

AVICENNA'S THEORY OF PRIMARY MIXTURE

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Abstract: Ancient Peripatetics and Neoplatonists had great difficulty coming up with a consistent, interpretatively reasonable, and empirically adequate Aristotelian theory of complete mixture or complexion. I explain some of the main problems, with special attention to authors with whom Avicenna was familiar. I then show how Avicenna used a new doctrine of the occultness of substantial form (whose roots are found in Alfarabi) to address these problems. The result was in some respects an improvement, but it also gave rise to a new set of problems, which were later to prove fateful in the history of early modern philosophy.

Résumé: Les anciens Péripatéticiens et les Néoplatoniciens ont éprouvé de grandes difficultés à mettre sur pied une théorie aristotélicienne du mélange total, ou de la complexion, qui soit à la fois consistante, herméneutiquement raisonnable et empiriquement adéquate. J'explique quelques-uns des problèmes principaux, en accordant une attention spéciale aux auteurs familiers d'Avicenne. Je montre ensuite comment Avicenne utilise une nouvelle doctrine du caractère occulte de la forme substantielle (dont les racines sont à rechercher chez Alfarabi), pour traiter ces questions. Le résultat atteint représentait, sous certains aspects, un progrès, mais il donnait aussi naissance à une nouvelle série de difficultés, qui scelleront son destin dans l'histoire de la première philosophie moderne.

Avicenna's views on mixture have attracted a certain amount of attention, both in the Middle Ages and more recently, for several reasons. First, the nature of mixture is a fundamental issue in Aristotelian / Neoplatonic physics, as well as in Galenic medicine: according to both of those closely related traditions, most if not all bodies in the universe are mixtures of different ingredients – ultimately, of the elements. Second, as had become evident already in antiquity, the issue is not only fundamental but very difficult. The later ancient accounts all have significant problems, whether conceptual, empirical, interpretative or (most commonly) all three at once. Third, Avicenna's approach to the problem, whatever exactly the details of it, is clearly quite different from those of his

predecessors or successors. Hence in catalogs of views on mixture, Avicenna tends to appear as a singleton.¹

I would also like to add a fourth reason for interest, which has been less appreciated: namely, that Avicenna's innovation in this area depends upon his radical moves in others, especially on the relationship between substantial form and sensible quality. In particular, Avicenna seems to have been the first to maintain clearly that no sensible characteristic is ever essential to a substance – *i.e.*, that the true differentiae of substances are always occult. Since this latter view was vastly influential on later thought, we should welcome any light that can be thrown on Avicenna's understanding of it, and on his motivation for adopting it. I will suggest that problems about mixture played a major role.²

In general, mixtures can be divided into two types: primary mixtures, in which the ingredients are simple (elemental) bodies, and secondary mixtures, in which the ingredients themselves are composite. I will focus on primary mixture here; I hope to take up Avicenna's views on secondary mixture (and higher levels of composition in general) on another occasion.

I. TERMINOLOGICAL PRELIMINARIES

At least two Greek words are naturally translated as “mixture”: μίξις (or μεῖξις), from the verb μίγνῶναι, and κρᾶσις, from κεραινῶναι. The Arabic translators associated these two verbs, respectively, with the roots *kh-l-ṭ* and *m-z-j*. Hence μίξις, with rare exceptions, is translated by a term such as *khalīṭ* or *ikhtilāṭ*, κρᾶσις by *mizāj* or

¹ See A. Maier, “Die Struktur der materiellen Substanz,” in *An der Grenze von Scholastik und Naturwissenschaft* (Rome, 1952); F.A.J. de Haas, “Mixture in Philoponus: An encounter with a third kind of potentiality,” in J.M.M.H. Thijssen and H.A.G. Braakhuis (eds.), *The Commentary Tradition on Aristotle's De generatione et corruptione: Ancient, Medieval and Early Modern* (Turnhout, 1999), pp. 21–46; and the earlier sources cited by each.

Below I will cite Plato's and Aristotle's works, using standard abbreviations, from the Oxford Classical Texts editions, except *De generatione et corruptione*, ed. Harold H. Joachim (Oxford, 1922). Page citations from Galen's works are given in the form *xK / y / z*, where *x* is the page number in the appropriate volume of *Claudii Galeni Opera omnia*, ed. D.C.G. Kühn (Leipzig, 1821–33), *y* is the page and line numbers in the Greek edition I have used, and *z* is the page and line numbers in the Arabic version I have used, if any. Abbreviations and details of the editions used will be given at the first citation of a given work.

CAG abbreviates *Commentaria in Aristotelem Graeca*.

Avicenna's *Shifā'* is cited as follows. *Sh. M.* = *al-Shifā': al-Manṭiq*, *Sh. Ṭ.* = *al-Shifā': al-Ṭabṭ'iyyāt*, *Sh. Il.* = *al-Shifā': al-Ilāhiyyāt*, all ed. Ibrahim Madkour *et al.* (Cairo, 1950–). In the case of the *Ṭabṭ'iyyāt* and the *Manṭiq*, I cite the part (*fān*) by a short version of its name, e.g. *Simā'* = *al-Simā' al-ṭabṭ'ī*, *Samā'* = *al-Samā' wa-al-'ālam*.

