8 Foundations of Roman science in Latin

Man kann, vielleicht etwas überspitzt, sagen, dass die lateinische Literatur ihrer Wurzel und ihrem Wesen nach Übersetzungsliteratur im weiteren Sinne ist und dass die Sprach- und Stilmittel der lateinischen Hoch- und Literatursprache in Poesie und Prosa weitgehend auf dem Boden der Übertragung aus dem Griechischen gewachsen sind und sich entfaltet haben.

‘It can be said, perhaps exaggerating somewhat, that Latin literature is, in its roots and nature, translation literature in a broad sense, and that the linguistic and stylistic devices of Latin standard and literary language in poetry and prose largely grew and developed on the ground of translations from Greek.’

Puelma (1980: 139)

§1 In the previous chapter, we identified a newly emerging Denkstil in Greek medicine, historiography, Aristotelianism, and Hellenistic science whose common property is striving for the greatest possible certainty. It took the Romans time to adopt and take over parts of this Greek Denkstil, as will be seen in this chapter; in most fields, this was a conscious process of borrowing. This chapter will cover the institutional background for science in Rome (§2), the beginnings of learning expressed in Latin (§3), the three crucial early authors Varro, Lucretius, and Cicero (§§4–7), some later imperial authors and texts that might pass as scientific (§§8–11), and that most Roman ‘science’, jurisprudence (§12). In general, the Romans were less interested in theoretical science and more in practical arts. As Stahl (1971: 241) puts it:

The Greeks, the Wunderkinder of intellectual history, first propounded and pursued ideas for ideas’ sake. The Roman penchant for doing rather than wondering represents a return to normalcy.

As we have seen above (chaps 2–3), there was no consensus as to what Roman word should stand for such Greek science: often disciplina was used, besides ars, sometimes scientia, or even other terms. Although there is quite a lot of Roman learning in Latin texts, in most cases it remains questionable whether it can be addressed as science. The few remains of Fachprosa from the later second and the early first century BC, the time when Greek influence and especially Stoic philosophy entered Rome, visible for instance in the circle of men around the two Scipios,¹ have been studied in detail by Suerbaum et al. (2002). The scanty surviving material about potentially scientific writers before the three obvious first candidates (Varro, Lucretius, Cicero) will be examined below (§3). Indeed, the Latin

¹ See Alesse (2017), with further references.
standard language itself became fixed\(^2\) precisely in the last decades of the Republic and in the early reign of Augustus.\(^3\) In order to be able to speak about scientific matters, a standardised, stable language, capable of expressing and preserving insights, is of paramount importance. In the case of Cicero, it will become clear that this language is still very much in the making, with Cicero working on it consciously. The kind of literary Latin\(^4\) fixed in this period was to remain the standard form of the language ever since (not only for science), although the spoken language, of course, kept on developing and changing, finally turning into the Romance dialects. This fixing of Latin may be seen as a conscious though only partly successful attempt to supplant Greek as the language of literature, including philosophical and scientific literature, in Rome.\(^5\) Its main internal stimuli were law and oratory.\(^6\) However, Greek remained common knowledge among educated men until Late Antiquity, and many Romans preferred to write their texts in Greek. The first known Roman to write a Fachtext, the historiographer Quintus Fabius Pictor (fl. ca. 200 BC), did so in Greek.\(^7\) Some other republican Romans who wrote scholarly works in Greek are known, for instance Licinius Lucullus on the bellum marsicum, or even occasionally Cicero himself.\(^8\) Only in Cicero’s time was the first public library in Rome founded by Asinius Pollio (75 BC–AD 4); it had a Greek and a Latin section, as did later public libraries founded by Augustus.\(^9\) Varro was its librarian. The problem of higher learning in Latin is well explained by Cicero’s Academica (I.2, ed. Plasberg, p. 4), where the interlocutor Varro tells him why he had long refrained from writing a Latin work on philosophy:

\[ \text{nam cum philosophiam viderem diligentissime Graecis letteris explicatam, existimavi si qui de nostris eius studio tenerentur, si essent Graecis doctrinis eruditi, Graeca potius quam nostra lecturos, sin a Graecorum artibus et disciplinis abhorrerent, ne haec quidem curaturas, quae sine eruditione Graeca intelligi non possunt. Itaque ea nolui scribere quae nec indocti intellegere possent nec docti legere curarent.} \]

\(^2\) See the discussion on the vitality and death of Latin at certain times in chap. 16 §1 below.
\(^3\) Similarly Leonhardt (2013: 57).
\(^4\) On some aspects of its formation, see Marouzeau (1949) and Neumann (1977).
\(^5\) See Leonhardt (2013: 73).
\(^6\) Von Albrecht (1992–1994: 1:39).
\(^7\) Known from Dionysius of Halicarnassus, Antiquitates Romanae I.74.1, ed. Fromentin, p. 189. On this author, see Timpe (1972).
\(^8\) As he mentions in Epistolae ad Atticum I.19.10, ed. Watt, p. 40. Lucullus’ work is also mentioned there, as well as in Plutarch, Vitae parallelae Lucullus 1.8, ed. Ziegler, vol. 1, p. 360: διαφώς ζηταί γάρ Ἑλληνική τις ἱστορία τοῦ Μαρσικοῦ πολέμου (‘A Greek history of the Marsic War has survived’).
\(^9\) Pohlmann (1994: 65) provides a good overview of libraries in Antiquity.
‘As I saw that philosophy was most diligently explained in Greek writings, I supposed that if some of us [Romans] wish to study it, they should, if they are schooled in Greek letters, rather read Greek books than ours [Latin ones], if they do not detest the arts and sciences of the Greeks, so that they will not care about things that cannot be understood without a Greek education. Therefore, I did not want to write what neither uneducated people can read nor educated people care to read.’

Indeed, quite in general, Latin was not much used for theoretical scientific or philosophical studies in Roman times. Upper-class Romans were fluent in Greek; indeed, parents often sent their children to Greek schools in the East. To all intents and purposes, the Roman Empire used Latin in its Western half and Greek in its Eastern half for official purposes. Thus, translation of imperial documents, decrees, and similar texts from Latin into Greek had to be a routine procedure. Conversely, it is striking that we know only of very few instances of literary, philosophical, or scientific works being translated between these two languages. Clearly, many regarded the Latin language as incapable of expressing higher learning adequately, and considered such topics as belonging to a Greek Denkstil that should be read in Greek. This phenomenon of a lack of theoretical studies in Latin is not infrequently referred to in Latin literature, sometimes as the patrii sermonis egestas, and it becomes quite topical. An illustrative example of the veneration of Greek from the middle of the second century AD is Aulus Gellius (Noctes atticae X.22.3, ed. Marache, vol. 3, pp. 179–180), who writes:

Verba ipsa super hac re Platonis ex libro, qui appellatur Gorgias, scripsi, quoniam vertere ea consilium non fuit, cum ad proprietates eorum nequaquam possit Latina oratio aspirare ac multo minus etiam mea: […]

‘I have copied these words of Plato about this topic from the book called Gorgias, because it did not seem meet to translate them, as the Latin language can in no manner aspire to their properties, and even less my Latin: [a long quotation from Plato’s Gorgias in Greek follows].’

Similarly, many authors argue that the Roman mind was more set on practical things, so we do know of texts by agrimensores, medical texts, texts on technical matters in general, introductory compendia, and the like. Even Roman philosophy takes on a rather practical bent in writers such as Cicero (rhetoric and politics) or

---

10 See Stahl (1962). Von Albrecht, speaking of Latin Antiquity: ‘Wissenschaftliche Forschung im strengen Sinne ist und bleibt weitgehend eine griechische Domäne’ (‘Scientific research in the strict sense is and remains largely a Greek domain’; 1992–1994: 1:450); Ogilvie (2015: 270) writes that ‘most serious ancient scientific works were written in Greek’.

11 On which see Fögen (2000).

12 That something becomes a topos implies, however, that it was perceived as a fact at some point.
Seneca (Stoic ethics aiming at ἀπάθεια). Thus, Stahl wrote an entire book about something which according to him hardly existed: ‘Roman science’; indeed, he often seemed to get frustrated with his field of study. The picture that emerges of ‘Roman’ ‘science’ from the beginnings up to the twelfth century is mostly one of the copying of translated textbooks from one generation to the next, of ever-decreasing quality, of ‘secondhand information, an uncritical approach, inconsistencies, failure to acknowledge sources, lack of structure’ (Stahl 1971: 96). This picture is a largely appropriate portrayal of mathematical and strictly theoretical studies, as far as we can tell on the basis of the surviving texts. These fields, indeed, seem to have had little appeal for Romans – but things look different in applied sciences (artes) and in non-natural sciences, such as agricultural technology, medicine, grammar, historiography, and most importantly jurisprudence, widely cultivated by Latin writers in Antiquity and beyond. Jurisprudence was developed into a scientific activity by the Romans. Its original language is consequently Latin, and juridical works were – unusually – translated from Latin into Greek, where Latin terms were often simply reproduced in Greek (see §12). Moreover, from the third century onward, Christian theology was much practised among the Church Fathers and was perceived as a kind of scientific, not only scholarly or even purely speculative, activity, as they tried to elucidate the relationship between the divinity and the world – Incarnation, Trinity, etc. – in contact and confrontation with the state-of-the-art scientific theology of their time: neo-Platonism (see chap. 9 §2). Nonetheless, the topos that Latin is unfit for Greek disciplinae such as dialectica is still alive and well in the fifth century AD, as can be seen in Martianus Capella (De nuptiis Philologiae et Mercurii IV, §334, ed. Ferré, p. 6), where personified Dialectica speaks but parum digne in Latin:

Ac mox Dialectica, quamquam parum digne Latine loqui posse crederetur, tamen promptiore fiducia restrictisque quadam obtutus vibratione luminibus etiam, ante verba formidabilis sic exorsa: [...] [13]  
‘And all of a sudden Dialectica, although it was thought that she can hardly speak decent Latin, yet with greater confidence, her eyes stern with but a slight quiver of her glance, and impressive even before uttering a word, she began thus: [...]’

13 ‘Roman science has been a much neglected field of study. Because it can be reasonably asked not only whether it was really science but whether it was Roman, many authorities avoid the second question and warily refer to Greco-Roman science’ (Stahl 1962: 3). ‘Scientific knowledge in Roman times never rose above the lowest level of Greek popular science’ (251).
14 Indeed, Stahl admits readily that the picture would be very different if not only theoretical science but also technology were to be considered.
Institutions for science and Sitz im Leben

§2 It is of crucial importance for activities such as science to have a Sitz im Leben in a society from which they can continue being practised from generation to generation and develop further. If they do not, they are at best cultivated by some eccentrics who stand high chances of soon being forgotten (recall the ‘community effort’ criterion in chap. 4). Today, and since the thirteenth century, this place is usually the university. In early modern times, there were also erudite societies; in Greek Antiquity, private and to some extent state-sponsored Hellenistic schools. Indeed, the number of people in Antiquity that would pass as scientists was small; even including scientifically working philologists, historians, and logicians, the number would remain modest. It was certainly the roughly two centuries after Aristotle that were most fruitful for the sciences, precisely due to state patronage in Alexandria and Pergamon.

There were no similar university-like institutions teaching more theoretical sciences in the Roman Empire, and the change from Hellenism to the Roman Empire proved to be a setback for the development of science. At least some emperors financed chairs for rhetoric and philosophy, and there was, apparently, occasionally an attempt to found more ambitious university-like structures, such as an institution apparently called the Athenaeum, a ludus ingenuarum artium in Rome under Hadrian. As Hadot (1984: 252) concluded, higher studies were done as part of the philosophy curriculum, which – depending on the teacher’s school – included mathematics and natural sciences to varying degrees; in the case of Platonists, hardly any of the latter, for Peripatetics and Stoics, a little of both. The strong neo-Platonic current in Christianity may help to explain why the Early Middle Ages took over the Seven Liberal Arts (chap. 9 §1), which lack natural science proper. Sulla’s destruction of the Academy and its reappearance only when the Roman Empire had become Christian may be seen as symptomatic for the Romans’ lack of interest in theoretical studies.

---

15 On ancient Greece, see Lloyd (1987: 330–336), concluding: ‘Even among the literate elite themselves, the gap between those who were capable of independent research and those who merely know something about it was very great, as the immensely learned, but at points quite uncritical and confused, Pliny illustrates’ (331).

16 This is also stressed by Lloyd (1973: 3 and passim); it is one of the main points of Russo (1997).

17 In Demandt (1999), a collection of essays treating important universities, there is a conspicuous gap between Alexandria and Constantinople.

