Europe it may normally have been prepared by steeping or boiling rose leaves or flowers in the fluid, not by distillation properly speaking, but that the increasing assimilation of the medical translations from Arabic convinced Western apothecaries and physicians that it might be desirable to prepare rose water by distillation rather than by decoction, and they began to do so; and that in the 1260s they were beginning to recognize that the new technology allowed them to produce other tempting drugs that they had begun to encounter in the Arabic literature, like the blessed oil of bricks.

20. M.E. VAHTER, *Metabolism of Arsenic in Biological and Environmental Effects of Arsenic*, FOWLER, B, ed., Elsevier Science, 1983.

21. Part of what follows is drawn from my paper, *Alcohol, Rose Water, and the Blessed Oil of Bricks*, to conference on «The Rising Dawn': The Contribution of Alchemy to Medieval Medicine and Intellectual Life», University of East Anglia, Norwich (England), 21 March 2002. See also my *Alchemy in the Chirurgia of Teodorico Borgognoni*, in Chiara CRISCIANI and Agostino PARAVICINI BAGLIANI, ed., *Alchimia e medicina nel Medioevo* (Firenze: Sismel, 2003), 55-75.

22. In the Middle East bitumen was used as a binder for the light clay from which bricks were made, and so when the bricks were heated or distilled, petroleum was driven off: it is this that burns so easily, and acts as a warming liniment.

The developments in the 1260s can be further illuminated, I think, by the *Tractatus mirabilis aquarum* attributed to Peter of Spain that was incorporated into his *Liber de oculo*. Here Peter described the production of five marvelous waters useful to the eyes. The first was prepared by putting certain herbs and white wine «in campana in qua fit aqua rosata» and distilling it; the second was a distillation of sal gemma; the third was a decoction or steeping of herbs in wine, not involving distillation; the fourth was a distillation of herbs steeped in hot water; and the fifth, a mixture of metallic compounds steeped successively in a virgin's urine, white wine, fennel juice, egg white, mother's milk, red wine, and egg white again, and then distilled. Some historians have taken Peter's treatise as one of the earliest Latin recognitions of the existence of alcohol, but I think this is to misinterpret its meaning: Peter does not appear to think that the distillation of wine is of any more intrinsic interest than the distillation of hot water or of urine, and he does not suggest that any of these marvelous fluids is to be drunk—they are all to be dropped into the eye. His analogy to the production of rose water from its petals or leaves is what is significant: in each of these waters, Peter's interest is focused on the substances whose virtues are being extracted by the process involved (which is not necessarily distillation)—the herbs, the metallic compounds—and not the particular liquids into which they are passing.

Within ten years or so, the technology of rose-water distillation underwent other modifications that did at last permit the ready production of 'aqua ardens'. From a technical point of view, the crucial innovation in the distillation of alcohol was the introduction of the 'serpentinum', a long tube leading from the alembic to the receiver that could be externally cooled, thus making possible for the first time the collection of low-temperature distillates, including alcohol. (A slow fire and a succession of distillations were other important innovations.) Once the rose-water technology was modified, once the 'serpentinum' was introduced into the system, men like Peter and Teodorico would have been ready to profit from the innovation. In fact, Peter did not live long enough to do so—he was elected pope in 1276 and died a year later. But Teodorico lived another twenty years and saw the promise of the new technology fulfilled, as described in the *De aqua vite* ascribed to him. Extending the new distillation of rose water to the distillation of bricks and of other substances led medical practitioners to recognize that the distillation of wine produced a substance of great physiological power independent of the herbs that had been placed in the original wine. In Teodorico's Bologna this seems to have happened in the period 1275-85.

Against this background, the knowledge of 'aqua ardens' displayed by Arnau de Vilanova around 1300 seems neither particularly impressive nor surprising. The apparent sum total of his information—that the medicine was distilled in an alembic from old red wine to which other simples were sometimes added, and that it was good for treating wounds and for preventing paralysis—does not necessarily bespeak any direct familiarity with the drug. These facts

could be found in the many treatises on the subject that were beginning to appear: for example, they are all reported in Teodorico Borgognoni's *De aqua vite*. Arnau's description of arsenic sublimate comes closer to suggesting personal experience with the procedure: he describes with some explicitness not only the ingredients necessary but the stages in the process, identifying the moment when the alembic is to be sealed up and converted into what Teodorico and Bruno knew as an aludel (though Arnau does not seem to be acquainted with the latter term). Still, this level of detail about the process of sublimation was already widely available in medical texts of the day, so that Arnau's knowledge of the process is no more obviously personal than his knowledge of distillation.

IV

How did Arnau's awareness of chemical medicines and their production compare with that of his contemporaries at Montpellier? We can begin to understand this by looking at the *Lilium medicine* of Bernard Gordon, composed at Montpellier in 1305. This is a work concerned more with medical practice than with drugs and their production, so it is not entirely comparable with Arnau's *Antidotarium*; but in the *Lilium* Bernard regularly allows himself reflections on the theoretical and technical issues that underpin practice, and we might therefore hope to see him comment on the utility of chemical procedures like distillation and sublimation in creating effective medicines. And as it proves, Bernard was by no means oblivious to the usefulness of minerals or, indeed, of a chemical technology. His list of mortifying medicines ('mortificantes') that can be used in treating a fistula includes cerusa, litharge, 'es ustum', 'viride eris', vitriol, tartar, 'argentum vivum extinctum', iron shavings, quicklime, 'sulphur vivum', sal ammoniac, orpiment, alumen, 'realgar repressum', 'sal nitrum', 'plumbum ustum', 'sal tostum'... and it ends with 'aqua ruthe distillata per elambicum'. As he goes on, he describes a second distillation in greater detail:

«When a chronic fistula has penetrated deeply, let this water be prepared: take equal quantities of sal ammoniac, vitriol, red and yellow orpiment, and es viride: grind them up, place them in a glass alembic, well-sealed, over a slow fire. Discard the liquid passing over until the alembic becomes red, and keep it in a closed glass vessel; otherwise it will evaporate».²³

23. «Quando autem fistula antiqua est in profundo, fiat talis aqua. Rx salis armoniaci vitrioli auripig. rubei et citrini viridis eris ana. pulverizentur et ponantur in elambico de vitro bene lutato et fiat lentus ignis et prima aqua abiiciatur donec elambicum fiat rubeum et servetur in vase vitreo obturato aliter exalaret». Bernard GORDON, *Practica... dicta Lilium* (Venice, 1498), fol. 12va.

