

## Tagging Arabic medical texts: theoretical and applicative issues

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Despite the considerable importance of the Islamic classical medical tradition, no Arabic linguistic corpus currently available includes medical texts: a certain number of Classical texts are indeed available in standard informal electronic collections of Arabic texts, such as *Shamela*<sup>2</sup>, perhaps the largest free repository of Classical Arabic texts. But these texts, though useful, are generally unreliable and do not contain structured information. Therefore, the Arabic scientific corpora are still largely to be built<sup>3</sup>.

This state of affairs depends on the fact that Arabic corpora are mainly restricted to modern and contemporary texts, above all newspaper texts. This is an unfortunate state of affairs, because on the one hand this situation reduces the representativeness of the corpus, since a large part of the specialized lexicon is simply ignored; on the other hand, it leaves scholars of medical texts without specialized lexical tools because medical terminology – and scientific terminology in general – has very little space in medieval lexicons that, in theory, are based only on Classical literature and therefore tend to exclude – with a few exceptions – technical terms.

How could a corpus of Arabic medical texts be built? A representative corpus of Arabic medical texts would include at least three distinct traditions: Classical scientific medicine – what is nowadays sometimes called Unani medicine, the adaptation of Yunānī “Greek” by Indian Muslims –, prophetic medicine and contemporary, Western-style medicine. A fourth branch, derived but terminologically distinct from contemporary medicine, includes texts in Spoken or Educated Spoken Arabic, which are increasingly produced for immigrants in Western countries and in some Arab countries, like Morocco, for readers not familiar enough with Standard written Arabic. Of course, the decision to include such texts in a corpus is linked to the more general decision to include different levels

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1 Roma Tre Università.

2. [www.shamela.ws](http://www.shamela.ws).

3. As usual in Middle Ages Arabic Texts – or perhaps texts in general –, it is difficult to determine objective criteria to classify written works in genres; I’ll adopt more or less generally accepted classifications, which have recourse to different typological criteria: subject-matter, type of text, internal organization. A caveat is in order as far as chronological information is regarded: I aim to give a general idea about the historical extension of the most important genres, disregarding some thorny questions about dating. So, my aim is to give a general picture of the development of Medical genre through time.

from Classical and Standard Arabic, a move which is probably unavoidable if the requirement to gather a representative sample of Arabic must be met, but which would dramatically complicate the task of analyzing and tagging texts.

As to contemporary, Westernized medicine, one could think that contemporary technical medical lexicon is already covered by dictionaries and other reference works: in fact it is not so. Although contemporary medical dictionaries do indeed exist, they tend – as in other sectors of contemporary Arabian lexicography – to normalize terminology according to guidelines of language academies rather than on common medical terminological praxis. Moreover, as it is customary in Arabic lexicography, medical dictionaries often do not agree in their lexical choices. Just a few examples will suffice to illustrate this situation. In our survey we shall make recourse to two standard dictionaries and two Internet-based resources which will illustrate well the complexity of the current medical Arabic terminology. The first dictionary is the Unified Medical Dictionary or UMD<sup>4</sup>. It is a project sponsored by the Regional Office for the Eastern Mediterranean of the World Health Organization, which might be supposed to give it the status of a standard work of reference, but this is not always the case, as we shall see. The UMD is available in several formats: as a printed book, as a searchable CD and as a website.

The second dictionary, perhaps the most widely used medical dictionary in Arab countries, is the paper *Pocket Arabic Dictionary* by Yusuf Hitti<sup>5</sup>. It has a lesser official status than UMD, but it often better reflects current medical practice of the Middle East. Two Internet resources can be added to these dictionaries. The first one is Arabic Wikipedia<sup>6</sup>, which shares all advantages and disadvantages of free collaborative works: no central editor controls contributed items, which are mostly written in an anonymous way, and no strong standard of reference is included; on the other hand, it is perhaps the closest reference possible to current, everyday linguistic practice. The other Internet resource is an extremely well-managed Arabic medical website, Altibbi.com<sup>7</sup>, which includes – besides English translations of Arabic medical terms – extended descriptions, which make it a kind of online medical Arabic encyclopedia.