18 See Aurelius Victor, De caesaribus 14.3, ed. Pichlmayr, p. 93. Details in Barbagallo (1911: 130–135). In general on Roman state-run schools, see Pauly’s Real-Encyclopädie (s.v. ‘Schulen (Rom)’, by Erich Ziebarth). Much depended on the emperor in charge; there was no continuity.
In contrast to classical Greek and Hellenistic times, the people who engaged in scientific activities in the widest sense tended to be found at the imperial court, either as gentleman scientists from senatorial ranks who were also politically active and often died violent deaths (such as Cicero or Seneca) or as teachers of philosophy or rhetoric (Quintilian), often from the Eastern half of the Empire; or they engaged in practical arts such as medicine or law, often also based in the capital, many of them writing in Greek (e.g. Epictetus, Galen, Marcus Aurelius, Claudius Aelianus, Plotinus). At court, there was at best some interest in doxography of the kind: this philosophical school believes the cause of, say, earthquakes to be this, and that that, with no attempts to verify or refute these δόξαι. Of course, there were schools for more practical arts such as medicine, oratory, or law in the Roman Empire. For law there was the important school in Berytus (Beirut), teaching at ‘university’ level, as well as another one in Rome; at both, including the former, despite its location in the East, Latin was used as the scientific language of law. In the fifth century, a rival school in Constantinople was set up. These schools had fixed professor posts and offered a five-year curriculum to students. Indeed, law may in many respects be the scientific endeavour that most befitted the Roman mind and the one in which the Romans surpassed the Greeks.

Just as a Sitz im Leben for the more theoretical sciences did not exist in the Roman Empire, so too there did not exist one clear-cut style for those few authors who did write about them. In contrast, as we have seen (chap. 6 §4), Roman stylistics offers quite narrow criteria for the writing of many other genres, such as letters, epic poetry, or panegyrics. This stylistic theory continued to be used and to be highly influential in the Middle Ages and early modern times. As this was not the case for scientific texts, it is to be expected that scientists would copy each other’s style, or that of their Greek predecessors, and that several currents would be identifiable. After these preliminary considerations, we now survey some Roman authors, what they feel about science, and what kind of language they use or recommend.

19 The anonymous poem Aetna can serve as an example; see §8 below.
20 Probably founded in the late second century AD; see Jones Hall (2004).
21 Although probably not as the language of teaching; see Schulz (1961: 347) and Parker (1992: 272) for its development in the fifth century.
22 Söllner (1996: 132).
23 See Auerbach (1958).
24 Korenjak speaks of ‘Wildwuchs’ (‘rank growth’; 2016: 70).
The beginnings of science in Rome

§3 Very little Latin literature survives from before the time of Varro and Cicero. Before then, we know of some learned literature, but one doubts whether much of it was of a scientific nature, even if taken in a very wide sense; in general, writing among the still rather unsophisticated Romans will have been modest, with the one exception of jurisprudence, for which the Romans seem to have had a special affinity from early on. Jurisprudence as a scientific undertaking, in the sense that it sought theory-based systematic generality and had its own specialists,\textsuperscript{25} is described by Manthe thus: ‘die klassische Rechtswissenschaft untersucht die grundlegenden Beziehungen der menschlichen Gesellschaft und hat allgemeingültige Lösungen für ihre Probleme gefunden’ (‘classical jurisprudence examines the fundamental relationships of human society and has found universal solutions to its problems’; in Graf 1997: 455).

The beginnings of Roman law and its distinctive language should be considered in this context.\textsuperscript{26} Only scanty remains of old Roman law are extant, partly from inscriptions, partly from later quotations. The crucial first act of legislation in Rome was the \textit{Leges duodecim tabularum} (traditional date: 450 BC).\textsuperscript{27} Their language was, of course, still very archaic, and they are famous for their epigrammatic character, as this example shows:

\begin{quote}
\textit{Si in ius uocat, ito; ni it, antestamino; igitur im capito.}
\end{quote}

‘If someone calls to court, one must go. If not, a witness is to be taken. Thus he is to be seized.’

For such an old legal collection, the Twelve Tables are remarkably detailed, but they are very different from the scientific Roman law of imperial times. Their language is simple; by far most commonly, conditional phrases with \textit{si} or \textit{ni(si)} are found, usually followed by imperatives in the third person. The often-changing grammatical subjects must be inferred from context. In order to reach such generality, a technical vocabulary of its own had to be developed; some abstract, legal technical terms are already discernible in the Twelve Tables, for instance \textit{auctoritas} (‘warrant’) or \textit{intestabilis} (‘incapable, by reason of misconduct, of being a witness or of making a will’).\textsuperscript{28} The Twelve Tables laws are still comparable to con-

\textsuperscript{25} Cicero often speaks of \textit{iuris civilis scientia} (‘the knowledge/science of civil law’); Schiavone (2007: 122) also emphasises its scientific character.
\textsuperscript{26} Good introductions to its development are Schulz (1961) and Söllner (1996).
\textsuperscript{27} Edition: \textit{Roman statutes}, ed. Crawford, vol. 2, p. 578. On the collection’s language: p. 571.
\textsuperscript{28} Translations from Lewis & Short.
temporary Greek models such as the laws of Lycurgus for Sparta, or of Dracon and Solon for Athens, or the surviving Cretan Gortyn laws.  

After a period of Hellenisation in the second century, Greek ways of thinking, including Greek philosophy and science, were introduced to a certain degree in Rome. Marcus Porcius Cato (234–149 BC) illustrates very well the advent of Greek thinking in Rome and both the reluctance to engage with it and the fascination with doing so. This Hellenisation made Greek dialectic enter jurisprudence, as can be seen in the new importance of eloquence and use of Aristotelian terms such as *differentia*, *genus*, *species*. Sextus Aelius Paetus Catus (fl. 198–194 BC) wrote a first juridical work in this vein, the *Commentaria tripertita*, apparently developing law out of the Twelve Tables. Unfortunately, the work is completely lost, but it was praised by Cicero. Specialised jurisprudence that can be called scientific in the above sense, seems to begin in Rome at the latest around 100 BC, especially with the pontifex Quintus Mucius Scaevola (ca. 140–82) and his influential (lost) work *ius civile*. Greek philosophical influence seems to be tangible in him: he defined juristic terms and, again, operated with *genera* and *species*. In Cicero’s time, there were already professionals, such as his friend Servius Sulpicius Rufus. As in Roman law courts a side committing formal errors had *eo ipso* lost its case, it became of paramount importance to be precise and to stick to the juridical rules meticulously. However, Roman law remained an *ars* and despite Cicero’s apparent endeavours did not become a *scientia* based on first principles.

---

29 Livy relates that the Romans had sent a delegation to Greece to be informed on how laws should be organised (*Ab urbe condita* III.34, ed. Bayet et al., vol. 3, pp. 51–52). Although this is usually not taken at face value by modern historians, it still shows that even in jurisprudence the Romans acknowledged a debt to the Greeks (for which see e.g. Jörs, Kunkel & Wenger 1949: §4.3, p. 5). On the other hand, even the elementary term *poena* is a Greek loanword.

30 On this author and his life, see Astin (1978). On the Romans’ relationship to Greek, see Kaimio (1979).

31 See Schulz (1961: 73).

32 Schulz (1961: 41–42); the three parts covered the text of the Twelve Tables, a commentary, and process formulas.

33 *De re publica* I.18 (30), ed. Ziegler, p. 20.

34 See Jörs, Kunkel & Wenger (1949: §14.4, p. 23), quoting Gaius, *Institutiones* I.188, ed. Manthe, p. 104, and Augustine, *De civitate Dei* IV.27, ed. Hoffmann, vol. 1, pp. 197–199. Later times are still aware of this foundational work; cf. *Digesta* D 1.1.2, ed. Krüger & Mommsen: *Post hos fuerunt Publius Mucius et Brutus et Manilius, qui fundauerunt ius civile* (‘After these there were Publius Mucius, Brutus, and Manilius, who founded civil law’). The newer reworked edition of Jörs by Heinrich Honsell et al. (4th ed., Berlin, 1987) has removed this paragraph, apparently seen as too philological.

35 In his lost *De iure civili in artem redigendo*. As Schulz put it ‘Die römische Jurisprudenz hat diese Ermahnungen mit höflichem Schweigen beantwortet’ (‘Roman jurisprudence answered these admonitions with polite silence’; 1934: 44).
with a deductive structure. Indeed, it remained surprisingly tolerant of previous legal approaches in the provinces of the Empire, as can still be seen in the papyrus evidence from the Roman province of Egypt. Roman juridical methods remained casuistic; as Söllner (1996: 105) puts it:

> Such rules, principles, and policies were formulated with extreme caution. They always concerned only delimited groups of cases. Roman jurisprudence is concerned with individual cases and their proper resolution. There was a strong aversion to overly abstract terminology and to arguing with general principles of law.

Apparently, Roman jurists saw reality as too complex for fixed definitions and rules. The oft-quoted Roman warning against ‘scientific’ definitions (understood in a broad sense as covering all fixed juridic rules) instead of casuistics is found in Justinian’s *Digesta* L 17.202, ed. Krüger & Mommsen:

> Omnis definitio in iure ciuili periculosa est: parum est enim, ut non subuerti posset.

> ‘Each definition in civil law is dangerous, for it is rare that it cannot be overthrown [by some cases].’

Definitions such as Ulpianus’ *Ius est ars boni et aequi* (‘Law is the art of what is good and just’) are only used at the beginning of works and play a more ornamental rôle. Thus, Roman law may qualify as a science according to broad criteria, but in Antiquity it would not have been seen as an *ἐπιστήμη* by Aristotelians. On the other hand, it kept a clear and central rôle in Roman society, in contrast to most other sciences (Schulz 1961: 84):

> Wenn so die römische Jurisprudenz sich zu einer Wissenschaft im eigentlichen und strengen Sinne entwickelte, so blieb sie doch eine Wissenschaft römischer Staatspriester, Senatoren, Magistrate und *iuris consulti*, d. h. von Männern, die mitten im praktischen Staats- und Rechtsleben stehen. Daraus ergab sich ihre klare Abgrenzung zu anderen Wissenschaften.

> ‘Even if Roman jurisprudence thus developed into a science in the strictest and most rigorous sense, it remained a science of Roman state priests, senators, magistrates, and *iuris consulti*, that is, of men from the midst of practical state and legal life. This was the reason for its clear demarcation from other sciences.’

---

36 See Alonso (2013) on the status of ‘peregrine law’ in Egypt.
37 *Digesta* D 1.1.1 pr., ed. Krüger & Mommsen, vol. 1, p. 1; on the author, see below.
The language of late republican and early imperial Roman law is poorly known, but it is clear that it was already perceived by contemporary Romans as a technical language not easily understandable to laymen. It has been characterised as using archaisms, precision involving a lack of metaphors, and — in contrast to other early scientific Latin — a lack of Greek terms. Its further development toward ‘classical’ Roman law (second to third century AD) is pursued below (§12).

Unfortunately, the beginnings of Latin’s deliberate use as a medium for the other, more typically Greek, sciences and philosophy are even less accessible today. Romans before the first century BC will certainly have talked about things important for their life and the administration of their growing empire as well as about Greek learning, but practically nothing has come down to us except Cato’s *De agri cultura*. This learned *Fachbuch* describes how to work a large-scale Roman farm; even by a very broad definition, it cannot be called ‘scientific’, although it does shed some light on the importance of Greek influence in Cato’s time. There are close to no surviving documents from the following century, although the existence of some scholars is known, for instance the grammarian and historian Lucius Aelius Stilo Praeconinus (ca. 154–74 BC), teacher both of Varro and of Cicero, but none of his works is extant. The same is true for the historian Lucius Cornelius Sisenna (ca. 120–67 BC).

**Late republican and Augustan imperial times**

§4 The three important learned authors of surviving texts from the late Republic – Varro, Lucretius, and Cicero – all show the importance of Greek or, indeed, consciously try to break its monopoly; they are already heavily Hellenised. In their time, some other scientific writers are known by name – such as Marcus Verrius Flaccus (ca. 55 BC–AD 20), who wrote grammatical treatises and a very voluminous dictionary, or Nigidius Figulus’ (ca. 98–45) equally voluminous *Commentarii grammatici* – but their texts are lost. The three main authors were contempor-
aries of one another, and the oldest of them (Varro) outlived the other two. It will
become clear that none of them can strictly be called a scientist: Lucretius was
more a poet wanting to share his Epicurean convictions, making use of doxo-
graphic science for this end, while Cicero was more a politician and rhetorician
with an interest in Greek philosophy. Varro was a scholar; those of his works that
may have most deserved to be called scientific are, unfortunately, lost. Nonethe-
less, all of these three authors were crucial in enriching Latin’s expressive cap-
abilities. Before their time, no specialised philosophical or scientific vocabulary
in Latin seems to have existed (excepting jurisprudence).43

§5 Marcus Terentius Varro (the older, 116–27 BC)44 was a prolific writer and
student of Roman antiquities and their language and culture, who worked in a
scholarly manner. For Quintilian he was the vir romanorum eruditissimus.45 Unfor-
tunately, most of his numerous works filling some 620 scrolls46 are lost. He appar-
ently borrowed much from (also lost) Greek compendia. Many titles of his numer-
ous works are known; some of them betray an interest in natural science, such as
De aestuariis (‘On Tidal Inlets’).47 As Stahl puts it, ‘Varro’s work seems to have been
the fountain-head of much of the subsequent Latin scientific literature’ (1971: 4).
His treatise De disciplinis in nine books, in particular, would be very interesting to
study in the present context, but only very few fragments survive and it is not even
clear which books treated what discipline.48 Some of the few surviving fragments
make one wonder whether their content was not more of an antiquarian and etymo-
logical nature than actually about the disciplines’ scientific content.49 Cicero aptly
calls him Varro noster diligentissimus investigator antiquitatis.50 But in other cases,
this is clearly not his sole interest, for instance in his descriptive study of religion,
where he may have coined the phrase theologia naturalis (in his Antiquitates).51