It is striking, however, that Bernard does not recommend sublimate of arsenic for fistula, even though the compound was by now well known in medicine as a powerful caustic; indeed, as far as I have been able to determine, he makes no reference to any medicinal sublimates at all in the *Lilium*.

Bernard describes one other chemically produced medicine, an oil of the sort that Peter of Spain had been so interested in, but the importance of his discussion goes well beyond the procedure he lays out. The oil is oil of tartar, to be produced by distillation in the original medieval sense of the term, that of dripping out slowly from a mixture.

«Oil of tartar is made as follows: tartar crystals are calcined in a calcinating oven, and then are laid out on marble, and what seeps out will be a very clear oil; let it be kept in a glass vessel and let [the sore] be anointed with it, and without any doubt it will be cured. But only alchemists know this procedure, because the alchemical approach is useful in medicine in many ways, but in others it is troubling because so many die on that road».²⁴

In early exponents like Peter and Teodorico, medical practitioners had eagerly pursued the processes themselves, but now Bernard seems to be indicating that by 1300 medicine has lost its active involvement with chemistry, that new craftsmen, alchemists, have taken over from physicians and now have control over these techniques, which are too complicated—and too dangerous—for the ordinary medical practitioner to master.

This indication is reinforced by Henri de Mondeville's comments in book V of his *Chirurgia* (written about 1319), an 'antidotarium' in some respects not unlike Arnau's. Like Arnau, Henri devoted attention to technical procedures that physicians or apothecaries could use to alter the properties of medicine, describing various techniques of combustion and lavage in even more detail. To increase the drying action of copperas (ZnSO_4 ?), for example, you crush it, place it on a tile over a charcoal fire, and increase the heat with a bellows until it melts and turns green. For tutty, you heat it until it turns red, add wine or vinegar, allow it to cool, and repeat the process. Most of this, Henri adds, is usually done by apothecaries, yet the detail in his accounts suggests that he was familiar with the procedures and could have carried them out himself. Again, however, there was a limit to his knowledge: «this is enough about how to prepare medicines useful to surgeons, though I have left out... certain delicate and difficult procedures unknown to the ordinary surgeon, procedures like the sublimation of arsenic, which, being rarely needed

24. 'Oleum autem de tartaro sic fit: Tabule tartari calcinentur in furno calcinationis, et postea ponantur supra marmore et quod distillabitur per filtrum erit oleum clarissimum et reservetur in vase vitreo et locus iungantur, et curat [morphæam] proculdubio. Sed iste modus non est notus nisi alchimis, quia modus alchimicus in multis est utilis in medicina, sed in aliis est ita tristabilis quod in eius via infinitissimi perierunt.» *Ibid.*, fol. 17ra.

by surgeons, are left to alchemists».²⁵ Elsewhere, speaking of the medicinal oils whose production had launched the new medical technology, he declared that «preparing some of these can be difficult and painstaking, even dangerous, like making ‘oleum benedictum’... and they are better left to the alchemists, who are accustomed to it; they can be better prepared in the shops of craftsmen who do this sort of thing routinely than by us ourselves».²⁶ Mondeville wrote this in Paris, when he was virtually on his deathbed; his remarks may well reflect the situation in that city in the ‘teens, but they may also be a memory of his professional experiences in Montpellier, where he had studied and had been teaching at about the time that Bernard began to write the *Lilium*. In either case, they show, again, that the enthusiasm of medical practitioners for the new technology they helped to create (sublimation and distillation) had waned, that they had turned it over willingly to a new craft speciality, and that as a result their knowledge of the craft itself was not especially high.

Perhaps this can help us clarify Arnau’s well-known criticism of ‘alchemists’ in the *Speculum*. He is describing the action of subtiliative medicines, which he says are medicines between the first and second degrees of hotness—but, he goes on, this is not a hard-and-fast rule. His commitment to a medical instrumentalism leads him to insist that the physician must judge medicines, not by their complexion, but by their effect on the body to be healed—and in this way, he concludes, «ignorantia detegitur fatuorum alchimistarum qui, de potentia applicabilis ad mineralia, non aliter iudicant quam determinetur a medicis corporum humanorum».²⁷ Is he perhaps implicitly acknowledging that alchemists are trying to claim control over mineral medicines, and insisting that their production of those medicines must still be subordinated to the needs and knowledge of physicians? If so, Arnau’s attitude towards the new chemical medicines, as well as his knowledge of the subject, seems quite typical of his contemporaries’.

25. «Praedicta sufficient de praeparationibus medicinarum pertinentium quantum spectat ad cyrurgicos mediocres exceptis praeparationibus medicinarum pertinentium ad aegritudines oculorum et quibusdam aliis praeparationibus subtilibus et laboriosis ignotis cyrurgicis communibus, sicut est sublimatio arsenici et multa similia, quibus etiam parum indigent cyrurgici, quae alchemistis relinquuntur.» HENRI DE MONDEVILLE, *Chirurgia*, in J.L. PAGEL, ed., *Die Chirurgie des Heinrich von Mondeville* (Berlin, 1892), p. 514.

26. «Modi conficiendi olea sunt quidam difficiles, artificiales, laboriosi et quandoque periculosi, sicut modus faciendi oleum benedictum, oleum de terebinthina, de stercoribus humanis et de similibus et isti modi et eorum similes alchemistis relinquuntur qui ut plurimum in talibus consumuntur, et quia melius forum habetur de talibus in apotheca et ab artificibus qui faciant supradicta, quam si nos ipsi huiusmodi olea faceremus.» *Ibid.*, p. 515.

27. *Speculum*, cap. 34; *Opera*, fol. 26rb. Cited in J. A. PANIAGUA, *Notas en torno a los escritos de alquimia atribuidos a Arnau de Vilanova*, in «Archivo Iberoamericano de Historia de la Medicina», 11 (1959), 417; reprinted in *Studia Arnaldiana*, p. 462.