## 1. ARABIC MEDICAL TERMINOLOGY: A CASE STUDY

As an example, we shall review how these resources translate “xenograft”, a particularly telling case of lexicographical ambiguity. By “xenograft” we denote the “living cells, tissues or organs transplanted from one species to another”, typically from pigs to humans. The case is interesting, because it is related to a relatively recent technology, still almost entirely foreign to Arab countries (even for the

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4. UMD (*Unified Medical Dictionary*), 1983. The electronic, updated version is available at: [[www.emro.who.int/umd/](http://www.emro.who.int/umd/)].

5. Hitti, 1988.

6. [<http://ar.wikipedia.org/wiki/>].

7. [[www.altibbi.com](http://www.altibbi.com)].

juridical restraints to use organs or tissues from impure animals), which would lead one think that a single, standardized term is in use, but this is definitely not the case.

The electronic version of the Unified Medical Dictionary translates the term as *ṭu'm aḡnabī* or *ṭu'm ḡayrawī* (showing a preference for the first term). Hitti's pocket medical dictionary prefers instead *ṭu'm ḡayrī* (not *ḡayrawī*) and suggests as an alternative *ṭu'm muḡāyr*. Which is the form currently in use? Arabic Wikipedia, which – like our dictionaries – has not a form for “xenotransplantation” (which is paraphrased as “transfer of organs among living beings”), calls the grafts in the plural *ṭu'ūm muḡāyira* or *ṭu'ūm aḡnabiyya* and cites as an example “the transplantation of pig cells to the man”, using perhaps “cells” as a hyperonym for all possible grafts (cells are notoriously NOT transplanted from pigs to humans). The very informed site Altibbi.com, which does propose a translation for “xenotransplantation” as *īḡtirās ḡarīb*, while sticking to *ṭu'm aḡnabī* for “xenograft”.

Summing up, we have four distinct terms which are selected by sources in highly idiosyncratic, asymmetric ways. If we try to google the relevant terms (in the strict form with article), we obtain the following results. Hits:

|                     |     |
|---------------------|-----|
| <i>ṭu'm aḡnabī</i>  | 109 |
| <i>ṭu'm ḡayrawī</i> | 0   |
| <i>ṭu'm ḡayrī</i>   | 165 |
| <i>ṭu'm muḡāyir</i> | 150 |

Strikingly enough, but perhaps not too surprisingly, one or the terms suggested by the UMD, *ṭu'm ḡayrawī*, is simply unattested, whereas the other one, *ṭu'm aḡnabī*, while relatively frequent (the concept itself is clearly not a terribly frequent one on the web), is less frequent than the two alternatives chosen by Hitti, which seems to be more in tune with current use than the UMD is; it performs even better than the two Internet resources.

Anyway, the dictionaries don't account for the terminological richness and variety of the medical lexicon in the different Arabian countries, often influenced by prestigious foreign languages (like English or French that very often prevail also in the university teaching) but also by the spoken varieties, as we have already hinted at. Therefore, it's necessary to include contemporary medical texts in a representative corpus of written Arabic.

A selection of such works is not straightforward. One could think about including excerpts from medical textbooks used in the few Arab countries such as Syria, which provide a partial or full medical learning in Arabic. Another source of information might be websites of hospitals and medical centers in Arabic countries, where something linguistically closer to everyday practice is likely to be found. Of course, such a choice would entail additional problems, in particular as to the textual status of texts which are, by definition, very far from the habitual concept of *ne varietur* text.

As far as popularized medicine is concerned, the search for texts could be even harder. Written text of such genre are not easily available outside the original area of distribution (let imagine leaflets in spoken or near-spoken Arabic distributed to low-literacy patients in a Moroccan hospital), and also dissemination through the Internet is not widespread. Anyway, concern about such texts is in my opinion necessary if a really representative corpus of Arabic medical texts is to be built.

On the other hand, when we talk about classical medical texts, two distinct traditions are included. The best known and the most prestigious one is doubtless the Arabic-Islamic scientific medical tradition, which gave new life to the Hippocratic-Galenic medicine it received from the Late Antiquity.<sup>8</sup> But another, less known but not less important, tradition is the so-called prophetic medicine.