43 See Leonard & Smith’s edition of Lucretius, p. 217.
44 Introductions: Cardauns (2001); Lehmann (1997).
45 Institutio oratoria X.1.95, ed. Rahn, vol. 2, p. 468.
46 See Kent’s edition, vol. 1, p. viii. The existence of many of them is only known from a list com-
piled by Jerome. For a full list, see Della Corte (1970: 255–257).
47 Mentioned in De lingua latina IX.19(26), ed. Goetz & Schoell, p. 152.
48 Ritschl, De M. Terentii Varronis, collected references to it and fragments from it. However, he
was over-optimistic in his conclusions based on very scanty evidence.
49 e.g. stella a stando (‘star’ is said because it “stands” still [in contrast to planets’]) is one of
these fragments, apparently from the book on astronomy; from Cassiodorus, Institutiones II.7.2,
ed. Mynors, p. 155.
50 Brutus 15(60), ed. Martha, p. 21.
51 No longer extant, but quoted by Augustine, De civitate Dei VII.7, ed. Hoffmann, vol. 1, p. 131.
The fragments are collected in Varro, Antiquitates rerum divinarum, ed. Cardauns.
His two surviving works are one on agriculture and books 5–10 (of 25) of *De lingua latina* in a rather corrupt textual form. Besides his interest in antiquarian matters, a scientific spirit becomes apparent in this author every now and then. For instance, he seems to inform his readers of the existence of microbes when speaking of what would seem to be malaria and wisely advises building the homes of farm slaves away from swamps (*De re rustica* I.12.2, ed. Flach, vol. 1, pp. 110–111):

> Advertendum etiam, siqua erunt loca palustria, et propter easdem causas, et quod *cum* ares-
> cunt, crescunt animalia quaedam minuta, quae non possunt oculi consequi, et per aera intus in
> corpus per os ac nares perveniant atque efficiunt difficilis morbos.\(^{52}\)

‘Precautions must also be taken if there are swampy areas, both for the mentioned reasons and because when they dry out, minute animals grow that the eye cannot discern, and – airborne – they enter the body through the mouth and the nose and cause serious diseases.’

Of course, it is unknown whether this was his own insight. An awareness of polysemy and the importance of precise language can also be seen when he weighs whether our understanding of language should be based on the theory of *analogia* or of *anomalia* (*De lingua latina* X.2(6–7), ed. Goetz & Schoell, p. 175):\(^{53}\)

> quare quoniam *fil[i]t*, ut potius de vocabulo quam de re controversia esse videatur, illud est po-
> tius advertendum, quom simile quid esse dicitur, *quin* cui parti simile dicatur esse (in hoc
> enim solet esse error), quod potest fieri ut homo homini similis sit, non sit, ut multas partis ha-
> beat similis et ideo dici possit similis habere oculos, manus, pedes, sic alias res separatim et
> una plura. itaque quod diligenter videndum est in verbis, quas similitudinem habere* dicuntur, ut
> infra apparebit, is locus maxime lubri-
> cus est.

‘Because, as it happens that this controversy is rather about words than things, when something is called “similar” it is rather to be discerned to what part [of the other thing] it is similar: for in this the mistake often lies. Just as it may be that one man is similar and not similar to another one, although he has many similar parts and could thus be called similar in having eyes, hands, feet, and other things like this separately or taken together – so it is to be considered exactly in the case of words that are said to be “similar” what parts and in what ways they possess similarly; as will become clear below, this matter is most hazardous.’

Varro ultimately prefers the Aristotelian *analogia* camp over the Stoic anomalists, but rightly insists that the two are both necessary principles for explaining language (IX.1(3), p. 148). Indeed, his argumentation in the above quotation reminds one of Aristotle’s weighing of several meanings of words. Varro speaks about *dis-

\(^{52}\) See Sallmann (1976).

\(^{53}\) A discussion held mostly between Alexandrian and Pergamon (Greek) scholars, the former claiming that language and grammar are rational, the latter that they are spontaneous products. See Douay & Pinto (1991).
ciplinae right at the beginning of book V of De lingua latina, when he discusses the scientific discipline etymologia. He often groups words together in a meaningful way; sometimes they are indeed from the same roots (according to modern linguistics), but often the combinations are very fanciful. Much of the surviving books cover etymologia in the sense explained above (chap. 1 §9). Occasionally, the author admits that he is not sure about the origin of a word, like (V.36(182), p. 55):

*stips ab στοιβῆ fortasse, graeco verbo.*

‘The word *stips* [donation] maybe derives from the Greek στοιβή [heap].’

He then links many Latin words to this one: *stipare, stipendium, stipulari.* Sometimes he offers more than one explanation (e.g. on *nox*; VI.2(6), p. 59) or refutes an etymology (e.g. of the month name *Aprilis* from Ἀφροδίτη; VI.4(33), p. 70) with convincing arguments. He admits that in the study of poetic language much remains unclear (*latent multa*; VII.1(2), p. 92). That Varro constructed a coherent theory of language is shown by Taylor (1974). It becomes clear that some technical Latin vocabulary is still not fixed: for instance, Varro usually uses *initium* for ἀρχή, in contrast to later *principium*. In addition, syntactically his prose is sometimes somewhat awkward or (rather) pre-classical.54 Already for Varro, short relative clauses seem to be the means of choice for translating Greek participles and nominalised verbal expressions, such as *qui so-luta oratione loquuntur* (‘those who write in prose’).55 Clearly, he felt at least as much at home in Greek as in Latin. Indeed, it seems that he abbreviated three of his long works to a Greek ἐπιτομή (the Antiquitates, Imagines, and De lingua latina). He occasionally gave Latin works Greek titles, such as the Logistoricon libri, which apparently contained philosophical dialogues.56 Varro’s long works were often read and digested in late antique compendia, which may partly explain the poor preservation of the original works. Thus, it is but guesswork to tell what content of the later compendia actually goes back to him and what does not. Later

---

54 As the classicist Norden puts it in Ciceronian pathos: ‘Man wird wohl sagen dürfen, daß dies größte Werk über die lateinische Sprache in dem schlechtesten lateinischen Stile geschrieben ist, den irgendein Prosawerk zeigt; im ganzen genommen kann man überhaupt kaum von einem Stil sprechen: es sind roh aufeinander getürmte Steinblöcke’ (‘It will be fair to say that this greatest work on the Latin language is written in the worst Latin style to be found in any work of prose; on the whole, one can hardly speak of a style at all: there are raw blocks of stone piled up’; 1958: 1:195).
55 De lingua latina X.3(70), ed. Goetz & Schoell, p. 188.
56 Fragments in Cardauns (1960).
Latin authors from Antiquity saw Varro as the first, and one of the foremost, Latin scholars. Martianus Capella’s *Dialectica* says (IV, §335, ed. Ferré, p. 6) about him:

> Ni Varronis mei inter Latiares glorias celebrati mihi eruditio industriaque suppeteret, possem, ‹ego›, femina Doricae nationis apud Romuleae uocis examina, aut admodum rudis, aut satis barbara, reperiri. Quippe, post Platonis aureum flumen atque Aristotelicam facultatem, Marci Terentii prima me in Latinam uocem pellexit industria ac fandi possibilitatem per scholas Aussonias comparauit.

‘If the erudition and diligence of my famous Varro, the glory among the Latins, had not been at hand, I could have been found a woman of Dorian [i.e. Greek] nation by examination of my Romulian language [i.e. Latin], or even to be either rather uncultured or quite barbarous. Indeed, after Plato’s golden flow [of words] and Aristotle’s skill, it was Marcus Terentius’ diligence which first allured me to the Latin tongue and matched the capabilities of speech at the schools of Ausonia [i.e. Italy].’

Plato is remembered for his rhetoric, Aristotle for his science, Varro for his diligence and for being the founder of Latin dialectic. It is indeed unfortunate that more of his works have not survived.

§6 The Epicurean philosopher Titus Lucretius Carus (ca. 99–ca. 55 BC), about whose life virtually nothing is known, wrote a surviving didactic poem in hexameters, *De rerum natura*. The main point of his poem was to introduce an Epicurean worldview, including Democritus’ atomism, to a wider Roman audience. Psychologically, he tries to free people from superstitious fears, indeed from *religio* in general (I.62–89, ed. Ernout, vol. 1, pp. 33–34), a goal he believes can be reached by pondering *naturae species ratiocinio* (I.148, vol. 1, p. 36). In the first book, he tries to refute the worldviews of Heraclitus, Empedocles, and Anaxagoras. Book II tries to prove an infinite world with many inhabited Earths (II.1048ff., vol. 1, p. 109). Book III sets out to prove the mortality of the soul seen as just a conglomerate of atoms, book V makes plausible how humanity developed culture after starting out as brutes, and book VI explores natural *mirabilia*. Books V and VI in particular do contain scientific arguments, mostly about the Earth and the heavens; but Lucretius’ knowledge of these matters is meagre. He makes fun of fancy theories such as a round Earth, with people walking upside down in the antipodes (I.1052–1068, vol. 1, pp. 67–68), even though a spherical Earth had been scientific consensus among the Greeks for centuries by his time. He does make use of syl-

57 Compare chap. 9 §5 below on Martianus and his remarkable Latin.
58 As Stahl (1962: 82) puts it, ‘he fails to comprehend the more abstruse doctrines of Epicurus and has an obvious lack of interest in astronomical matters’.
59 Details in Gleede (2021: section 1.1).
logisms, for instance in order to ‘prove’ that his atoms are eternal (I.503–548, vol. 1, pp. 48–50), or in the following (II.479–482, vol. 1, p. 88):

[...] primordia rerum
finita variare figurarum ratione.
quod si non ita sit, rursum iam semina quaedam
esse infinito debebunt corporis auctu.
‘[...] that the atoms’ forms vary in a finite way. If it were not so, again some of the atoms would have to exist with infinite size.’

This, however, seems to be more a non sequitur, or maybe a poetic device, not a strictly logical one. Indeed, much of the book is more Epicurean δόξα and an attempt to make converts. Despite this, the author was faced with the difficult task of putting scientific and philosophical Greek thought into Latin, and into Latin that fits hexameters. His vocabulary was studied by Eucken (1879: 50), who composed a list of some of his attempts for new terminology. Some of them did not find widespread imitation: dispositura, variantia, retinentia, compositura, differtas, formamentum, while others did: elementa, experientia, forma, materia/ -es, moles, concretus, generalis, innatus. His language is indeed innovative; in particular, his use of suffixes is striking: -men, -tus, -cola, -ger, -fer, -tim, -per are common. For key terms Lucretius used poetic variatio, the best example of which is his atoms, which are variously called principia, semina rerum, corpuscula, minima naturae, rerum primordia, genitalia corpora; or, in an especially beautiful poetic passage (I.705–715, vol. 1, p. 55), water is described in the space of a few lines as umor, liquor, and imber. Such poetic synonymy is rather unhelpful for scientific clarity; it is, however, typical for epic language to have several synonyms for important words at one’s disposal for different positions in a line of verse. Lucretius’ poetic language, thus, does not conform well to the scientific needs of perspicuitas and univocitas.

Lucretius does not usually employ Greek words in his poem, except those that had been imported into Latin by earlier generations (such as aether, elephantus, lympha, theater); a rare exception is philema (φίλημα; IV.1169, vol. 2, p. 46), ‘kiss’, which is attested in Latin only here. It is interesting to compare how Cicero translated Greek terms. This can most easily be done for Epicurean terms used by both writers, as Peters did. A few examples: Cicero does not mind saying atomus, but

60 List from von Albrecht (1992–1994: 1:238), with bibliographies.
61 Interestingly, the same polysemy can be observed in Indian metrical śāstra literature. For the case of astronomy, see Pingree (1981).
62 Peters, T. Lucretius et M. Cicero, pp. 6–7. Exact passages are quoted there, but these rare terms can also easily be listed using the lemmatised search function in Corpus Corporum. On p. 24, Peters offers a list of tentative new coinings by both authors.
Lucretius does, and uses many other terms for it, as mentioned. For other terms, too, Lucretius’ pursuit of poetic variatio becomes clear: Cicero says inane for κενόν, Lucretius both inane and vacuum; Cicero is less scrupulous in coining indolentia for ἄποιεια, which Lucretius renders as privatus dolore (indolentia would not fit a hexameter). Some terms had to be circumscribed: φυσιολογία becomes the not very evident naturae species ratioque in Lucretius (four times); Cicero has no scruples about using physiologia, which, again, cannot fit a hexameter. In a famous, self-conscious passage on his Latinising of Greek concepts, Lucretius writes (I.136–145, vol. 1, pp. 35–36):

\[
\textit{Nec me animi fallit Graiorum obscura reperta}
\textit{dificile inlustrare Latinis versibus esse,}
\textit{multa novis verbis praeertem cum sit agendum}
\textit{propter egestatem linguae et rerum novitatem;}
\textit{sed tua me virtus tamen et sperata voluptas}
\textit{suavis amicitiae quemvis efferre laborem}
\textit{suadet et inducit noctes vigilare serenas}
\textit{quaerentem dictis quibus et quo carmine demum}
\textit{clara tuae possim praepandere lumina menti,}
\textit{res quibus occultas penitus convisere possis.}
\]

‘It is not hidden to me that it is difficult to explain the obscure discoveries of the Greeks in Latin verses, especially as one has to deal with many things in new words because of the poverty of the [Latin] language and the novelty of the content. But your\textsuperscript{63} virtue and the expected sweet joy of your friendship persuade me to tackle any toil and make me wake through cheerful nights and seek with what words and what song I might unveil the clear light of your mind, with which you are able to examine hidden things fully.’