V

We have already seen from his *Antidotarium* that Arnau was at least vaguely aware of distillation and sublimation, but we have not yet asked to what extent he might have used the new medicines produced by these techniques in his practice. Take sublimation, for example, so highly praised by Bruno and Teodorico for its production of sublimate of arsenic. Bernard Gordon, we have seen, made no use of sublimate of arsenic in his *Lilium*, and Henri of Mondeville shows no particular enthusiasm for it. Was Arnau any readier to administer it to his patients? Here we might consider his remarks in the *Speculum medicine*, a work that was loosely composed around the framework of Johannitius' *Isagoge*; a standard of academic medicine, Johannitius' work dealt with the naturals, non-naturals, and contra-naturals in turn. But Arnau's treatment is distinctly idiosyncratic: his lifelong fascination with medicines and medicinal action has here induced him to move from complexion (among the naturals) into a disproportionately long account of the qualities of medicines—not just their primary ones of hot and cold, dry and moist, but also their secondary and tertiary ones, which (as in the *Antidotarium*) he exemplifies with not only vegetable but mineral drugs: 'capitello vel aqua nitrosa' (chap. 41), 'attramentum nigrum quod dragagantum vocatur' (chap. 49).²⁸

Yet in the *Speculum* Arnau is still notably restrained in his account of medicines produced by what I see as the 'new' chemical technology of sublimation. He mentions only in passing that «the whitest arsenic sublimate is often used as a cautery and corrosive... It is the strongest of all cauterizing agents».²⁹ The *Speculum* once more gives the impression that by the end of his life Arnau was perfectly well aware that metallic sublimate was entering the contemporary armamentarium, and he supposed that other practitioners might find them useful, but that they were relatively unimportant to his practice, just as they seem to have been to Bernard Gordon's.

And distillation? Are there references in Arnau's works (besides the passage from the *Antidotarium* with which I began) to the usefulness of distilled products, like 'aqua ardens'? There are some hints, but they do not suggest that these products played an important part in his medical practice. In a practically-oriented work that was apparently more or less contemporary with his draft of the *Antidotarium*, the *Medicationis parabole* drawn up for Philip IV in 1300, Arnau speaks of the effectiveness of 'aqua ardens' in language that is very similar to his account in the *Antidotarium*: «Recentia vul-

28. *Ibid.*, fols. 17va, 18rb.

29. «Arsenico sublimato quod est albissimum frequenter utitur pro cauterio et corrosivo... omnium autem cauterizantium medicinarum potior est arsenicum sublimatum». *Ibid.*, fol. 18rb.

nera cum aqua ardenti lota sanationis effectum citissime consequuntur».³⁰ He does not go on at greater length, which leads me to think, again, that by 1300 this was a medicine he was becoming aware of but did not employ widely. In the *Speculum*, later in the same decade, Arnau mentions briefly that «in applicatis exterius... aqua ardens oculum calefit»,³¹ and says nothing more about its properties. Such modest praise of 'aqua ardens' does not encourage us to believe that Arnau made much use of it, though he was evidently interested in trying to explain or understand it: lecturing to his students in 1301, he offered 'aqua ardens' to illustrate the principle that the subtler the material, the more penetrative it was:

«the 'aqua ardens' that is produced by distillation from wine is subtler than ordinary water, and so too is red choler; for while they do contain a certain earthiness, the strength of the lighter elements in them is such that as regards this effect, that is, [the ability] to penetrate narrow openings quickly, their earthiness is insignificant and does not impede their penetration».³²

Such remarks certainly show an intellectual curiosity about the new substance, but no particular excitement about its possible role in medicine.

Can the judgments of his contemporaries be of help in interpreting Arnau's attitudes towards 'aqua ardens'? Was their enthusiasm for the distilled product of wine any less tepid than his? Bernard Gordon, like Arnau, was certainly aware of its existence and possible medical role. In his *Tractatus de gradibus*, written in 1303, Bernard discussed the variable properties of different wines, among which he included

«'aqua ardens'—that is, wine distilled in an alembic; since it rapidly heats the body and rises to the head unless it is diluted with plenty of water, it would seem to be hot in the fourth degree».³³

30. Likewise, the other property mentioned in the *Antidotarium*, its effectiveness in cases of paralysis, is signaled in *Parabole* IV. 70: AVOMO 6/1:107, 71.

31. *Speculum*, cap. 18; *Opera*, fol. 7vb.

32. «Hoc autem convenit rei pro tanto quia per suam substantiam appropinquat ad naturam levium elementorum, et ideo aqua ardens que per distillationem fit ex vino subtilior est quam sit aqua simplex, et similiter colera rubea; quia licet participant aliquod terrestreitas, tamen tantum est dominium in eis levium elementorum quod comparatione huius effectus qui est cito penetrare per strictos meatus nulla est terrestreitas vel insensibilis nec inpediens penetrationem.» MS Munich, CLM 14245, fols. 23v-24r; *Repetitio super «Vita brevis»*, *Opera*, fol. 278ra. I am preparing an edition of this work for AVOMO.

33. «Aqua ardens, hoc est vinum distillatum per alembicum, quoniam cito inflammat corpus et ascendit ad caput nisi cum multa aqua reprimatur, et ita videtur calidum in 4^o.» [Julius Leopold] PAGEL, *Ueber die Grade der Arzneien nach einer bisher ungedruckten Schrift des Bernhard von Gordon aus dem Jahre 1303*, in «Pharmaceutisches Post», 28 (1895), 260.

Evidently Bernard was not convinced that its therapeutic usefulness outweighed its problems, when administered internally: quite aside from the hangover he seems to be referring to, by classifying it among the medicines hot in the fourth degree (like mustard, quicklime, or vitriol) he is implicitly placing it among drugs that «are not to be taken internally unless [the doctor] is a man highly experienced in controlling their dangers», as the *De simplicibus* attributed to Arnau warns,³⁴ and then only in the most desperate cases. Perhaps it is not altogether surprising that two years later, 'aqua ardens' did not appear in the *Lilium medicine* at all. In the *Antidotarium*, Arnau at least mentioned that 'aqua ardens' was supposed to be of value in washing wounds and in treating paralysis; but the *Lilium's* chapters on these subjects (I.26, II.27) contain no hint whatsoever of the new remedy. Indeed, more than a decade after Arnau and Bernard wrote, Henri de Mondeville too could still find relatively little therapeutic application for alcohol, which he called 'aqua vite': he mentioned it briefly as one of a number of treatments for scrofula, for ear abscesses (along with a number of oils), and for fistula,³⁵ but he showed no signs of believing that it was a particularly useful treatment for any of these conditions, and he never referred to it at all in his *Antidotarium*.

VI

What are we to make of all this? Why, after the initial medical excitement over sublimates and distillates in the 1260s and '70s, did Arnau and his Montpellier contemporaries around 1300 seem so little interested in their use? After all, within a short time thereafter they would be staples of medical practice. I have several suggestions to make. For one thing, they may still have been relatively difficult to come by at the beginning of the fourteenth century. They were discovered by medical practitioners who could produce them themselves and put their products directly into use, but by Arnau's day they were becoming the product of the alchemist's laboratory, and if a practitioner wanted to experiment with them, to learn their use and their limitations, he had to have a competent craftsman at hand who had learned the new procedures and could supply him with trustworthy, standardized materials. We have no statistics, of course, but I wonder how widespread the production of these materials was in 1300; how many suppliers were there in contemporary Montpellier?