## 2. PROPHETIC MEDICINE

Prophetic medicine<sup>9</sup> is a set of hygienic and herbal popular practices sanctified by the tradition of the Prophet, becoming source of medical rules. It is typified by an informal terminology, very different from the language of the texts of scientific medicine: it uses much less adaptations and borrowings from Greek sources, and generally prefers autochthonous words. Prophetic medicine, although it is what we would call a non conventional medicine in contemporary terms, has an important relevance in the dichotomous system of sciences of Arab-Islamic Middle Age because it fills the slot corresponding to scientific medicine in the series of Arab-Islamic sciences or new sciences, opposing to ancient or foreign sciences.

While scientific medicine should doubtless occupy the largest space in every corpus of classical Arabic Medical texts, a representative corpus needs to include some material from prophetic medicine as well. Even if the historical role of the Arabic Medical tradition is almost exclusively due to scientific medicine, Prophetic Medicine played a much larger role in the Medieval Arabic Culture than generally acknowledged, thanks to its links with Islamic law (since its main source are prophetic hadith) and its diffusion in popular milieus. It should not be overlooked that prophetic medicine books are still widely read, if not practiced in the Islamic world. For space limitations I won't develop the discussion on prophetic medicine any more, and I'll limit to evoke a possible work in this tradition to include in a corpus of Arabic Medical texts such as *al-Tibb al-nabawī* ("On prophetic medicine") by Ibn Qayyim al-Ġawziyya (d. 751/1350)<sup>10</sup>, the Hanbali jurist, pupil of Ibn Taymiyya (d. 728/1328)<sup>11</sup>. A passage will illustrate the features of such texts, that – particularly – deals with the treatment of dropsy or ascites,

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8. Cf. Jacquart and Micheau, 1996.

9. A very good summary of the differences between prophetic and scientific (called "mechanistic") medicine can be found in Shefer-Mossensohn, 2009, p. 40 ff.), in the introductory part on a book on Ottoman Medicine.

10. See EI<sup>2</sup>: s.v. "Ibn Kayyim al-Ġawziyya" (H. Laoust).

11. Cf. EI<sup>2</sup>: s.v. "Ibn Taymiyya" (H. Laoust).

founded on the administration of a therapy based on the combination of urine and camel milk. The excerpt shows three levels of narration corresponding to three levels of authorities: *ḥadīṭ*, comment of the author, opinion of the *auctoritates* of the scientific medicine.

Here, the traditional remedy:

The Prophet's remedy for dropsy: In the Sahihan (the two Sahih of Muslim and Buḥārī ) it is narrated that Anas bin Malik said: "Some people of 'Ukl and 'Uraynah tribe came to Al-Medina and its climate did not suit them. So the Prophet ordered them to go to the herd of camels reserved for charity, and to drink their milk and urine. Therefore, they went as directed. After they became healthy they killed the shepherds of the Prophet's camels and drove away all the camels, thus becoming aggressors against Allah and His Messenger The Prophet sent (men) in their pursuit and they were captured. The Prophet then ordered that their hands and feet to be cut off (and it was done), and their eyes were branded with heated pieces of iron. They were then kept in the sun until they died." The proof that these people were complaining from dropsy, is from Imam Muslim who narrated in his Sahih from the same Hadith above that the Bedouins said, "We have not found Al-Medina suitable for us and our stomachs swelled, our organs became weak [...]."

Now, Ibn Qayyim al-Ġawziyya comments:

Dropsy is a physical disease that occurs when a harmful cold substance penetrates the external organs of the body and in addition the body organs other than those that are used in digestion, causing them to swell. There are three types of dropsy: in body tissue (fleshy), which is the most serious of the three, in a body cavity, and in an organ (drum). The remedy required for this disease includes mild laxatives and diuretic medicines that help rid the body of fluids. These diuretic qualities exist in the milk and urine of camels and that is why the Prophet ordered them to drink them. Camel milk is a mild laxative, diuretic, cleanses and opens that which is closed and removes the obstructions and soothes the body. This is especially the case when the camels graze on beneficial herbs, such as wormwood, lavender, chamomile, daisy and lemongrass. These herbs help against dropsy. Dropsy is usually symptomatic of an ailment in the liver, especially due to congestion in the liver. The milk of the Arabian camels helps in this case, because of its many benefits as mentioned and which help open the clogged passages and the obstructions. Al-Rāzī said "The she-camel's milk soothes the liver and the effects of a spoiled constitution" Al-lsrā'īlī in addition said, "The she-camel's milk is the softest, least concentrated and lightest milk. It is the best choice for moving the bowels, as a laxative and for opening the clogged passages and obstructions. What makes this evident is the fact that this type of milk is mildly salty, as a result of the animal's instinctively hot nature. Therefore, the she-camel's milk is the best remedy for the liver as it soothes it, opens its pores and veins and softens the hardness of fresh food. Fresh, warm camel's milk is beneficial against dropsy, especially when taken with fresh, warm camel urine, thus making the combination more salty and adding strength to its effectiveness in dissolving harmful fluids and as a laxative. If the [combination of milk and urine] did not purge the stomach,