The apparent egestas of Latin is mentioned again in III.260, vol. 1, p. 124, as an excuse for why the author cannot explain how the atoms mix to form larger bodies. In fact, this would rather seem to be due to missing fundamentals of physics and chemistry than a matter of language. Of course, Lucretius cannot be blamed for not being a modern chemist (Lavoisier’s kind of chemistry was developed nineteen centuries after him), but this passage makes one suspect that the egestas quoted above may also be more of an excuse than a genuinely felt deficiency.\textsuperscript{64}

Both his approach (atheism, atoms and void, infinite worlds, mortality of the soul) and his language will find imitation in early modern times, most conspicu-

\textsuperscript{63} The poet is speaking to Venus, the deity of voluptas, the Epicurean goal in life.

\textsuperscript{64} More on this in Fögen (2000: 228); this topos is most often repeated in the context of Fachsprache, and the poverty is mostly seen in the lexicon. But Fögen’s sweeping conclusion that ‘Sprache, Rasse, Nationalcharakter und Kultur nichts miteinander zu tun haben’ (‘language, race, national character, and culture have nothing to do with each other’; 235) is a non sequitur.
ously by Giordano Bruno (see chap. 12 §4), but his style, including its poetic *variatio* in the designation of key terms, will become the general norm for didactic poets in general. For instance, Benedictus Stay – writing hexametric poetry about Newtonian physics in the eighteenth century – still uses *munus, officium, vires* all to mean physical ‘property’ with no semantic distinction.\(^{65}\)

§7 Marcus Tullius Cicero’s (106–43 BC) important rôle in the creation of Latin technical as well as rhetorical language is generally acknowledged.\(^{66}\) He was first and foremost a politician and orator; his interest in Greek science was limited, and his interest in Greek philosophy had a typically Roman practical bent, as he himself states (*Tusculanae disputationes* I.2(5), ed. Fohlen, p. 6):

> In *summo apud illos honore geometria fuit, itaque nihil mathematicis industrius; at nos metiendo ratiocinandique utilitate huius artis terminavimus modum.*
> 
> ‘Geometry stood in highest esteem among them [the Greeks], and so nothing was more famous than the mathematicians, but we [the Romans] limited the manner of this art to the utility of measuring and reckoning.’

Which is, in fact, what the Egyptians had already done before the Greeks. A little later (I.4(7), p. 7) he points out:

> *perfectam philosophiam semper iudicavi, quae de maximis quaestionibus copiose ornamentque dicere.*
> 
> ‘I always judged the best philosophy to be the one that is able to speak copiously and ornately about the highest questions.’

Of course, for ‘copious and ornate’ speaking, one does not necessarily have to understand the topic at hand fully. Indeed, Cicero admits his difficulty in understanding higher Greek learning and shows a lack of interest in trying harder. He gave up his project of writing a study on geography, as he confesses to Atticus (*Ad Atticum* II.4.1, ed. Watt, p. 53):

> *Fecisti mihi pergratum quod Serapionis librum ad me misisti; ex quo quidem ego, quod inter nos liceat dicere, millesimam partem vix intellego.*
> 
> ‘You made me a great favour by sending me Serapion’s book, of which, as I may say between us, I hardly understand a thousandth part.’

---

\(^{65}\) In his *Philosophiae recentioris versibus traditae*. I.409 makes this amply clear: *Ast hic officia, aut vires, aut munera dicam* (‘But I will say property, force, or function’).

\(^{66}\) The literature on Cicero is too vast to do it justice here. We mostly quote directly from his works. Büchner (1964) is still worth reading on his life and work.
Thus, Cicero was not deeply interested in Greek natural science, but his interest and skill in political and social science (as we would call it today) was considerable.67 His most ambitious work may be the dialogue *De re publica*, which imitates Plato’s *Respublica* in form, but its content is quite original. It survives only, and not in full, on a palimpsest (fig. 11). Cicero stresses that he agrees with Socrates, who instead of studying nature cared more about things relevant to human life (*De re publica* I.10(15), ed. Ziegler, p. 11), concluding that *eas artis, quae efficiant, ut usui civitati simus* (‘those arts that make us useful to the state’; I.20(33), p. 22) are the most important ones. He stresses the importance of properly defining the matters one studies (I.24(38), p. 24) and that rational argument is more important than authority (I.38(59), p. 36). The dialogue’s setting is in a villa at a gathering of Scipio Africanus the Younger and some of his friends, because (III.3 (5), pp. 83–84)

*ad domesticum maiorumque morem etiam hanc Socrate adventiciam doctrinam adhibuerunt.*

‘it was them who added the teaching originating from Socrates to [Roman] home-grown custom from the forefathers’.

Fig. 11: Cicero’s *De re publica* (here parts of II.1), which survives only on a palimpsest (ca. AD 400). Roma, Biblioteca Apostolica Vaticana, Vat. lat. 5757, p. 277. The text written over it is Augustine, *Ennarrationes in Psalmos*.

Source: https://commons.wikimedia.org/wiki/File:Cicero,_De_re_publica,_Vat._Lat._5757.jpg
(image by user Πυλαιμένης, public domain).

Much of book II contains examples of state forms that are evaluated to determine which one is best. In some points, Cicero differs strongly from Plato: for example, in IV.4(4), p. 109, he disapproves of pederasty. His search for the optimal state is

---

67 See Wood (1988) on the importance of Cicero’s political thought.
in general much more realistic than Plato’s, and may be called a scientific contribution to politology.\textsuperscript{68}

Cicero himself sees one of his greatest contributions in having made the Latin language richer (\textit{Brutus} 72(253), ed. Martha, p. 91):

\begin{quote}
\textit{[..] cuius te paene principem copiae atque inventorem bene de nomine ac dignitate populi Romani meritum esse existimare debemus.}
\end{quote}

‘[Atticus speaking about Cicero:] in which we have to value your merit highly for the name and dignity of the Roman people as almost the pioneer and bringer of wealth [of language and eloquence].’

In order to do this, he faced a similar problem to Lucretius: he wanted to integrate Greek concepts into normal Latin, although for rhetorical instead of poetical reasons.\textsuperscript{69} Indeed, he tried to prove that Latin can express everything Greek can (\textit{De finibus} III.1(5), ed. Moreschini, p. 91):

\begin{quote}
\textit{[..] nos non modo non vinci a Graecis verborum copia, sed esse in ea etiam superiores,}
\end{quote}

‘[...] that we are not only not vanquished by the Greeks at the amount of words, but we are even better at it’,

since he thinks (I.10, p. 5):

\begin{quote}
\textit{Latinam linguam non modo non inopem, ut vulgo putarent, sed locupletiorem etiam esse quam Graecam.}
\end{quote}

‘The Latin language is not only not poor, as the crowd thinks, but richer even than the Greek.’

Nonetheless, he is aware that this is quite wishful thinking, as he betrays in \textit{Tusculanae} (II.15(35), ed. Fohlen, p. 96):

\begin{quote}
\textit{Haec duo Graeci illi, quorum copiosior est lingua quam nostra, uno nomine appellant.}
\end{quote}

‘The Greeks call these two [words, i.e. \textit{dolor} and \textit{labor} = Greek πόνος] by the same name, although their language is richer than ours.’

His success in improving Latin’s richness of expression was limited, but Cicero’s Latin style was to become a rôle model in many prose genres. Cicero is also often credited with the idea of building a native Latin philosophical language instead of

\textsuperscript{68} Cicero’s abilities in this respect were seen very negatively by Montesquieu, Hegel, and Mommsen, often citing character deficits in Cicero. But Bernett (1995) rightly revises this excessively negative assessment (5–6 on these three authors, 260–265 for her own assessment).

\textsuperscript{69} See Michel (1972–1973).
merely imitating Greek.\textsuperscript{70} He is not afraid to use new words in general (\textit{De finibus} III.4(15), ed. Moreschini, p. 95):

\begin{quote}
Si enim Zenoni licuit, cum rem aliquam invenisset inusitatam, inauditum quoque ei rei nomen inponere, cur non liceat Catoni? Nec tamen exprimi verbum e verbo necesse erit, ut interpretes indiserti solent, cum sit verbum, quod idem declaret, magis usitatum. Equidem soleo etiam quod uno Graeci, si aliter non possum, idem pluribus verbis exponere, et tamen puto concedi nobis oportere ut Graeco verbo utamur, si quando minus occurret Latinum, ne hoc ‘ephippiis’ et ‘acratophoris’ potius quam ‘proegmenis’ et ‘apoproegmenis’ concedatur; quamquam haec quidem ‘praeposita’ recte et ‘reiecta’ dicere licebit.
\end{quote}

‘If it was permitted to Zeno, when he encountered an unusual matter, to impose an unheard-of name onto it, why should this not be permitted to Cato? Yet it would not be necessary to translate it word by word, as translators lacking eloquence are wont to, if a synonymous word is more usual. Indeed, it is also my custom to express in several words what is expressed in one Greek word, if it cannot be helped. And yet I hold that it must be allowed us to use a Greek word if ever a [corresponding] Latin word occurs less, so that \textit{ephippii} [saddle] or \textit{acratophora} [wine-cup for unmixed wine] should be more acceptable than \textit{proëgmena} or \textit{apoproëgmena}, as the latter can be said as \textit{praeposita} [preferred] and \textit{reiecta} [rejected].’

Incidentally, Cicero here also tells us about bad translators of Greek philosophy in his time. Of course, he also keeps using Greek words that are already in firm use in Rome such as \textit{philosophia}, \textit{grammatica}, or \textit{musica}: \textit{quamquam latine ea dicerent} (\textit{Academica} I.7(25), ed. Plasberg, p. 47):

\begin{quote}
et id quidem commune omnium fere est artium; aut enim noua sunt rerum novarum facienda nomina aut ex aliis transferenda. quod si Graeci faciunt, qui in his rebus tot iam saecula versan-tur, quanto id nobis magis concedendum est, qui haec nunc primum tractare conamur.
\end{quote}

‘and this is common to almost all \textit{artes}: either new names have to be coined for new matters, or they have to be transferred from other [fields]. If the Greeks, who have been engaged in these matters already for centuries, do this, how much more this has to be conceded to us who are now for the first time trying to practise them.’

Nevertheless, on the whole Cicero tries to avoid neologisms and uses existing words for new Greek concepts\textsuperscript{71} – similarly to what Aristotle already did in Greek. A few examples of his translations (it is not always clear whether they really are new coinings or not): \textit{decorum} (for τὸ πρέπον), \textit{mulierositas} (φιλογύνεια), \textit{orbis} (κύκ-\textsuperscript{70} See Levy (1992), and also Poncelet (1957) and Puelma (1980), who agree on this topic.
\textsuperscript{71} Glucker (2012) collects the passages where Cicero discusses his translations of philosophical terms.
λος, providentia (πρόνοια), qualitas (ποιότης), temperantia (σωφροσύνη).\textsuperscript{72} Springhetti points out (\textit{Latinitatis fontium}, p. 20):

\begin{quote}
\textit{Ut statim apparat, haec vocabula fere ex philosophia Stoicorum et Epicureorum desumpta sunt; ex Aristotele vero quaedam mutavit de re dialectica et rhetorica. Nihil prope inventur in Cicerone de vocabulis propriis investigationis metaphysicae et logicae, hoc est de ‘ente’ et ‘essentia’, de cognitionis ratione, etc., quae in Aristotele et apud cultores philosophiae ‘scholasticae’ inveniuntur.}

\textquoteleft\textquoteleft As becomes immediately clear, these words are usually taken from Stoic and Epicurean philosophy; from Aristotle he borrowed some concerning dialectic and rhetoric. But close to nothing is found in Cicero concerning proper terms of metaphysical or logical investigation, that is, “being” and “essence”, or epistemology, etc., which are found in Aristotle and in scholastic philosophers.\textquoteright\textquoteright
\end{quote}

For Epicurean concepts, he coins abstract terms by suffixation, such as adhaesio (ἀφη), aequilibritas (ἰσονομία), contemplatio (θεωρία), perspicuitas (ἐνάργεια), ttitillatio (γαργαλισμός)\textsuperscript{73} – exactly what humanist Ciceronians will blame 'scholastics' for. It has already been pointed out that Cicero cared more about rhetoric than about scientific knowledge; this explains his approach to new coinings very well: the \textit{rhetor} should use unusual words sparingly in order not to put off his audience.\textsuperscript{74} However, in his private correspondence, when he is not hard-pressed by his project of proving Latin’s capabilities, things look somewhat different. An example will show how Cicero is in colloquial speech quite unable to resist the use of Greek philosophical and other terms (\textit{Epistula ad familiares} XV.18, ed. Shackleton Bailey, p. 575):

\begin{quote}
\textit{longior epistula fuisset, nisi eo ipso tempore petita esset a me, cum iam iretur ad te; longior au-
tem φλύαρον aliquem habuisset nam σπουδάζειν sine periculo vix possumus.}

\textquoteleft\textquoteleft The letter would be longer if it had not been requested from me [by the messenger] who was leaving for you. But it would have been longer containing foolery, for we can hardly be serious without danger.\textquoteright\textquoteright
\end{quote}

\textsuperscript{72} See the long list in Springhetti, \textit{Latinitatis fontium}, pp. 15–20. More examples from Eucken (1879: 52): affectio, anticipatio, complementum, differentia, distantia, evidentia, impressio, incrementum, inductio (technically), lineamentum, notio, partitio vs divisio, progressio, proportio, positio, proprietas, qualitas, relatio (only as rhetorical concept), varietas, definitivus, disparatus, divisus vs individus, moralis, nativus, modificare.