A second factor, which perhaps applies more to Bernard and Arnau than it does to Henri, is the functional division between medicine and surgery, bet-

34. «Non sunt approximande ab intus nisi sit vir valde expertus in emendando periculum earum.» *De simplicibus*, in *Opera*, fol. 234vb.

35. MONDEVILLE, *Chirurgia*, ed. PAGEL, pp. 471, 488, 495.

ween academic medical masters like Bernard and practicing surgeons like Henri. Generally speaking, the former took as their province the internal physiological body, the latter the external body: to oversimplify and over-generalize, surgeons applied ointments externally (often incorporating mineral materials), physicians administered drugs orally, almost always vegetable in origin. Thus in his later life Arnau himself came to believe strongly in the power of coriander, dried and powdered and taken internally in combination with other medicines, as a panacea for treating almost all illnesses.³⁶ But the evidence we have suggests that both arsenic sublimate and 'aqua ardens' were perceived by all our witnesses as primarily surgical medicines, useful when applied to the skin but potentially dangerous when taken internally. Arsenic sublimate, of course, was strictly surgical in use, a caustic medicine capable of searing the skin and used therefore in healing ulcers and fistulas, but fatal if taken internally. More surprisingly, 'aqua ardens' too seems to have been viewed as essentially an external remedy: Arnau's references to it stress its value in external application to the eyes and skin and in cleansing wounds, as well as in cases of paralysis (and he may have believed it should be applied externally in the latter condition too); Henri acknowledges its potential in treating abscesses and fistulas; while Bernard seems rather suspicious of its internal effects. If both these medicines were seen as primarily relevant to surgical practice (and both, after all, had emerged out of a surgical rather than a medical tradition), Arnau and Bernard, as physicians, would have had less reason to use them. To be sure, as I have pointed out elsewhere, there was no impenetrable barrier between the two kinds of practice, and both these learned physicians certainly treated surgical cases occasionally, but that was not what they usually did or how they thought of themselves. When they wrote, they wrote about medical rather than surgical conditions, conditions for which external remedies had little relevance; and their comparatively limited exposure to surgical cases meant that they could have only restricted opportunities to become familiar with the strengths and weaknesses of the new medicines when applied to wounds and ulcers.

But there may have been one other element that contributed to Arnau's lack of enthusiasm in particular, namely, the intellectual conservatism of age. I feel a little heretical calling Arnau a conservative of any kind: he has been an innovative, creative figure to me for so long. We are so used to thinking of him as defined by the given body of his writings that we forget that they were shaped by the trajectory of his biological life, and I think we should remember that in 1300 Arnau was the oldest of the three witnesses I have drawn on, a man probably about sixty-five years old. As it happens, that is my present age, and I am increasingly aware of how difficult it is for me to

36. '*Coriandri bulliti in aceto et exsiccati.*' *An Arnaldian touchstone?*, in «Arxiu de Textos Catalans Antics», 21 (2002), 659-663.

embrace new ideas, to begin new projects, to adopt new tools and techniques: I am becoming intellectually conservative. I don't mean by that that I am hostile to these innovations, merely that I already have so much that I want to do that I am resistant to spreading myself still thinner. My younger university colleagues are eagerly taking up new computer software applications, for example; there is scarcely anyone under the age of fifty who doesn't use PowerPoint in giving lectures to classes, or presenting papers to conferences like this one, but it is nothing I have the least interest in learning; I have given talks without PowerPoint with reasonable success for forty years and I don't want to take the time to learn how to use it for an uncertain gain. I am content with what I know and have used successfully for decades, and I see no need to change my approach now. This is only speculation, of course, and you may think it fanciful and unworthy of our hero, but may not Arnau have reacted in much the same way to the new chemical medicines? Let others use them, but not him; he knew of them, and did not deny their possible efficacy, but he preferred to stay with his time-tested favorites—like the dried and powdered coriander for which he expressed such enthusiasm in his last years.

APPENDIX

However: if we feel compelled to try to maintain an image of Arnau as a man still open to new ideas at the very end of his life, we have to turn to the *De vinis* attributed to him and to make a case for its authenticity.³⁷ I confess that I am deeply uncertain as to whether this work is genuinely his. Juan Antonio Paniagua has already emphasized some of the difficulties in believing that it was written by Arnau;³⁸ all have great weight, yet none is entirely conclusive. First, the manuscript tradition is not particularly early and is extraordinarily variable: the work circulated under four very different openings, and its conclusion is equally inconsistent. Against this, one might point out that Montpellier seems to have understood him to be the author by the later half of the fourteenth century.³⁹ Second, its internal references are atypically

37. I regret that I have not yet been able to consult the dissertation of Maria Aparecida PILEGGI PERASSOLLO, *Fragmentos do universo cultural valenciano na montagem da obra alquímica de Arnaldo Vilanova* (Sao Paulo, 1992) and its discussion of the *Liber de vinis*.

38. Juan A. PANIAGUA, *El maestro Arnau de Vilanova, médico*, 2nd ed., corregida, p. 71; in *Studia Arnaldiana*, p. 121. This judgment from 1994 represents a change from his seeming acceptance (in 1959) of the authenticity of the *De vinis*: *Notas en torno*, 416-417; *Studia Arnaldiana*, pp. 461-462.

39. The text is included in MS Leipz. Univ. 1183, which seems to have been produced at Montpellier: see Michael McVAUGH, *Two Montpellier Recipe Collections*, in «Manuscripta», 20 (1976), 175-190.

numerous and seem different from those in Arnau's genuine writings, many of them being to Latin, Greek, and Arabic authors whom he seldom or never mentions elsewhere (Macrobius repeatedly, Rufus, Maimonides, Avenzoar). Yet one of *De vinis*' references which it seems strange to find cited in an academic medical work—Palladius' *De agricultura*—is in fact to a treatise that had actually been of great importance to Arnau when he composed his *De humido radicali*. Indeed, the author of *De vinis* shows his familiarity with a number of older Arnaldian themes: the 'humidum radicale' for one, the concept of 'proprietas' for another; and yet, to go back to the other side of the argument, the *De vinis*-author never refers back to his own earlier writings on those subjects, as the historical Arnau tended increasingly to do in later life. And finally, as we will see, there is a certain discontinuity between a number of the ideas that are central to *De vinis* and the ideas of the 'real' Arnau; yet there are some suggestive correspondences, too.