then one should take a stronger laxative". The author of al-Qānūn in addition commented, "Do not listen to those who claim that milk does not provide cure from dropsy. Rather, know that camel's milk is an effective cure, because it cleanses gently and easily, due to its other qualities. This type of milk is so beneficial that if a person substituted water and food with camel's milk, he would be cured [from dropsy and other ailments], Some people tried this remedy and were soon cured. We should state that the best camel urine is that of the camels of Bedouin people."<sup>12</sup>

The excerpt includes the quotation of a *ḥadīth* which we could find easily with a *ḥadīth* research program<sup>13</sup> and we should need to mark it in a tagged corpus, because it's important to be able to detect if a word is included in the original text by Ibn Qayyim al-Ġawziyya or if it is inside the *matn* of a tradition: it's important for lexical, syntactic and historical reasons. What is interesting is that we can see how Ibn Qayyim al-Ġawziyya mixes *sunna* texts, *ḥadīth* commentary and quotations from scientific medicine which corroborate the validity of prophetic teachings: let us not forget that Islam must not disagree with science and the other way round. All these layers could and indeed should be represented in a corpus.

### 3. THE ARABIC-ISLAMIC SCIENTIFIC MEDICAL TRADITION

On the other hand, there is the Arabic-Islamic scientific medical tradition, which gave new life to the Hippocratic-Galenic medicine it received from the Late Antiquity. Arabic-Islamic scientific Medical tradition is based upon Hippocratic-Galenic doctrine, which in his turn is built on humoralism theory: the human body is a vessel filled with four humors (Blood, Yellow bile, Black bile, Phlegm) connected to qualities (according to the dichotomy hot-cold and wet-dry), to the four elements (air, fire, earth, water), to seasons (spring, summer, autumn, winter), temperaments (sanguine, choleric, melancholic, phlegmatic) and human organs (liver, gall bladder, spleen, brain and lungs). These fluids are in balance when a person is healthy: diseases and disabilities resulted from an excess or deficit of one of these four humors. Scientific medicine can perhaps be defined through the words of the most important author in Medieval Arabic medicine, Ibn Sīnā, who says in the incipit of the *Qānūn*:

(Medicine is) the science by which we learn the various states of the human body in health, when not in health, the means by which health is likely to be lost, and when lost, is likely to be restored to health. In other words, it is the art whereby health is conserved and the art whereby it is restored, after being lost.<sup>14</sup>

The approach in this case is outright rational, based on a full-fledged theory, and its authorities should primarily be found in the Greek-Roman tradition rather than in the Islamic one.

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<sup>12</sup> Ġawziyya (*Ṭibb*: p. 53-56).

<sup>13</sup> See for instance the SALAH project (Boella et al. 2011).

<sup>14</sup> Avicenna (Gruner: p. 25).