\textsuperscript{73} See Peters, \textit{T. Lucretius et M. Cicero}, who provides a long list. Loci can be easily found in Corpus Corporum.

\textsuperscript{74} As Cicero himself explains in \textit{De oratore} III.154, ed. Kumaniecki, pp. 321–322, with two examples.
Greek terms are italicised in the translation. But an answer by his friend Gaius Cassius Longus shows how far Roman intellectuals could go in mixing languages (XV.19, p. 576):

*difficile est enim persuadere hominibus τὸ καλὸν δι’ αὐτὸ αἰρετὸν esse; ἡδονὴν vero et ἀτραγὰκτίαν virtute, iustitia, τὸ καλῷ parari et verum et probabile est. ipse enim Epicurus, a quo omnes Catii et Amafinii, mali verborum interpretes, proficiscuntur, dicit ἧν ἡδεῖς ἄνευ τοῦ καλὸς καὶ δικαίως χίν.' itaque et Pansa, qui ἡδονὴν sequitur, virtutem retinet, et ii qui a vo-bis φιλόδονοι vocantur sunt φιλόκαλοι et φιλοδίκαιοι omnisque virtutes et colunt et retinent.

‘For it is difficult to persuade men that the good is to be preferred for its own sake; it is both true and demonstrable that pleasure and impassiveness prepare virtue, justice, and the good. For Epicurus himself, from whom all Catii and Amafinii – bad translators of his words – set out, says: there is no pleasurable life without a good and just one. Therefore, also Pansa who follows pleasure, maintains virtue, and those whom you call pleasure-lovers are lovers of the good and the just and cultivate and maintain all virtue.’

In his works for publication, Cicero clearly constrains himself to using purer Latin style, which he was thus to shape decisively. It will be seen that Cicero’s influence on technical language is rather less decisive than that on Latin in general. This is not surprising: forms of Latin with fewer rhetorical constraints were found to be more useful for scientific communication. Nonetheless, we should not underestimate the pioneering effort of Cicero, which certainly did have an impact on the further emancipation of Latin from Greek.

The slightly earlier, anonymous author of the *Rhetorica ad Herennium* (ca. 86–82 BC) – met above as the first attested user of the word *scientia* (chap. 2 §3) – must be mentioned here, at least in passing, for forging a Latin terminology for Greek rhetoric. He believes that ὀνοματοποιεῖν, *nova verba fingere* (‘coining new words’), is only acceptable in poetry (IV.42, ed. Achard, p. 182), a sentiment that seems to hold good for much of Latin literature and rather to the detriment of scientific expression.

The most important technical writer in this epoch from whom there is an extant text is certainly Marcus Vitruvius Pollio (ca. 75–ca. 15 BC). He had worked as an imperial engineer constructing war-engines, bridges, basilicas, and aqueducts. His treatise on architecture and engineering – finished only in the 20s – endeavours to be more than a practical *artes* handbook, as the very beginning makes clear (*De architectura* I.1.1, ed. Fensterbusch, p. 22):

---

75 Examples of terms in Eucken (1879: 51).
76 See von Albrecht (1992–1994: 1:695).
Architecti est scientia pluribus disciplinis et variis eruditionibus ornata, cuius iudicio probantur omnia quae ab ceteris artibus perficiuntur opera. Ea nascitur ex fabrica et ratiocinatione.

‘The knowledge of an architect is adorned with many sciences and various kinds of learning. By his judgement everything accomplished by the other arts is examined. This knowledge arises from both practice and theory.’

He also stresses that all sciences form a single edifice (I.1.12, p. 30):

At fortasse mirum videbitur inperitis, hominis posse naturam tantum numerum doctrinarum perdiscere et memoria continere. Cum autem animadverterint omnes disciplinas inter se con
junctionem rerum et communicationem habere, fieri posse faciliter credent; encyclios enim disci
plina uti corpus unum ex his membris est composita.

‘It may seem amazing to those unacquainted [with science] that human nature is able to learn thoroughly such a number of teachings and to keep them in memory. But when they realise that all sciences are conjoined and in communication among each other, they will easily believe that it is possible. The cycle of the sciences is made up as if one body from such members.’

In contrast to Cicero, Vitruvius’ language appears relatively plain, but the author is nonetheless certainly consciously adorning it rhetorically. The eighteenth-century criticism of Schusterstil (‘cobbler style’) is certainly manqué. 78 The composition is well structured, and every book has a preface situating its content in the work. Unfortunately, the technical designs that were included have been lost. The book became very influential among Renaissance architects.

Although both the Roman epoch and the Early Middle Ages saw few advances in the more theoretical sciences in Latin, technical knowledge grew steadily through the entire period (Hägermann & Schneider 1991: 244):

Neuerungen wie das gallische Mähgerät oder der Räderpflug machen deutlich, daß die Rö
mer überdies fähig gewesen sind, auf veränderte regionale Bedingungen zu reagieren. Ange
sichts solcher Fakten muß dem Imperium Romanum eine hohe Dynamik technischer Entfal	ung zuerkannt werden.

‘Innovations such as the Gallic mower or the wheeled plough show that the Romans were furthermore able to respond to various regional conditions. In the light of these facts, the Ro
man Empire must be recognised as having been highly dynamic in its technological devel
opment.’

Unfortunately, but few technical treatises like Vitruvius’ have come down to us. Frontinus (ca. 40–103), the author of another such text, in good Roman vein...

77 Vitruvius seems to try to take πρακτική and θεωρετική over into Latin with fabrica and ratioci
natio.
78 Loci in von Albrecht (1992–1994: 1:700).
points out the importance of useful technical engineering (*De aquis* 16, ed. Kunderewicz, p. 11):

*Tot aquarum tam multis necessariis molibus pyramidas videlicet otiosas conpares aut cetera inertia sed fama celebrata opera Graecorum!*

‘Compare, if you will, with these massive [Roman] water-conducting constructions, useful to many, the idle pyramids or other useless but celebrated works of the Greeks!’

**Later imperial era**

§8 A selection of some potentially ‘scientific’ imperial authors is now considered. The medical writer and pioneer in medical Latin Cornelius Celsus (ca. 25 BC–ca. AD 50) and his language will be discussed below (chap. 21 §3). Much remains unclear about the anonymous hexametric didactic poem *Aetna*. Sudhaus, its editor, sees it in early Augustan times, von Albrecht (1992–1994: 1:564) rather in the first century AD. It was certainly written before the great eruption of Vesuvius in AD 79, which would hardly have gone unmentioned. The author’s diction is clearly indebted to Lucretius; much of his content is probably based on lost Greek works by Posidonius. His language is full of metaphors and allusions and often difficult to follow. The text studies in a Stoic manner θαυμάσια τῆς γῆς (‘marvels of the Earth’), in this case the greatest known volcano. About two-thirds of the 646 lines treat volcanism in a scientific manner (the rest is *prooemium* and *conclusio*, much of which are directed against the mythological ‘lies’ of poets). The poet’s ardour for science can be seen in the following lines, in a single sentence spanning twenty-eight lines (*Aetna* 224–251, ed. Sudhaus, pp. 16–18):

*Non oculis solum pecudum miranda tueri more, nec effusos in humum grave pascere corpus,*

* nosse fidem rerum dubiasque exquirere causas,*

---

79 See Sudhaus’s edition, p. 82, for details.

80 Sudhaus in his edition characterises the author’s language thus: ‘seine Abhängigkeit von dem Ausdruck seiner lateinischen Vorgänger und seines unzweifelhaft griechischen Originals, das Ringen mit einem schwierigen und der poetischen Bearbeitung widerstrebenden Stoffe, der von dichterischer Seite vorher nicht durchgearbeitet war, das Schweben in Metaphern und Personifikationen, vielleicht auch das unbeabsichtigte Einfließen einzelner Worte und Wendungen eines *sermo plebeius* – alles das hat dazu beigetragen, unser Gedicht zu einem der schwierigsten zu machen’ (‘his dependence on the expression of his Latin predecessors and his unquestionably Greek original, his wrestling with a difficult subject matter that resisted poetic adaptation and that had not previously been elaborated by poets, his indulgence in metaphors and personifications, perhaps also his unintentional inclusion of individual words and phrases of a *sermo plebeius* – all this contributed to making our poem one of the most difficult’; p. vi).

81 On its content and poetology, see Volk (2005).
ingenium sacrare caputque attollere caelo,
scire quot et quae sint magno natalia mundo
principia [...] 
sed manifesta notis certa disponere sede
singula, divina est animi ac iucunda voluptas.

‘Not to see with the eyes alone the wonders [of the world] as cattle do, nor to be fixed to the
soil and to fatten the heavy body, but to know what is the nature of things and to seek out as
yet uncertain causes, to consecrate one’s mind and to raise one’s head to the sky, to know
how many and what are the inborn principles of the great world, [examples of scientific
questions follow], but to assign to each single phenomenon its certain place – that is divine
and delightful joy for the mind.’

This little poem has only survived because it was included in the Appendix Ver-
giliana, which can serve as a reminder of how much more scientific material will
have existed of which no knowledge whatsoever has come down to us. No con-
clusion has been reached as to the relationship (if any) between Aetna and Seneca,
the next author. In general, this remarkable scientific poem enjoyed little suc-
cess.

Lucius Annaeus Seneca (4 BC–AD 65) is another Roman author who may
be labelled a scientist. As a Stoic gentleman philosopher, he was mostly inter-
ested in ethics, and most of his extant work deals with ethical questions, but it is
known that in his youth he followed scientific interests, possibly acquired during
his stay at Alexandria, and he wrote works such as De situ et sacris Aegyptiorum,
De situ Indiae, De lapidum natura, De piscium natura, and De forma mundi. Un-
fortunately, they are completely lost. He describes his methodology, applicable
both to literary studies and to scientific ones, in Epistola 84 (2–7, ed. Préchac,
vol. 4, pp. 121–123), likening the work to bees who collect material but transform
(concoquere) what is collected into something new. The surviving work most pro-
mising for our purposes is the Naturales quaestiones. It treats striking phenomena
from the natural world in eight books, especially atmospheric phenomena, the
flow of water (especially the Nile), wind, earthquakes, and comets. Surprisingly,
voleanoes are absent. The author states his aim as (III, praef. 1.1, ed. Hine,
pp. 108–109):

mundum circuire constitui et causas secretaque eius eruere atque aliis noscenda prodere.

‘I decided to survey the world in order to dig up its causes and secrets and to disclose what is
known to others.’

82 Grimal (1979) is recommended as an introduction to this well-studied and important author.
83 Von Albrecht (1992–1994: 1:930). More details in Berno (2015: 82). Cassiodorus still read a De
forma mundi. Grimal (1979: 66–78) covers Seneca’s time in Alexandria.
Seneca relies heavily on Aristotle and Posidonius, the extent of the latter’s use being hard to gauge as his works are lost. Oltramare, in his edition of the *Quaestiones*, discusses whether Seneca’s work should be termed ‘scientific’ and answers in the affirmative, among other things because of Seneca’s approval of the beauty of disinterested science,\(^8^4\) because he leaves unclear questions undecided,\(^8^5\) and because he believes in science’s progress and admits that some scientific problems need further study (esp. *Naturales quaestiones* VII.3, ed. Hine, pp. 284–285: comets). But Oltramare also admits that the work is not a strict scientific or technical work: the author uses changing terminology (e.g. *spiritus* and *anima* can mean very different things), and the work has literary pretensions (edition, p. xxxiii). Besides, there are hardly any observations and conclusions that are without doubt first-hand. An example of Seneca’s way of reporting science is the genesis of lightning (II.21.1, p. 71). Seneca states:

\[\text{Dimissis nunc praeceptoribus nostris incipimus per nos moveri, et a confessis transimus ad dubia. quid in confesso est? fulmen ignem esse, aequae fulgurationem, quae nil aliud est quam flamma futura fulmen si plus virium habuisset; non natura ista sed impetu distant.}\]

‘After our teachers have been heard, let us begin to move by ourselves and pass over from what is clear to the uncertain. What is clear? That lightning is fire, and similarly sheet lightning, which is nothing else than a flame that would become lightning if it had more force. They do not differ in nature, only in intensity.’