De vinis can usefully be compared with the *Antidotarium*, for both are concerned with applying technical processes to the preparation of medicines. Like the *Antidotarium*, *De vinis* begins with a short general introduction before moving on to particulars: it starts with a discussion of the merits of wine per se, explains that medicinal simples heated with wine will pass on their own properties to the wine, and concludes by describing three procedures by which medicinal wines are prepared.⁴⁰ Then it turns to an account of a number of individual wines, an account that takes up more than three-quarters of the work. This process of infusion was well known to Arnau, and it is one of the techniques he describes in the *Antidotarium*: «infunduntur interdum medicine quatenus virtus que queritur extrahatur» (fol. 245ra). But it is striking that the *Antidotarium*'s discussion of infusion does not mention the value of infusion into wine at all: here we find esula infused into vinegar, fresh mirabolans infused into hot water, turpeth infused into cucumber juice, melons infused into cold water, and so forth—but wine is never mentioned as the vehicle of an infusion. It is also striking that the two texts exhibit quite different attitudes towards the role of heat in preparing medicines. The *Antidotarium* is matter-of-fact about the use of heat in 'coctio' and 'assatio', offering practical insights about its use (in 'coctio' the fire should not have a high flame, because that destroys medicinal 'virtus');⁴¹ *De vinis*, on the other hand, expresses what might almost be called a metaphysical celebration of the power of fire. The former work certainly better suggests the pragmatism or instrumentalism so characteristic of Arnau's mature scientific thought than does the latter.

Exactly the same contrast is apparent in the case of the *Speculum*. Here we find the same kind of attempts at down-to-earth description and practical

40. *De vinis*, in *Opera*, fols. 262rb-263ra.

41. *Antidotarium*, fol. 245rb-va.

discrimination that we have noted in the *Antidotarium*, when Arnau lays out for his readers the different ways in which heat can change the qualities of medicinal substance: «quod autem per ignem alteratur, aut coquitur aut aduritur; que vero coquuntur, aut elixantur aut assantur...»⁴² (distillation and sublimation, perhaps significantly, are not among the specific heat-based procedures he goes on to describe). The author of *De vinis*, on the other hand, speaks of heat in uncritical, all-embracing terms as a virtually universal and all-powerful agent: «quidam Hermetis filii appellaverunt ignem solem, et quidam caloris naturalis renum vicarium; et dixerunt eorum aliqui in eorum quibusdam secretorum libris quod istud quod operatur calor solis in visceribus terre et mineris in centum annis possibile est fieri posse per ignem die uno».⁴³ It is not easy to recognize the author of this transcendent praise in the passages of specific, concrete information where the historical Arnau tried to explain how and why certain kinds of heating had certain restricted and well-defined kinds of effects.

The reason why the question of authenticity matters so much to us here today, of course, is because one of the wines praised in the second part of *De vinis* is a 'vinum extinctionis auri', prepared by steeping (extinguishing) sheets of gold four or five times in wine. Its account of this wine links the work with the tradition of an elixir for the preservation of life going back to Roger Bacon and on to John of Rupescissa.⁴⁴ It is the gold that is the essential ingredient, of course: «aurum quidem est res archana perfectissima temperamento equali compositum mirabili proportionem elementarium virtutum... et propter istud quod habet de virtutibus ex proprietate a natura insunt ei ex influenza celi specifica virtutes alie».⁴⁵ The procedure is merely a way to transfer the power of the gold into the wine, «et breviter omne vinum suscipit virtutem et operationem rerum que exvirtuantur»⁴⁶ in eo secundum modos iam dictos». Anyone can do it, alchemist or no: prelates are boiling it up in their own kitchens, says our author. Indeed, he suggests that holding gold in one's mouth and swallowing the saliva, or consuming gold shavings, is just as healthful as drinking the auriferous wine.⁴⁷

42. *Speculum*, cap. 22, fol. 11ra.

43. *De vinis*, fol. 262ra.

44. Chiara CRISCIANI and Michela PEREIRA, *Black Death and Golden Remedies*, in A. PARAVICINI BAGLIANI and F. SANTI, eds., *The Regulation of evil: Social and cultural attitudes to epidemics in the late Middle Ages* (Sismel, 1998), esp. pp. 13-22.

45. *De vinis*, fol. 263vb.

46. «Exvirtuare» is an unusual word several times used by the author of *De vinis* (fols. 260va, 263vb) but which I have not found yet in Arnau's genuine writings, even though, as we have seen, the historical Arnau often discussed the process by which the powers in one material could be extracted from it and communicated to another.

47. Antoine CALVET, *Mutations de l'alchimie médicale au XV^e siècle. À propos des textes authentiques et apocryphes d'Arnaud de Villeneuve*, in «Micrologus», 3 (1995), 201, seems to believe that the *De vinis*-author is making fun of these practices, but as I read the text I am not

But the author's rapturous enthusiasm for the medicinal virtues of gold (which is expressed at still greater length) is another feature of *De vinis* that is a little difficult to reconcile with Arnau's authorship. Gold does not appear to have played an important part in his therapeutics, even for wealthy patients (the *Parabole* for Philip IV refer to it only briefly, and traditionally, as a cordial medicine,⁴⁸ and the *Regimen* for Jaume II does not mention it at all). Nor does it seem to have had an important role in shaping his theoretical presuppositions. The historical Arnau certainly understood gold to be of special benefit to the heart, as we have seen. In the *Speculum* he cites gold as an example of a medicine that acts directly on the body, and not through its complexion: «quamvis [aurum] non mutet complexionem corporis manifeste tamen confortat cor et letificat sumptum».⁴⁹ But it is not the only one to do so. Jacinth, he goes on, is another cordial medicine that acts in the same way as gold, namely, through its 'proprietas'; «letificat et confortat cor hiacintus grossa et electa si teneatur in ore preter quod transmutetur».⁵⁰ Here jacinth, not gold, is the medicine Arnau recommends that his patients suck on for the health of their heart—in implying that gold is a less effective medicine than jacinth, he may be echoing the judgment of Avicenna's treatise on cordial medicines, a treatise that he himself had translated.⁵¹ In any case, it is worth underscoring the fact that the historical Arnau always appears to have thought of gold as essentially a cordial medicine, not as the great panacea that *De vinis* would celebrate so fervently. The auriferous wine described in the latter work strengthens the heart, to be sure, but it also preserves the blood from corruption, conserves youth, encourages urine to flow, and heals epileptics, madmen, and lepers.⁵² Perhaps I should add that this supposed ability to cure the insane is not mentioned in Arnau's own *De parte operativa*, even though that work includes an unusually long and thoughtful discussion of the way in which 'proprietas' acts.⁵³

It might, I suppose, be suggested that the 'vinum extinctionis auri' is to be identified with the cryptic elixir briefly mentioned by Arnau at the very

sure that he is doing more than simply saying that they are less effective than making «potable gold.» Another practice mentioned here is taking doses of the compound medicine dyaciminum, which contained silver and gold shavings, a recipe for which is found much earlier in the *Antidotarium Nicolai*, from which it is taken up virtually verbatim in the second part of the *Antidotarium* ascribed to Arnau.