Now, some historical guidelines on Scientific Medicine. The first genre in Scientific Medicine from a chronological point of view, and one of the most important ones, is represented by Translators of Greek Medical Text from the Classical age and Late Antiquity: this genre whose importance in the organization of the Classical Arabic Islamic culture cannot be overstated is of paramount importance in the period since the third century of the Hijra (IX century). On the other hand, as happens in other domains, translations are among the few genres in Medical writing which dies up in a couple of centuries after a blossoming development. Although one usually speaks about Classical medical works as the main source for Arab translators, it should be remarked that translators worked rather on the canon of works fixed in Late Antiquity: it was the centers of Late Ellenistic culture in the Middle East – Alexandria, Antiochia, Edessa, Harran, Nisibis and Gondeshapur – which in fact selected the works to be translated, in most cases through a certain or probable intermediate translation into the Syriac; this helps explain why among translated works we find Classical works of the Antiquity – but with significant gaps: Galen, like Aristotle in philosophy, is throughout represented, while Hippocrates is virtually absent – side to side with later works, e.g. In a way, it was the Alexandrine scholars who built the corpus which will be the basis of anybody else’s corpus, like ours. The quintessential representative of the most important group of translators is Hunayn ibn Ishāq (192/808-260/873), an Arabic-speaking Nestorian with an excellent knowledge of Syriac and Greek, who translated into Arabic (perhaps through an intermediate Syriac translation) the whole Galenic corpus. Inclusion of translations into a corpus presents some specific issues, besides the general questions on how to make a representative choice and the specificities of medical texts: in particular, one might ask whether the original Greek text should be included in the corpus annotations, and – if so – which text.

A second, fundamental stage in the development of Arabic-Islamic medicine is the production of large manuals autonomous, usually defined as “medical encyclopedias” owing to their comprehensive character. The most renowned Arabic medical encyclopedists are al-Rāzī, al-Mağūsī and Ibn Sīnā: they are the most important protagonists in this process of “vivification of medical sciences”. Let us shortly review these authors and their contributions.

– ‘Alī Ibn al-‘Abbās al-Mağūsī, known as Haly Abbas in our Middle Ages, was a Zoroastrian, as shown by his *nisba*. His only extant work, *al-Kitāb al-kāmil* “the complete book”, also called *al-malakī* “the royal one” (owing to its dedication to the Buwayhid *amīr* ‘Adud al-Dawla), is translated in Latin as *Liber Regius* or *Pantegni* (from the Greek *pantèchnē* for “the whole art”). *Al-Kitāb al-kāmil* is a true encyclopedical work, which transmits the whole of the Classical heritage without any effort for originality.

– Ibn Sīnā, our Avicenna, from Afšāna in the nearby of Buḥāra, is – as far as medicine is involved – the author of *Kitāb al-šifā’* “the Book of Healing” and, most important, *al-Qānūn fī al-Ṭibb*, our Canon of Medicine, the medical *summa* by ex-

cellence, and probably the most authoritative medical work in our Late Middle Ages and the early Renaissance. Although the Canon is deeply rooted in the Greek tradition, Avicenna proposes an original synthesis, where sources are not always easy to determine.

– Al-Rāzī, known in the West as Rhazes or “the Arabic Galen”, is the author of *al-Kitāb al-Hāwī*, literally translated in Latin as *Continens*, is especially remarkable for his creative synthesis involving Greek medical theory, Indian elements and his own clinical notes; this practical-experimental attitude, that brought him well beyond the Greek model, earned him the nickname al-Māristānī “the hospitalist” by Ibn Ğulġul (332/944–after 384/994).

I won’t discuss any further other Classical medical genres, even if specialized works on specific branches should be mentioned: anatomy, surgery, ophthalmology, and of course pharmacopoeia<sup>15</sup>. I won’t say anything about alchemy as well, since this branch needs a specific space in Scientific literature. What is common to these texts is their great complexity and very large extent. Including a whole encyclopedic work, or a large translation, in a corpus, while highly desirable, would imply a tremendous amount of work in entering, checking and tagging the texts. Perhaps, limiting oneself to excerpts could be the only viable solution in a preliminary stage.

In classical scientific texts we face very different problems than we do in prophetic medicine texts: as a rule, no quotation of the *sunna* are included, but frequent reference is made to classical and early Muslim authorities. Even in this case, quotations have to be tagged in order to potentially exclude them or single them out in the data base queries. Other information which should better be marked are borrowings from classical languages or middle Persian technical terms. In addition to general problems that are connected to the construction of an Arabic corpus, there are many specific problems involved in the building of a medical corpus: compared with literary and newspaper texts, the medical lexicon involves more linguistic layers. The Arabic technical and scientific terminology, above all the medical one, is hard to identify because – missing a classical language that, as Latin and Greek do for European languages, acts as source of terms (one might say that classical Arabic is its own classical language) – it arranges that in many cases common words have been used as technical terms, making the work of the annotator very difficult. Then, which information must be included in a corpus? From this point of view, current corpora vary a lot, in type and information. The prototype of modern corpora, the Brown corpus, includes only information on the parts of the speech. Of course, one could legitimately ask if all these in-depth tagging is really needed, after all tagging lemmas, parts of speech and morphological features could well be enough for a corpus, and tagging such information as quotations and borrowings in texts with neither quotes nor italics is doubtless no easy task, but it can be argued that the lack of such information