Seneca then explains that lightning is generated by colliding clouds – a theory he sells as his own, but which is by and large Aristotelian (*Meteorologica* II.9). The argumentation is based on analogies and probabilities from better-known phenomena (striking fire through friction or hitting violently; *Naturales quaestiones* II.22.1, ed. Hine, pp. 72–73) to the *explicanda*. In the manner of question-and-answer literature, he also addresses counterarguments. The procedure is quite as scientific as was then possible, although the work is clearly written not for ‘scientists’ but for educated laymen and may be called a handbook of striking natural phenomena. Perhaps most remarkably, in book VII, on comets, Seneca rightly argues that comets are regular supra-lunar phenomena, a point on which Galileo still went badly astray, believing them to be atmospheric in nature and polemically against the Jesuit Orazio Grassi, who held the correct point of view.\(^8^6\)

\(^8^4\) e.g. ‘Quod inquis ‘erit pretium operae?’ quo nullum maius est, nosse naturam (“What”, you will ask, “is the value of the work?” That compared to which there is none greater: to know nature’; *Naturales quaestiones* VI.4.2, ed. Hine, p. 238).

\(^8^5\) *Interim illud existimo [...]* (‘For the time being, I hold this [...]’; I.1.5, p. 155).

\(^8^6\) Cf. Galileo’s *Discorso delle comete* (Galilei 2005). The question was much discussed in the seventeenth century.
Although Seneca admits taking this point over from an otherwise unknown and undatable Apollonius of Myndus (VII.4.1, p. 285) – who apparently claimed to follow some Chaldaei – he nonetheless tries to refute his main sources, Posidonius and Aristotle, and he emphasises how little is still known about such a rare phenomenon as comets (VII.3.1, pp. 284–285):

\[\begin{align*}
Necessarium est autem ueteres ortus cometarum habere collectos. deprendi enim propter raritatem cursus eorum adhuc non potest, nec explorari an uices seruent et illos ad suam diem certus ordo producat. noua haec caelestium observatio est et nuper in Graeciam inuecta. & 87
\end{align*}\]

‘It is necessary to have collected past appearances of comets. Their orbits could not yet be detected due to their rarity, nor could it be elucidated whether they are subject to return and that a fixed order produces them on the right day. Such observation of heavenly phenomena is still young and was only recently introduced into Greece.’

The *Naturales quaeestiones* seem to have been a rare work before the twelfth century, but there are many manuscripts from that century, and some one hundred in total,88 showing that it was much read in the early times of the heyday of mediaeval science (although possibly as yet *faute de mieux*); it was still much admired by Roger Bacon.89

Seneca discusses the rôle of Latin and Greek in a few interesting passages in his letters. He lives roughly a century after Cicero, but the situation does not seem to have changed much in respect to the general approach to new coinings and to the perceived or topical inferiority of Latin compared to Greek. His well-known discussion of the participle of ‘to be’ (*Epistola* 58.1, 6.7, ed. Préchac, vol. 2, pp. 70–71):

\[\begin{align*}
Quanta uerborum nobis paupertas, immo egestas sit, numquam magis quam hodierno die intellexi. Mille res inciderunt, cum forte de Platone loqueremur, quae nomina desiderarent nec haberent, quaedam vero «qua» cum habuissent, fastidio nostro perdissent. Quis autem ferat in egestate fastidium? [...] & 89
\end{align*}\]

‘Quid sibi, inquis, ista praeparatio uult? Quo spectat?’ Non celabo te: cupio, si fieri potest, propitiis auribus tuis “essentiam” dicere; si minus, dicam et iratis. Ciceronem auctorem huius uerbis habeo, puto locupletem: si recentiorem quaeus, Fabianum, disertum et elegantem, orationis

---

87 Seneca, remarkably, goes on to prophesy Halley’s achievement (VII.25.7, p. 312): *Erit qui demonstret aliquando in quibus cometae partibus currant, cur tam seducti a ceteris errent, quanti qualesque sint. Contenti simus inuentis: aliquid ueritati et posteri conferant* (‘There will be someone who at some point will demonstrate in what part [of the world] comets run, why they err so far off the other [planets], how many and what kinds there are. Let us be content with what we have found; let posterity confer something to truth too’).

88 See the edition by Hine, pp. vi–xx.

89 There are 120 mentions of Seneca’s name in the *Opus maius* alone.
etiam ad nostrum fastidium nitidae. Quid enim fiet, mi Lucili? Quomodo dicetur οὐσία res necessaria, natura continens fundamentum omnium? Rogo itaque permissas mihi hoc uerbo uti. Nihilominus dabo operam, ut ius a te datum parcissime exerceam: fortasse contentus ero mihi licere. Quid proderit facilitas tua, cum ecce id nullo modo Latine exprimere possim, propter quod linguae nostrae conuicium feci? Magis damnabis angustias Romanas, si scieris unam syllabam esse, quam mutare non possum. Quae sit haec, quaeris? τὸ ὅν.

‘How great is the poverty of our vocabulary, even insufficiency, I have never better understood than today. We come across a thousand things, for instance when speaking about Plato, that should have a name but do not. Some, that would have had one, lost it due to our haughtiness. Who can stand haughtiness in insufficiency? [...]’

“What is this preface for?”, you will ask, “Where to does it aim?” I shall not conceal it from you: I wish, if it may be, to say essentia to your well-disposed ears. If not, I shall say it to angry ears. I have Cicero as the authority of this word, I daresay a substantial one. If you want a more recent one, Fabianus, an educated and elegant author of a polished speech even for our haughtiness. For what could be done, my Lucilius? How could οὐσία be said, the necessary thing which naturally contains the foundation of all things? I ask you to allow me to use that word. Nonetheless, I will strive to use the concession you gave me but very sparingly; possibly, I shall even be content to have it. But to what avail will your readiness be, when I can in no way express in the Latin language what made me raise this outcry against our language? You would even more damn the Roman narrowness, if you knew that it is a single syllable that I cannot translate. You will ask, which one is this? τὸ ὅν [being].’

In fact, already Caesar had proposed to fill this gap in the conjugation of the verb esse,91 which is especially painful to philosophers, with a new word ens by analogy with potens.92 Only in Late Antiquity did the word become common in philosophical literature. Seneca also realised that words tend in general not to be used without ambiguity (De beneficiis II.34, ed. Préchac, p. 58):

plures esse res quam uerba. Ingens copia est rerum sine nomine, quas non propriis appellatio-nibus notamus, sed alienis commodatisque.

‘there are more things than words. There are a tremendous amount of things without a name, which we do not call by their proper appellation but by alien and adapted ones.’

---

90 According to Quintilian, the Stoic Sergius Plautus translated this word as essentia: οὐσίαν, quam Plautus essentiam vocat, neque sane alius est eius nomen Latinum (‘ουσία, which Plautus calls essentia, as forsooth there is no other name in Latin’; Institutio oratoria III.6.23, ed. Rahn, vol. 1, p. 316). Details in Fögen (2000: 162).

91 As quoted in Priscian, Ars XVIII.75, ed. Hertz, vol. 2, p. 239.

92 From a modern linguistic point of view, *sens would have been preferable (compare absens, praesens). The old participle of esse was lexicalised as sons (‘guilty’, the one who ‘was’ it). For more on ens, see Stotz (1996–2004: VIII, §127.5 = vol. 4, p. 221).
In his letters, he often discusses the precise meaning of Latin terms and their relation to Greek ones. But, as we have seen, he does not seem to use them more unambiguously in his *Naturales quaestiones*. In general, his aristocratic manners apparently made him less interested in scientific strictness and painstaking gathering of data. He is more concerned with pursuing what Norden nicely characterised as ‘das Ungewöhnliche, Packende, ja Raffinierte durch Zusammendrängung langer Gedankenreihen in sensationelle Pointen’ (‘the unusual, enthralling, refined, by compressing long lines of thoughts into sensational points’; 1958: 1:319). Seneca was, of course, able to write very different kinds of Latin. His only surviving scientific work mixes rather terse scientific prose, often including series of logical arguments, with Stoic rhetorical exuberance.

§9 Marcus Fabius Quintilianus’ (ca. 35–ca. 100) only extant work, the *Institutio oratoria*, is concerned with mostly practical rhetoric and can therefore hardly qualify as a scientific text. But it is nonetheless a very well-structured handbook that studies many facets of language in a scientific spirit. The topic is the *ars oratoria*. Similarly to what Vitruvius had pointed out for the art of the architect, in order to be a good orator one must know the sciences (*Institutio oratoria* I, praef. 18–19, ed. Rahn, vol. 1, p. 10):

*Sit igitur orator vir talis, qualis vere sapiens appellari possit; nec moribus modo perfectus [...] sed etiam scientia et omni facultate dicendi. qualis fortasse nemo adhuc fuerit.*

‘The orator should thus be such a man as can be called truly wise: not only perfect in his manners [...] but also in knowledge and in all ways of speaking. Maybe no one has as yet been such a one.’

His point about the potential of the Latin language is interesting: he is afraid that Latin is losing words (VIII.6.32, vol. 2, p. 230):

*deinde, tanquam consumpta sint omnia, nihil generare audemus ipsi, cum multa cotidie ab antiquis ficta moriantur.*

‘Then, as if all possibilities had been used up, we do not dare to create new ones, although every day many coinings of the ancients vanish.’

And he, again, emphasises Latin’s poverty (VIII.3.33, vol. 2, p. 162):

---

93 See Grimal (1992), who studied his use of the terms for ‘mind’ in Latin.
94 On the style of the *Naturales quaestiones*, see Berno (2015: 90).
Many new coinings are imitated from Greek, especially many by Verginius Flavus,\textsuperscript{96} of which some are rather harsh, such as \textit{queens} or \textit{essentia}. I do not understand why we disdain them so much, unless we are ill-disposed judges against ourselves and toil for the poverty of our own language. But some of them do survive.’

He quotes some such words that had only recently been admitted as decent Latin: \textit{reatus, piratica, musica, fabrica}. Quintilian emphasises the importance of scientific progress and laments that it is not of great importance to his contemporaries (X.2.4–5, vol. 2, p. 486):

\begin{quote}
\textit{Ante omnia igitur imitatio per se ipsa non sufficit, vel quia pigri est ingenii contentum esse iis, quae sint ab aliis inventa. quid enim futurum erat temporibus illis, quae sine exemplo fuerunt, si homines nihil, nisi quod iam cognovissent, faciendum sibi aut cogitandum putassent? nempe nihil fuisset inventum. cur igitur nefas est reperiri aliquid a nobis, quod ante non fuerit?}
\end{quote}

‘Most of all, imitation by itself is thus not sufficient; indeed, it is typical of a slothful mind to be content with what others have invented. What future could there have been in those times that lacked examples if men had held that nothing except what was already known was to be done or thought? Obviously, nothing would have been invented. Therefore, why is it unseemly that something should be found by us that had not been known before?’

The Roman rhetorical taste had hardly changed since Cicero’s time; novelty was still seen as a vice.

Among all of the authors mentioned up to now, there is a tendency not to coin new words but rather to restrict or otherwise change the scope of existing words, as will be confirmed in more detail below (chap. 21) for the medical writer Celsus. We saw above that some Greek authors (such as Plato and to a lesser degree Aristotle) used the same kind of caution when in need of new terminology, but some did not mind new words at all (such as Democritus). The following authors are more practically minded and more open to acquiring new terminology, and less

\textsuperscript{95} An unusual participle to the defective verb \textit{queo}. The manuscripts have the meaningless \textit{quae ens}; the reading \textit{queens} is based on a modern emendation by Halm which the editor Rahn does not accept. But the rare occurrence of the similar form \textit{quiens} (twice in Apuleius) and the absence of \textit{ens} in these early times makes it plausible. Rahn reads, less convincingly, \textit{[quae] ens}, having erroneously taken up \textit{quae} from the clause immediately following. Leumann (1977: 521–522) also reads \textit{queens}.

\textsuperscript{96} Author of a lost \textit{Ars rhetorica} under Nero.
bound by a Latin stylistic ideal, be it for coining new words or even for using foreign (i.e. Greek) words.

§10 Gaius Secundus Plinius (AD 23–79) wrote a large, surviving encyclopaedia of ‘natural history’. Like Seneca, Pliny was an aristocratic gentleman scholar. The work is a compendium of results nearly exclusively not his own, mostly descriptive, and often the author appears as highly credulous and unable or unwilling to see contradictions. Although he does sometimes compare sources according to their own merits, his very busy political life and his overambitious work are more likely to make him fail to satisfy our criteria for science. Unfortunately, he does not at all explain what ‘science’ is for him or reflect upon what he is doing, and why and how in Latin.

There are quite a few words not previously attested in his work, for example exacutio (‘whetting’), incantamentum (‘incantation’), explicabilis (‘explicable’); they are usually formed by suffixation. Depending on the field, his use of Greek words is quite frequent, especially for realia such as stones, herbs, and medical conditions. Sometimes he cannot find a Latin name and writes something like non habet Latinam appellationem (‘it has no Latin name’; Naturalis historia XXI.26(50), ed. Ernout et al., vol. 21, p. 44). Only in some fields, such as agriculture, can Pliny make use of an extensive existing Roman vocabulary. He admits himself that his sterile materia demands rustic and barbarous vocabulary on occasion, and stresses that he is the first Roman to attempt such a comprehensive work on natural philosophy (I, praef. 12–14, vol. 1, pp. 50–51):

Meae quidem temeritati accessit hoc quoque, quod leuioris operae hos tibi dedicaui libellos. Nam nec ingenii sunt capaces, quod aloqui in nobis perquam mediocre erat, neque admittunt excessus aut orationes sermonesue aut casus mirabiles uel eventus varios, iucunda dictu aut legentibus blanda, sterilli materia: rerum natura, hoc est uita, narratur, et haec sordidissima sui parte, ut plurimarum rerum aut rusticis uocabulis aut externis, immo barbaris etiam cum honoris praefatione ponendis. Praeterea iter est non trita auctoribus uia nec qua peregrinari animus expetat: nemo apud nos qui idem temptauerit, nemo apud Graecos qui unus omnia ea tractauerit.