48. *Medicationis parabole*, II.27, AVOMO 6/1:39.

49. *Speculum*, cap. 18, fol. 6vb.

50. *Ibid.*, fol. 7ra.

51. «Aurum iudicatur inter iudicium argenti et iudicium hiacynthi, et est quidem infra hiacynthum et supra argentum; cuius quidem complexio temperata est aliquantulum vicina calori, et est eius operatio a proprietate.» *De viribus cordis* II.3, in AVICENNA, *Liber canonis* (Venice, 1507; rpt. Hildesheim 1964), fol. 549ra.

52. *De vinis*, fol. 263va.

53. *De parte operativa*, in *Opera* (1520), fol. 127ra-b.

end of the *Practica summaria*, whose authenticity seems by now reasonably well established; some manuscripts indicate that this short work on practical therapeutics was drawn up by Arnau for Pope Clement V, which would date it after 1305.⁵⁴ The bulk of its prescriptions and general recommendations stress the effectiveness of herbal medicines in treating a series of specific conditions, beginning with headache and ending with fevers. The very last chapter (chap. 29) of the work describes a method for driving venomous reptiles out of their lairs, and then without any transitional material launches abruptly into a very different kind of material, a miscellaneous list of simple medicines whose peculiar 'proprietary' render them suitable as treatments for particular illnesses. And Arnau begins this concluding section by saying

«inter simplicia a proprietate valentia primum et ultimum est elixir maioris operis alkymie si ad ultimam ducatur perfectionem»

—a medicine even better, he goes on, than the stone that grows in the head of a dead asp 'ad preservationem continuum'.⁵⁵ Could this alchemical elixir be the 'vinum extinctionis auri', and therefore a kind of authentication of Arnau's authorship of *De vinis*? I think it is premature to say so. Quite apart from the absolute vagueness of the language here (and 'elixir' was at this moment a very fluid term anyway),⁵⁶ we would need to be sure that these final lines of the *Practica summaria* were original with Arnau; they are so unlike the rest of the work that they might very well have been attached to its end by copyists making use of Arnau's name and reputation for alchemical engagement.⁵⁷ We will need to wait for a critical edition before deciding what kind of elixir Arnau was recommending to the pope—or if he recommended one at all.

One other perplexing feature of *De vinis* deserves to be mentioned here. The fifty or so medicinal wines it describes are all produced by infusion, but on three occasions the author goes on to say something about a distilled product. Speaking of wine into which rosemary has been infused, he refers to «aqua vite vel ardens facta de vino in quo remollita fuerit dicta herba» as a «res experta et a me visa» that can be applied topically to cure salt phlegm, scabies, cancer, fistula, and paralysis.⁵⁸ Again, towards the end of the work he

54. Sebastià GIRALT, *Entorn de la tradició textual de la Practica summaria d'Arnau de Vilanova*, in «Dynamis», 24 (2004), 269-80.

55. *Practica summaria*, fol. 207rb.

56. Michela PEREIRA, *Teorie dell'Elixir nell'alchimia latina medievale*, in «Micrologus», 3 (1995), 103-48.

57. Giralt's detailed account of the twenty-one manuscripts known of the work reveals that in at least one of them (Paris, BN n.a.l. 343) the final chapter on venomous animals ends with the words «de quarto in quartum diem post occasum solis»—that is, the material about the elixir which concludes the work in the printed editions is *not* present in the manuscript; *Entorn de la tradició*, 277.

58. *De vinis*, fol. 263va.

describes a wine to which ginger and cinnamon are added which is then «distilletur ad modum aque rosate», which whitens and freshens a woman's skin and is especially good against paralysis.⁵⁹ Finally, a little further on, he explains that herbs can be steeped in «aqua vitis que dicitur aqua ardens seu aqua vite» and the product drunk in wine «ad multas res medicinales».⁶⁰

These three passages, which is all that *De vinis* has to say about distillation and 'aqua ardens',⁶¹ are, like so much in this work, equivocal in their significance for Arnau's authorship. The 'aqua ardens' distilled from rosemary wine is to be used topically, exactly in the way—and for those limited purposes—that the historical Arnau recommended (in the *Parabole* and elsewhere), and the second is also presented as an external medication or lotion. Yet the third 'aqua ardens', which is to be drunk, is used in a way that is not recommended at all in Arnau's other works.

These discontinuities, or inconsistencies, that I perceive between the thinking in *De vinis* and that in Arnau's other works mean that I continue to feel hesitant to accept the former's authenticity. And yet I suppose it is conceivable Arnau could have had a kind of alchemical-medical epiphany at the end of his life that altered his thinking and left these traces in *De vinis*. The Hebrew translation indicates that the work was dedicated to Robert of Naples, which suggests that—assuming Arnau's authorship for the moment—it would have been a product of the same exposure to the Neapolitan court c. 1309 (and thus after the *Speculum* was finished) that I have suggested may be glimpsed in *De venenis*. Perhaps the Arnau of 1309-11 had begun to believe in a different kind of medicine from the Arnau whose earlier works of 1291-1308 we are beginning to know well, but I still find the possibility psychologically somewhat unconvincing. In any event, the question of the origin of the work is not likely to be resolved until the work has been carefully edited, which will not be soon, for it will be an enormous task: I know of fifteen copies that begin with the dedication to the king, «Sacre et semper victoriose regie...»; fifteen more that begin «Cum instat tempus...»; twenty-

59. «Vinum aromaticum ad ornatum mulierum dealbans et subtilians et abstergens et incolorans. Pone de zinzibere et cynamomo in vino et distilletur ad modum aque ros.. Valet etiam contra omnes frigidas complexiones et maxime contra paralysim.» *Ibid.*, fol. 265rb-va.