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15. I do not use the fitting word *pharmacological* because this term is specifically linked to modern time and to the development of chemistry.

doesn't allow researchers to evaluate rightly the date of attestation or the frequency of a term or a syntactic construction in the text under examination. On the other hand, annotating such a classical technical text requires anyway a tagger with specific knowledge of the genre, and detecting quotations and technical terms should not be too difficult a task for such a specialist.

The processing of medical texts gives some specificities we have to consider: above all, the question of the specialized lexicon is important: classical and post classical dictionaries, as Kazimirski, don't include scientific terminology and then the tagger hasn't any reference frame and in many cases he must decide in independence. There are problems and limits: the tagger should have a sound knowledge of the text's language and it's very difficult finding people so equipped.

A sample text from the first book of Ibn Sīnā's *Canon* will illustrate some of these points<sup>16</sup>:

### III. QUALITY OF SEDIMENT. COLOUR. ODOUR

*Black sediment*: this is a bad sign, as in the degree already shown [in 617]; but it is not so bad if the supernatant fluid is not black. [(Haly Abbas says it is a fatal sign if it comes on after being intensely red.)]

*Red sediment*. This shows dominance of sanguineous humour (sanguineous plethora) ; it occurs in fasting ; and when digestion is imperfect. If it continues to be present for a long time it denotes inflammation of the liver.

*Yellow*: this denotes great heat, because it is produced by bilious humour. It may also show an insidious disease.

*Green colour*: this has the same significance as black sediment.

*White colour*: this is sometimes good, sometimes bad. That is, when it is mucoid, ichorous, or foamy ; because this shows that the urine is not a completed secretion.

*Odour*. The indications from the odour have already been given in describing the other characters.

So, how should in general a corpus of Arabic medical texts be built? A representative corpus would include at least three distinct traditions: besides Prophetic medicine and Classical scientific medicine, contemporary, Western-style medicine should be also included. A fourth branch, derived but terminologically distinct from contemporary medicine, includes texts in Spoken or Educated Spoken Arabic, which are increasingly produced for immigrants in Western countries and in some Arab countries (like Morocco) for readers not familiar enough with Standard written Arabic. Of course, the decision to include such texts in a corpus is linked to the decisions to include different levels from Classical and Standard Arabic, a move which is probably unavoidable if the requirement to gather a representative sample of Arabic must be met, but which would dramatically complicate the task of analyzing and tagging texts.

As to contemporary, Westernized medicine, one could think that contemporary technical medical lexicon is already covered by dictionaries and other re-

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16. Avicenna (Gruner, p. 344).

ference works: in fact it is not so. Although contemporary medical dictionaries do indeed exist, they tend to normalize terminology according to guidelines of language academies rather than on common medical terminological praxis. Moreover, as it is customary in Arabic lexicography, medical dictionaries often do not agree in their lexical choices.

Anyway, the dictionaries don't account for the terminological richness and variety of the medical lexicon in the different Arabian countries, often influenced by prestigious foreign languages (like English or French that very often prevail also in the university teaching) but also by the spoken varieties. Therefore, it's necessary to include contemporary medical texts, even Patient Information Leaflets or PILs, in a representative corpus of written Arabic.

A selection of such works is not straightforward. One could think about including excerpts from medical textbooks used in the few Arab countries such as Syria, which provide a partial or full medical learning in Arabic. Another source of information might be websites of hospitals and medical centers in Arabic countries, where something linguistically closer to everyday practice is likely to be found. Of course, such a choice would entail additional problems, in particular as to the textual status of texts which are, by definition, very far from the habitual concept of *ne varietur* text.

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