‘What further adds to my temerity is also that these books I dedicate to you [Emperor Vespasian] contain a rather petty work. Indeed, they allow little ingenuity – which at any rate is extremely mediocre in me – and they do not admit digressions or speeches or dialogues or miraculous examples and sundry adventures, all of which are nice to write and pleasant for readers, due to the sterility of their subject-matter. They expound the nature of things, that is, life itself, including its most abject part, so that for many things, rustic or foreign words – even barbarian ones – have to be employed, albeit with an excuse. Moreover, this approach

97 For an introduction with bibliography, see Fögen (2009: section 5.3).
98 See the list in Healy (1999: 95–99).
is a path untrodden by authorities, and it is not one that the inquisitive mind seeks out to amble along. There is no one among us Latins who attempted this, no one among the Greeks who alone treated all these things.’

Of course, Pliny’s usual style is very different from that in this elaborate proemium. Indeed, as the non-italicised letters show, there is considerable uncertainty in the manuscript tradition in this complicated sentence. As a more typical example, his discussion of comets may be quoted (II.22(89), vol. 2, p. 38):

Restant pauca de mundo; namque et in ipso caelo stellae repente nascuntur. Plura earum genera: cometas Graeci vocant, nostri crinitas, horrentes crine sanguineo et comarum modo in vertice hispidas; iidem pogonias quibus inferiori ex parte in speciem barbae longae promittitur iuba.

‘A few things remain to be said about the heavens. In fact, also in the sky itself some stars appear suddenly. There are several kinds of them. The Greeks call some “comets”; our authors call them “hairy ones” [criniti], as they bristle with blood-coloured hair and are shaggy on top in the likeness of hair. They [the Greeks] call others “bearded ones” [pogoniiæ]; from these a mane is flowing forth from their lower part in the form of a beard.’

His encyclopaedia comprising some 400,000 words is the longest completely preserved Latin work from Antiquity, more than double the size of Isidore’s Etymologiae. It was to be much copied and used in further digests, and with it his lack of interest in checking sources and his rather unconscious, nonchalant style, making use of whatever linguistic devices happen to be at hand without scruples about elegance of expression. Despite all of this, the work does follow some scientific standards: Pliny believes that authors should cite their sources (praef. 21, vol. 1, p. 53), something he does at the beginning of each book and which makes him quite an exception. He depended heavily on Hilfswissenschaftler (slaves) for his huge work. They gathered the material for him, presented it to him, and took down his dictations. This may have reduced the quality of the content. Quintilian (Institutio oratoria X.1.128, ed. Rahn, vol. 2, pp. 483–485) tells us that Seneca, who worked similarly, was often cheated by such slaves:

Cuius et multae alioqui et magnae virtutes fuerunt, ingenium facile et copiosum, plurimum studii, multa rerum cognitio; in qua tamen aliquando ab his, quibus inquirienda quaedam mandabat, deceptus est.

---

99 Right after this quotation, Pliny tells us that these things Graeci τῆς ἔγκυκλιος παιδείας vocant (‘the Greeks call of the Circle of Education’)  
100 The remains of Livy’s Ab urbe condita are longer (some 530,000 words), but the work has not survived in full.
'He [Seneca] had many and great virtues: an easily available and copious talent, great zeal, much factual knowledge, in which, however, he was sometimes deceived by those he sent to get information.'

Pliny died (we might say) in the cause of science when he got too close to the erupting Vesuvius in AD 79. His work was very influential throughout the Middle Ages and into early modern times. Of course, the extremely long work also circulated in (often thematic) abbreviated versions and served as a quarry for later encyclopaedic writers such as Isidore, as did similar huge compendia that have not come down to us in full, for instance those by Varro or Celsus.

§11 The philosophical writer Lucius Apuleius (ca. 125–ca. 180) from Madaura in northern Africa did care about style, but nonetheless he was not afraid to coin new words. His style differs greatly from that of Cicero or other ‘classical’ writers. It is a great pity that his many works on scientific topics have not come down to us; they treated as diverse subjects as agriculture, trees, astronomy, and medicine. In his Apologia, he claims to have worked especially in biology: ex lectione et aemulatione Aristotelii (‘out of studying and wanting to emulate Aristotle’; 41, ed. Vallette, p. 50). Both his style and his intellectual depth differ so widely among his works that some have been taken to be spurious because they did not seem good enough, in particular his translation of the pseudo-Aristotelian De mundo. He also produced other translations from Greek, for example the De arithmetica of Nicomachos of Gerasa (the translation is lost). Some of these works may have contained reason to doubt Stahl’s disbelieve in the existence of Roman science, despite Beaujeu’s scepticism: ‘il nous apparaît bien plus comme un compilateur et vulgarisateur, habitué à faire sa pâture de connaissance prises chez les autres, que comme un chercheur et un inventeur’ (‘he appears to us much more as a compiler and populariser, accustomed to grazing on knowledge taken from others, than as a researcher and inventor’; edition, p. xi).

An example of Apuleius’ style may be quoted from De deo Socratis, which is basically a well-structured demonological treatise (14, ed. Beaujeu, p. 34):

Idcirco supersedebo inpraesentiarum in his rebus orationem occupare, quae si non apud omnis certam fidem, at certe penes cunctos notitiam promiscuam possident. Id potius praestiterit Lab-

101 See Maraglino (2012) on some aspects of its impact.  
102 Especially on medical topics; two such versions are Physica Plinii Bambergensis, ed. Önnerfors, and Plinii qui feruntur De medicina, ed. Önnerfors.  
103 The very few fragments are collected in Beaujeu’s edition. References and further details in von Albrecht (1992–1994: 2:1152).
tine dissertare, varias species daemonum philosophis perhiberi, quo liquidius et plenius de praeagio Socratis deque eius amico numine cognoscatis.

‘Therefore, I shall forebear to strain my discourse with these present things, which, although they may not enjoy certain belief by all, are at least of general knowledge. Rather, it would be better to study in Latin the various species of demons recognised among the [Greek] philosophers, by which you may understand more clearly and more fully the presentiments of Socrates and his demon friend.’

Apuleius’ style used to be characterised as tumor africanus until it was realised that this ‘bombast’ is not typically African.\(^{104}\) Other surviving examples of a similar style are Aulus Gellius, Fronto, Tertullian (chap. 9 §2), and Martianus Capella (chap. 9 §5). This post-classical tumor can be linked to similar un-Attic approaches in Greek at the same time. Typically for this, Apuleius uses a rich vocabulary: Bernhard (1927: 141) counted 233 words that are not recorded before him in the *Metamorphoses* alone. Most of them are formed by adding prefixes and/or suffixes – which will remain the usual way to extend Latin vocabulary, especially in scholastic times when stylistic reluctance is fully overcome – but there are also some true compounds, such as multiscius (‘knowing much’). Wellstein (1999: 41) found that the suffixes -tio, -tus, -tas, -bilis, -bundus, and -osus are especially frequent. Enriching the vocabulary does seem the way of choice in order to treat unfamiliar scientific topics, although stylistic bombast would tend not to seem very useful for scientific communication. As Apuleius used very different types of language in his various works, it is hard to say what kind of Latin he used in his lost scientific treatises.

It would be interesting to study the language of the second-century scientific literature in Latin besides Apuleius that is bound to have existed – in this time of the greatest extent of the Roman Empire and relative peace and prosperity. Unfortunately, not much is left, and close to no non-Christian Latin literature survives from the more turbulent third century either. At least some other learned authors are known: Censorinus (fl. 238), from whom a birthday present, *De die natali*, is preserved and a grammatical work, *De accentibus*, is known, or the agricultural writer Gargilius Martialis (d. 260), of whom some fragments survive. Another erudite author in these times was Sammonicus Serenus (d. 212), who is said to have possessed a library of 62,000 volumes; few fragments of his writings remain.\(^{105}\) The neo-Platonist antiquarian writer Cornelius Labeo may also have lived in the

\(^{104}\) First by Norden (1958: 2:596–597).
\(^{105}\) On these two authors, see Bardon (1952–1956: 2:260–263). The latter is not identical with the author of a didactic poem *De medicina* by another Quintus Sammonicus. Bardon also mentions (266) some more authors, mostly grammarians, who are known to have been active.
third century, the very few fragments are edited by Mastandrea. But these times were at least the heyday of classical Roman law.\textsuperscript{106}

\textbf{Classical Roman law}

\textbf{§12} The second and early third centuries AD, especially under Trajan and Hadrian, are the acme of the development of Roman law as it was to have lasting influence on the development of legal systems worldwide. Later times canonised five great jurists: Gaius (fl. 161), Iulius Paulus Prudentissimus (fl. ca. 210), Aemilius Papinianus (142–212), Gnaeus Domitius Annius Ulpianus (ca. 170–223), and Herennius Modestinus (fl. 240).\textsuperscript{107} In addition to these jurists, some others were at least as influential in their time, especially Salvius Iulianus (ca. 110–ca. 170). There were several legal schools, of which we know but little; in particular, the sources differentiate the Sabiniani (or Cassiani) and the Proculiani. There do not seem to have been great methodological differences, though. Masurius Sabinus' (first century AD) lost \textit{Libri tres iuris civilis}, apparently containing short, aphoristic rules, was much commented by adherents of the \textit{Sabiani}.\textsuperscript{108} The work’s form prompted its use as a point of departure for the elaboration of the commentator’s own thoughts – a very similar thing will happen with Peter the Lombard’s \textit{Liber sententiarum} in theology in the twelfth century.

A list of important juridical works survives in the so-called \textit{Index florentinus};\textsuperscript{109} it lists the works from which Justinian’s experts excerpted for the \textit{Digesta}. Of these, unfortunately, only Gaius’ introductory work \textit{Institutiones} survives in full, and this only by its fortunate conservation on a palimpsest (see fig. 12). It may be called a legal primer, written around AD 161. Although Gaius does not use the terms \textit{scientia, disciplina,} or \textit{ars}, even the opening of his work makes its pretensions as a scientific handbook clear (\textit{Institutiones} 1.1, ed. Manthe, p. 36):

\textit{Omnes populi, qui legibus et moribus reguntur, partim suo proprio, partim communi omnium hominum iure utuntur; nam quod quisque populus ipse sibi ius constituit, id ipsius proprium est}

\textsuperscript{106} ‘Le IIIe siècle ne paraît pas beaucoup mieux fourni en prosateurs qu’en poètes. Seuls, émergent d’émérents juristes’ (‘The third century does not seem to be much better supplied in prose writers than in poets. Only some eminent jurists appear’; Bardon 1952–1956: 2:259). Leonhardt’s (2013: 80) statement may be somewhat too strong: ‘As far as prose is concerned, only one genre was really alive between the second and the early third century: jurisprudence.’

\textsuperscript{107} Vol. 15 of ANRW dedicates a chapter each to our knowledge of these authors; for an overview of their background in society, see Kunkel (1967).

\textsuperscript{108} See Liebs (1976).

\textsuperscript{109} Schulz (1961: 170–173). Edition: \textit{Digesta Iustiniani Augusti}, ed. Krüger & Mommsen, vol. 1, pp. lii–lvi.
vocaturque ‘ius civile’, quasi ius proprium civitatis; quod vero naturalis ratio inter omnes homines constituit, id apud omnes populos peraeque custoditur vocaturque ‘ius gentium’, quasi quo iure omnes gentes utuntur. Populus itaque Romanus partim suo proprio, partim communi omnium hominum iure utitur; quae singula qualia sint, suis locis proponemus.

‘All people governed by laws and customs use partly their own law and partly that of all mankind. For whatever any people constituted as its law is its own and is called ius civile, as if the law of its own civilisation; but whatever natural reason constituted among all peoples, and what is kept by all people in the same way, is called ius gentium, as the law which all people use. Thus, the Roman people use partly their own law, partly law common to all people. Which is which will be told in its proper place.’

Fig. 12: Gaius, Institutiones survives only in a palimpsest (Verona, Biblioteca capitolare XV (13), fifth century, here: II.211–214). The upper (larger) writing is by Jerome. Source: Spagnolo (1909: 5).

The language used by Gaius is very clear, logical, and linear, although the text is a kind of hypomnemata for teaching and was not polished by the author. Manthe (edition, p. 13) concludes that his language is somewhat colloquial: there are some anacolutha, occasionally an ut with the infinitive, and such like. Söllner describes it as ‘sich durch Knappheit und den Verzicht auf ungebräuchliche und gefühlsbeladene Wörter auszeichnet’ (‘characterised by brevity and the renunciation of unusual and emotionally charged words’; 1996: 106).