It is sometimes assumed that Arnald of VILLANOVA, *The Earliest Printed Book on Wine* (tr. Henry E. Sigerist; New York, 1943), is a translation of Arnau's *De vinis*; but in fact it is a translation of a fifteenth-century German reworking of the Latin. Of the three references to distilled wine in the original, only this one remains in the German text as translated by Sigerist, at p. 41.

60. *De vinis*, fol. 265va.

61. Michela Pereira says «La storia della tecnica distillatoria è lunga e complessa, ed il ruolo del *Liber de vinis*—sia o no opera autentica di Arnaldo—non è quello di un testo innovatore ma di una testimonianza della diffusione dei distillati come farmaci fra XIII et XIV secolo.» *Indagine*, p. 126 n. 136. I am here trying to contribute a little more to this understanding of the medical diffusion of alcohol about 1300.

two that begin «Laudamus inquit vinum de bone vite»; and twenty that begin «[Quoniam] vinum album inter cetera [mirabile]». No doubt there remain many others for a future editor to locate.

POST-SCRIPTUM

Fernando Salmon began the discussion of the papers of the II Trobada by asking whether there might have been a fourth reason why Arnau de Vilanova did not enthusiastically accept the emerging alchemical medicine of his day, in addition to the three proposed in my paper: he suggested that the problem of supplying an intellectual rationale for the new procedures and medicines might have kept Arnau from endorsing them. This intriguing idea deserves more attention than we gave it in our discussion, and I want to explore it further here.

As I first thought about this question, I applied it to Arnau himself, and decided that it did not really apply. To begin with, Arnau could have offered explanations as to why and how the new medicines worked: for example, as I showed in my paper, he ascribed the effectiveness of 'aqua ardens' in treating wounds or paralysis, externally applied, to the subtlety of its particles, which allowed it to penetrate readily into the body. This explanation was physically plausible, but it was not grounded in natural philosophy, to be sure. Might Arnau have hesitated to endorse 'aqua ardens' because he could not prove how it worked? The answer, I think, has to be 'no'. The guiding principle of Arnau's medical thought all through his career was what I have elsewhere called a medical 'instrumentalism',⁶² a conviction that medical truth might differ from absolute philosophical truth: 'truth', for a physician, referred to a reasoned knowledge that could be shown to be effective in bringing about health, whether or not it conformed strictly to the necessary truth of natural philosophy. This is an empiricist doctrine, in a way, but it is not a pure empiricism; indeed, Arnau denounced pure empirics who claimed discoveries but had no explanation at all for them. 'Aqua ardens' was of course not a discovery of this sort: Arnau believed he did have an explanation that made sense of its action.

A lengthy exposition of this 'instrumentalism' is the burden of what was probably Arnau's first medical work composed during his decade of teaching at Montpellier—that is, his *De intentione medicorum*, probably written not much after 1291—and the principle seems to have been in his mind even ear-

62. Introduction to Arnau de VILANOVA, *De intentione medicorum*, ed. Michael R. McVAUGH; *Amaldi de Villanova Opera Medica Omnia* V.1, Barcelona, 2000.

lier. In another paper I have argued that in his *Introductio in librum de semine scripturarum* Arnau gave expression to just such a medical instrumentalism.⁶³ Towards the end of that work, he enumerates the spheres of secular learning, the liberal arts and the subjects of the other university faculties, to assert that in this cycle of the world each of these subjects—music, geometry, astronomy—attains to a kind of certain knowledge that possesses, ‘misterialiter’, a still deeper prophetic significance. But when he speaks of medicine, he admits that knowledge in ‘this’ field is not absolute but relative, and is determined by the physician’s role of restoring health:

«Hic salutis amator accedit ut conferat sanitatem, uidelicet medicus, qui rerum naturalium, non naturalium et contra naturam diuersitatem enumerans, tantum in ipsis profundat indaginem intellectus quantum acquisitioni salutis misterialiter est necesse, iuxta illud *Apostoli*: «Non plus sapere quam oportet», etc.»⁶⁴

Josep Perarnau has concluded that Arnau wrote these words «entorn el 1290»,⁶⁵ that is, slightly before he composed *De intentione medicorum*, and his language is obviously expressing the same instrumentalist position that he would expound more fully in the latter work, though here he is using *Romans*, xii, 3 to provide a scriptural basis for his philosophy of medicine: unlike the geometer or the astrologer, the physician need know no more than is necessary to treat his patient. The similarity of the views expressed in these two nearly contemporary works is indeed striking, and makes it clear that Arnau had arrived at this epistemological position very early in his career. A deeply rooted, long-standing instrumentalism of this sort is not at all incompatible with a belief in alchemical practice, as I implied above. In fact, it might make it easier to accept the efficacy of alchemical procedures and products, since they would not need to be reconciled with established natural-philosophical principles (and laws). The lack of a theoretical rationale for them would not have been an obstacle to employing them.

But we should not stop here. As Fernando has subsequently pointed out to me, Arnau would not just have had to convince himself, as an instrumentalist, that alchemical medicines could work. As a practicing physician, he would also have had to convince his patients that these unprecedented remedies could help them. Would his clients have been able to believe that these novel medicines, so foreign to the Galenic system, could really help

63. Michael R. McVAUGH, *Moments of Inflection: The Careers of Arnau de Vilanova*, in Peter BILLER and Joseph ZIEGLER, eds., *Religion and Medicine in the Middle Ages* (York, 2001), 47–67.

64. Arnau de VILANOVA, *Introductio in librum De semine scripturarum*, ed. Josep PERARNAU; *Arnaldi de Villanova Opera Theologica Omnia* III, Barcelona, 2004, 117, ll.712–16.

65. *Ibid.*, p. 79.

them, if no intellectual rationale for their effectiveness was forthcoming? Physicians in any age have to win the confidence of their patients before they can successfully treat them. In the first years of the fourteenth century, when alchemy had still not yet captured a wide audience, would the people Arnau treated have been prepared to accept the possibility that these inexplicable, radically different drugs would help them? Would they have been sophisticated enough to adopt an open-minded instrumentalism? Might they not have rejected the new medications, preferring to take the familiar medicines they believed in? I argued in my paper that Arnau's neglect of alchemy might have resulted from his conservatism in therapeutics; but patients can be conservative too, and their physicians have to take this into account. In Arnau's case, their conservatism would simply have complemented his own.