110 See Schulz (1961: 193–197).
Modestinus, the last of the five great jurists, wrote both in Latin and in Greek. There is an interesting testimony from him about the difficulties of expressing Roman legal thought in Greek (in contrast to the frequent complaints the other way round). Modestinus wrote at the very beginning of his Liber excusationum (preserved in Justinian’s Digesta D 27.1.1, ed. Krüger & Mommsen):

Ἑρέννιος Μοδεστῖνος Ἐγνατίῳ Δέξτρῳ. συγγράψας σύγγραμμα, ὡς ἔμοι δοκεῖ, χρησιμώτατον, ὑπὲρ παραίτησιν ἐπιτροπῆς καὶ κουρατορίας ἀνώμασα, τούτῳ σοι πέτομα. Ποιήσομαι δὲ ὡς ἂν οἶός τε ὡ τήν περὶ τούτων διδασκαλίαν σαφῆ, ἀφηγούμενος τὰ νόμιμα τῇ τῶν Ἑλλήνων φωνῇ, εἰ καὶ οίδα δύσφραστα εἶναι αὐτὰ νομιζόμενα πρὸς τὰς τοιαύτας μεταβολάς.

‘Erennius Modestinus to Egnatius Dexter. I wrote a book that, as it seems to me, is very useful, which I named Refusal [excusatio] of Stewardship and Curatorship, and now send it to you. I shall make the teaching about these matters as clear as I am able to, explaining the legal matters in the Greek language, although I know that they are held to be hard to express in such an alteration [of language].’

Modestinus sometimes just transliterates technical vocabulary: κουράτωρ < curator, ὀρατίων < oratio (in the sense of ‘legislative proposal of the emperor’), λεγεωνάριος < legionarius, πριμιπιλάριος < primipilarius, ἰνκόλα111 < incola. But there are also cases where, apparently, an accepted Greek equivalent did exist, such as ἐπίτροπος = procurator. Occasionally, there are also new Greek coinings containing Latin parts, such as κουρατορεύω (‘serve as a curator’), συνβετερανός < conveteranus.112 This shows that there were also difficulties in translating Roman scientific texts into Greek in cases where the Roman form of the science was more advanced. Unfortunately, few such cases have survived – even Modestinus’ Greek is preserved only in fragments – but it would still appear that Greek had less trouble expressing Latin thought than vice versa (on which see chap. 10 §5 below).

Kaser (1965) studied the amount of technicality in classical legal Latin and found that some features of later technical legal Latin are not yet fully apparent: most clearly, abstract nouns seem to be avoided, the action being expressed verbally instead (138). Later on, deverbal nouns in -tio will become more frequent (adsignatio, occupatio, usurpatio, etc.). Thus, the use of nouns instead of verbs (gestio, not gerere) seems to have been preferred for fixing concepts, in a manner similar to what scholastic Latin was to do in philosophy and theology in the thirteenth century. In juridical terminology, technical terms may be abstracted from the common language, but they may also return to common language (99).

111 With unexpected accentuation.
112 All these words are preserved in the Digesta. Passages can easily be found in Corpus Corporum.
The technical terminology can be characterised by unambiguity, economy, perspicuity – the very characteristics expected in scientific language (chap. 7 §6). Rhetorical ornamentation, overly emotional terminology, and metaphors were shunned.\textsuperscript{113} The language of law, still today very much based on the Roman one, may be said to represent a typically Roman Denkstil of learning that differs conspicuously in some respects from the Greek scientific one.

When the Principate was changed into a more absolute monarchy (the Dominate) by Diocletian (AD 284), legal questions lost much of their interest as the emperor gained more power, including legal power. Later times mostly just compiled and epitomised earlier sources. How they do this can occasionally be glimpsed if both texts survive. Gaius, \textit{Institutiones} I.49, ed. Manthe, p. 54, reads:\textsuperscript{114}

\begin{quote}
\textit{Rursus earum personarum, quae alieno iuri subiectae sunt, aliae in potestate, aliae in manu, aliae in mancipio sunt.}
\end{quote}

\begin{quote}
‘Again of these people who are subject to another’s law, some are under someone’s power [i.e. of the \textit{pater familias}, such as house children and slaves], some are under legal control [i.e. wives married \textit{cum manu}], some are so by formal acceptance [i.e. gaining transitory power over e.g. other freemen’s children].’
\end{quote}

The fifth-century \textit{Epitome Gai} 1.3, pr., ed. Baviera, p. 235, simplifies radically to:

\begin{quote}
\textit{Aliquae personae sui iuris sunt, aliquae alieno iuri subiectae sunt.}
\end{quote}

\begin{quote}
‘Some people are \textit{sui iuris}, some are subject to someone else.’
\end{quote}

Clearly, the various legal categories had become obsolete. The five jurists became the sole authority in later times: Theodosius II (401–450) prescribed that only they could be cited in legal cases; in the case of disagreement, the majority was to prevail, or Papinianus’ view if there was a tie.\textsuperscript{115}

Among the types of literature the Roman jurists wrote, the following can be distinguished: (i) overviews and school material (surviving: Gaius, \textit{Institutiones}; and, in post-classical réécriture, \textit{Pauli sententiae},\textsuperscript{116} \textit{Ulpiani Regulae, Fragmenta Vaticana}); (ii) commentaries, already on the Twelve Tables (e.g. by Antistius Labeo, ca. 54 BC–ca. 10 AD) and later on works such as that of Sabinus, and probably most commonly the text of the Praetor’s Edict (\textit{edictum praetoris}), which was extended every year; and (iii) casuistic texts in a broad sense: \textit{libri responsionum},

\textsuperscript{113} Carcaterra (1968: 17); Schulz (1961: 331–334).
\textsuperscript{114} Example from Söllner (1996: 130).
\textsuperscript{115} Söllner (1996: 127).
\textsuperscript{116} See Schulz (1961: 213–217).
digesta, quaeestiones, and so on.\textsuperscript{117} Of course, these types may approach one another in some texts; commentaries, in particular, often contained casuistics too. In general, and quite contrary to the expectations we have from other sciences, introductory texts (i) used a more abstract approach; the more advanced a text, the less rule-based it seems to become.\textsuperscript{118} According to the distinctions drawn above (chap. 5 §1), (iii) would make up the most scientific part, where legal science was further developed. Unfortunately, these texts are all lost. The legal material the Romans produced in the times of classical Roman law must have been enormous, so extensive that in Late Antiquity Theodosius II and then Justinian decided to have it collected and abbreviated in order to put it to use again. What survives today comes from these collections; Justinian’s has been known as the \textit{Corpus iuris civilis} since the twelfth century.\textsuperscript{119} Much of the corpus goes back to the five great jurists. Justinian told his specialists, led by Tribonian (d. 542) (C 1.17.2.10, ed. Krüger & Mommsen):

\begin{quote}
\textit{Tanta autem a nobis antiquitati habita est reverentia, ut nomina prudentium taciturnitati trahere nullo patiamur modo, sed unusquisque eorum, qui auctor legis fuit, nostris Digestis inscriptus est; hoc tantummodo a nobis effecto, ut, si quid in legibus eorum vel supervacuum, vel imperfectum, vel minus idoneum visum esset, vel adiectionem vel deminutionem necessarium accipiat et rectissimis tradatur regulis.}
\end{quote}

‘We have such reverence for the ancient jurists that we will by no means allow the names of the sages to be passed over in silence, but each of those who was the author of a law will be named in our \textit{Digesta}. We only elaborate them so that if something in them seems to be superfluous or imperfect or less apt, the text will receive a necessary addition or cancellation and will be passed on in the form of the most correct rules.’

It is disputed among specialists how much alteration the texts suffered in the course of incorporation into the Justinian collection. On the whole, the changes will mostly have involved the shortening of passages no longer relevant, usually not as strongly as in the above example.\textsuperscript{120} As Latin was hardly used in Justinian’s Eastern Empire, he allowed the texts to be translated into and also to be used in Greek.\textsuperscript{121}

\begin{itemize}
\item \textsuperscript{117} Söllner (1996: 110–113). Schulz (1961: part 3, chap. 4) differentiates more finely between Formelsammlungen, isagogische Literatur, Regulae/Definitiones/Differentiae/Sententiae/Opiniones, Kommentare, Problematia, Instruktionsschriften für Magistrate, and Monographien. For more on the narrative approach in various legal genres, see Babusiaux (2016).
\item \textsuperscript{118} In classical times, ‘[a]bstracte, prinzipielle Formulierungen findet man hauptsächlich in elementaren Schriften’ (‘abstract, principle-based formulations are mainly found in elementary writings’; Schulz 1961: 153).
\item \textsuperscript{119} Schanz & Hosius (1922–1935: 4.1:187–189). Edition by Krüger & Mommsen. Its constituents are arranged by author in Lenel, \textit{Palingenesia}.
\item \textsuperscript{120} As Söllner (1996: 146) concludes.
\item \textsuperscript{121} Söllner (1996: 134).
\end{itemize}
The Justinian law was to re-emerge at the school of Bologna under Irnerius (twelfth century; see chap. 10 §1) in the West; in Byzantium it remained in force at least to some extent as long as the Empire lasted. Emperor Leo VI had a summary made around the year 892, called the Βασιλικά.

**Relations to criteria for science**

§13 It is time to sum up and review the authors and texts from this epoch and to consider whether their activities can be called scientific according to the criteria proposed above (chap. 4 §5). Varro in his *De lingua latina* strove to understand the Latin language using a systematic method (criterion I) in a coherent way (IV), and he certainly based himself on a Hellenistic community effort (V). He is somewhat lacking when it comes to presenting mechanisms (II) and testability (III), but both these criteria only became important in linguistics from the nineteenth century onward, when historical linguistics discovered the sound law; testability is still only occasionally found in linguistics today. How much of Varro’s erudition was his own addition to the Hellenistic literature he had devoured, is a matter of speculation, as practically nothing of either survives. Lucretius’ aims were not scientific; rather, he can be seen as an Epicurean missionary (and an excellent poet), not a scientist.122 Cicero was not too deeply interested in theoretical details of Greek learning – indeed, he admits to having failed in them – and more concerned with rhetoric and the shaping of the Latin language. In contrast to Varro, he did not write any encyclopaedic works. His attitude toward Greek natural science is negatively characterised by Stahl (1962: 79):

> Cicero’s line of argument draws uncomfortably close to the attitude of a facile lawyer who in handling accident cases has acquired from medical reference books so many bits of anatomical, physiological, and neurological information and has so often succeeded in confuting the professional testimony of doctors in court that he sincerely believes he ‘knows more medicine than the doctors’.

But his interest in politics may well be said to have been of a scientific nature, as has been argued for *De re publica*. His importance in the present context was certainly greater as an innovator in the Latin language than as a scientist proper.

In Fleck’s terminology (chap. 5 §1 above), Seneca’s *Quaestiones naturales* could be termed *Handbuchwissenschaft*, as it collects results from many Greek studies and argues for or against them. In some cases, he does seem to improve

122 Stahl (1962: 83) rightly puts this as: ‘his significance should be judged as a poet, not as a scientist.’
existing theories, especially in cometology. In other fields, such as lightning, which was quoted as an example, there was no way to get a better understanding without much of the knowledge of modern physics and chemistry. His approach was certainly systematic (I) and often explained step-by-step, even offered mechanisms (II); it was coherent (IV) and based on the Hellenistic community effort (V). The difference from today’s science may be that the latter is much more testable (III) and its theory formalised (VI). Quite in general, the main difference between Seneca and the argumentation of the early ‘pre-Socratics’, some of whom wrote similar works, is that more details were available in his time, the logic is sounder, and the theories became more realistic. Thus, Seneca’s work may count as quite scientific, even if not very independent.

Quintilian wrote a well-structured and methodological, ‘scientific’, introduction to rhetoric in Latin for the first time (as far as we know). He is very systematic (I) and coherent (IV). But rhetoric is a practical art, not a science proper: its aim is to produce good orators, not to explain things step-by-step (II). Quintilian was to become much read among Renaissance humanists. Although Pliny certainly had a scientific inquisitiveness, his encyclopaedic work can at best be seen as a handbook, and moreover one with little critical awareness. Matters may have been different with Apuleius, but unfortunately, those of his works that may have been most scientific in nature are lost. His atypically open approach to coining new words was to become important. In general, we may wonder how much more scientific material has been lost to us: two important works discussed here are only extant on a single palimpsest each.

Up to now, everything mentioned clearly involves the taking over of a Greek scientific Denkstil, which sometimes worked well, sometimes less so. However, the best candidate for a genuine Roman science in this epoch is classical jurisprudence, although again its central importance for the Romans was that of an art, and therefore its applicability, not its theoretical system, stood in the centre. Thus, the explanatory and theoretical criterion (II) is not met. But this body of knowledge was certainly systematic (I), impartial (III), coherent (IV), and the fruit of a community effort (V), and its language was formalised (VI). Its language and its text genres are reminiscent of much later scholasticism at the thirteenth-century universities: unambiguity, economy, perspicuity were sought; rhetorical ornament, overly emotional terminology, and metaphors were shunned. New nouns were formed using suffixes. Important genres include quaestiones and commentaries on systematic works. As the preservation of legal sources from the Principate is so bad, it is difficult to get a precise picture of any more theoretical approaches that might well have existed.