Joseph ZIEGLER

ALCHEMY IN *PRACTICA SUMMARIA*:
A FOOTNOTE TO MICHAEL McVAUGH'S CONTRIBUTION

Inspired by the exciting debates in the «II Trobada...» and Michael McVaugh's quotation from *Practica summaria* where the author (most probably Arnau) mentions the elixir as the greatest product of alchemy and as the ultimately preservative medicine even better than the stone that grows in the head of a dead asp, I started a preliminary codicological enquiry into this treatise.¹ One of the fundamental conclusions of the «II Trobada...» was to highlight the urgent need to embark on a full codicological study of treatises containing alchemical references in Arnaldian and Pseudo Arnaldian texts. Only such an examination may enable us to chart and understand the way and the rationale by which alchemical texts came to be attributed to Arnau, who posthumously became an alchemical authority. In the particular case of *Practica summaria*, if all earlier versions of this probably authentic Arnaldian treatise included this short, but favourable reference to alchemy, we would have a clear indication (not a proof) that later in his career Arnau may have abandoned his earlier suspicious and critical attitudes to this art. The printed editions include this alchemical remark, as do two fifteenth-century manuscripts consulted by Michael McVaugh. I checked the three, to my knowledge, earliest manuscripts containing this treatise. Conveniently they are all located today in Erfurt.

1. Erfurt, MS CA Fol. 303, fols 89r-91v, is to my knowledge the earliest of all extant versions of *Practica summaria*.² The scribe was Peter of Bonn, a German who copied the text in Montpellier in the late 1330s or early 1340s. The text, entitled *Experimenta seu secreta magistri arnaldi de villa nova*, contains no allusion to the fact that it was composed for Pope Clement V. It is preceded by two short practical treatises on the cure for gout (artetica') and epilepsy, and a list of recipes all attributed to Arnau. Up to the discussion of defective appetite and immoderate thirst the treatise in the manuscript is structured identically to the printed version (up to chapter 27; the only difference is that the manuscript version unites chapters 26 and 27 into one paragraph). But then chapter 28 and the beginning of chapter 29 dealing with antidotes to poisons and the method for driving venomous reptiles out

1. For a full list of manuscripts see Sebastià GIRALT, *Entorn de la tradició textual de la Practica summaria d'Arnau de Vilanova*, in «Dynamis», 24 (2004), 269-280.

2. *Beschreibendes Verzeichniss der Ampolonianischen Handschriften-Sammlung zu Erfurt*, ed. W. SCHUM, Berlin, 1887, 207-211 (209).

of dwelling places is missing. Also absent is the reference to the elixir and alchemical medicine. The treatise ends with a discussion of simple medicines effective against particular diseases and medical conditions: epilepsy, apoplexy, colic, diarrhoea (*fluxus ventris*'), diarrhoea accompanied with nausea, toothach, and bad breath.

2. Erfurt, MS CA Quart. 217, fols 65r-72v, is a mid fourteenth-century manuscript.³ This version is entitled *Practica viatici arnaldi de villa noua*, and here too Pope Clement does not figure as the one who commissioned the treatise or received it. The text is structured like the version in MS CA Fol. 303, though occasionally long chapters are divided into smaller independent sections. It includes chapter 28 and the first part of chapter 29 about driving venomous reptiles out of houses, but it drops the reference to alchemical medicine and the concluding discussion of simple medicines curing particular diseases. Instead, the concluding chapter deals with laxative and purging herbal medicines applied to the stomach and the spleen.

3. Erfurt, MS CA Fol. 236, fols 224v-227v, was completed in Montpellier on the Wednesday after *Quasimodo* Sunday 1361.⁴ Its structure is identical to the version printed in the 1520 Lyons edition of Arnau's *Opera* and it is entitled in the *explicit* only: *Practica arnaldi de villa nova scripta domino pape clementi*. The manuscript contains other treatises attributed to Arnau (including *Liber de vinis* copied also in 1361, *Antidotarium* copied in 1360, and short treatises on the causes of sterility and on theriac, presumably apocryphal). The alchemical reference appears there on fol. 227v, thus:

«Inter simplicias a proprietate contra venena valentia primum et ultimum est elixir maioris operis alquimie si ad ultimam ducatur perfectionem, deinde lapis qui in fronte surde aspidis, scilicet serpentis, adgeneratur, deinde cornua ipsius polipemenon tormentilia vicem toxicum gentiana yreos, sed in proposito nulla melior que dicta est ad preservationem continuam.»

The fact that two of the earliest versions of *Practica summaria* do not contain the alchemical reference greatly reaffirms the doubts expressed by Michael McVaugh as to whether it ever was part of the original version of the treatise. But when examined together with the emergence of the alchemical connection in the 1361 version, it shows the chronological pattern according to which Arnau became associated with alchemy, and alchemical texts started to be attributed to him. This pattern is perfectly compatible with the pre-

3. *Beschreibendes Verzeichniss der Ampolonianischen Handschriften-Sammlung zu Erfurt*, ed. W. SCHUM, Berlin, 1887, 473-474 (473).

4. *Beschreibendes Verzeichniss der Ampolonianischen Handschriften-Sammlung zu Erfurt*, ed. W. SCHUM, Berlin, 1887, 143-148 (147).

liminary conclusions emerging from the debates of the «II Trobada...» and suggesting the years around 1350 as the time when Arnau's alchemical image took off. The earliest indications of Arnau's presumed deep involvement in medical alchemy⁵ seem to fall between the production of the first two manuscripts mentioned above and the third one which contains the alchemical allusions. The testimony of Giovanni d'Andrea in his *Additiones in Speculum* by William Durant (c. 1346/7) that Arnau was also a great alchemist who was working in the papal court on the production of gold through alchemical transmutation; the recurrent assertions of Giovanni da Rupescissa in his *Liber lucis* (c. 1350) that Arnau is a major alchemical authority on the production of the elixir; the attribution of *Rosarius philosophorum* to Arnau - all appear around 1350. Ten years later, an alchemical touch is added to the *Practica summaria*, an element which may have not been there originally. This is a plausible working hypothesis explaining the appearance of an alchemical reference in *Practica summaria*, but it can only be proved after a full examination of the other manuscripts of the text. Such an examination will deliver the final verdict concerning the authenticity of the text.

10. Michela PEREIRA, *Arnaldo da Villanova e l'Alchimia. Un'Indagine Preliminare*, in «Actes de la I Trobada Internacional d'Estudis sobre Arnau de Vilanova», ed. J. PERARNAU, vol. II, Barcelona, IEC 1995, 114-121.