² The only other author I am aware of who emphasizes this connection is H. Eichner, in the exhaustive “introductory study” to her edition of Averroes' *Middle Commentary on the GC* (*Averroes' Mittlerer Kommentar zu Aristoteles' De generatione et corruptione* [Paderborn, 2005]), pp. 162–87. (Below I cite this work as “Einleitende Studie,” as opposed to the actual text of Averroes' commentary, which is separately paginated, and which I cite as *M.C. in GC*.)

imtizāj, and so forth. Latin translation traditions are less clear: although forms of *μῖγνύναι* / *kh-l-t* correspond fairly reliably to forms of *miscere* (or *commiscere*, etc.), the translation of *κεραυνύναι* / *m-z-j* is much less stable. When a distinct term is used at all, it is perhaps most often *complectere*, but others – especially *temperare* and *confundere* – are also common. Here I will reserve “mixture,” and forms of the verb “to mix,” for forms of *μῖγνύναι* / *kh-l-t*, and translate forms of *κεραυνύναι* / *m-z-j* using ugly, but unambiguous, quasi-neologisms such as “complexion” and “complect.”³

As for the meaning of these terms: in *GC* 1.10, Aristotle contrasts “composition” (σύνθεσις = *tarkīb*), in which, small, possibly invisible, pieces of the ingredients remain in their original state, with “mixture,” in which the small pieces, having first been composed (or “apposed,” *παρατιθέμενα*), are altered and unified by mutual action and passion, such that the result is homoeomerous: every part is of the same kind as the whole.⁴ Although *μίξις* is the main term used in this discussion, *κρᾶσις* and related terms are used several times, apparently as equivalent to *μίξις*: see especially 328a8–9, 12. In two other passages, however, these terms are related differently: at *Top.* 4.2.122b25–31, “mixture” is the genus of which “complexion” is a species – namely, to all appearances, the very species which is called both “mixture” and “complexion” in *GC* 1.10; similarly, at *De sensu* 3.440a31–b17, mixture is divided into two species: one in which the smallest parts of the ingredients are merely “apposed,” and another in which they are “totally” (ὅλως πάντη πάντως) mixed.⁵ Later Greek authors derived their standard terminology from the latter two passages: namely, “mixture” as the genus, with “complexion” and “apposition” as its species.⁶ The definition of “complexion,”

³ “Temper” would actually be preferable, since *complectere* properly translates *συμπλέκειν* (and *confundere συγγεῖν*). But it is not really a usable English translation.

⁴ *GC* 1.10.328a5–15, b14–22. For *παρατιθέμενα* see 328a33. It is difficult to determine an Arabic equivalent to this term, but it appears that *τεθῆ παρ’ ἄλληλα* at *GC* 1.10.327b34 was translated as *yaqa’ ba’duhā ilā jānib ba’d* (see *M.C. in GC*, c. 85 [ad 327b31–28a5], 70,17–18, and see the Arabo-Hebrew translation, *La Traduzione arabo-ebraica del De generatione et corruptione di Aristotele*, ed. A. Tessier [Rome, 1984]: *yasumu qezatam ‘al zad qezatam*).

⁵ Unfortunately the Arabic version of the *De sensu*, like that of *GC* 1.10, does not survive.

⁶ See Alexander, *De mixtione* 13.228,27–36 (cited from R.B. Todd, *Alexander of Aphrodisias on Stoic Physics: A Study of the De mixtione with Preliminary Essays, Text, Translation and Commentary* [Leiden, 1976]) and Philoponus, *In GC* (CAG 14.2, ed. M. Hayduck [1901]), 1.2, 22,23–7, 1.9, 187,22–5, and see also Plotinus, *Enn.* 2.7.1.4–8 (cited from *Plotini Opera*, ed. Paul Henry and Hans-Rudolf Schwyzer, 3 vols., Oxford Classical Texts [1964–83]) and Galen, *De temperamentis libri iii*, ed. G. Helmreich (Stuttgart, 1969), 1.9.562–3K / 34,5–16 and 564K / 35,1–2. The *De mixtione* was apparently unknown in Arabic, although Alexander may well have said something similar in his *GC* commentary, the surviving fragment of which is, in fact, preserved only in Arabic (see the English translation, *Alexander of Aphrodisias: On Aristotle On Coming-to-Be and Perishing* 2.2–5, tr. Emma Gannagé [London, 2005]). Philoponus *In GC* was available, although no Arabic version is extant; Avicenna mentions it by title in his correspondence with al-Bīrūnī and clearly implies that he has read it. See *Al-As’ila wa-al-ajwiba*, ed. S.H. Naṣr and M. Moḥaqqueq (Tehran, 1974), 13,7–9, and see the discussion in D. Gutas, *Avicenna and the*

however, tends to be based on *GC* 1.10 – *i.e.*, on what Aristotle gives there as the definition of “mixture.”⁷

Avicenna’s terminology is based on this later ancient usage – in fact, he explicitly declares his preference for it, while mentioning the other possibility.⁸ More importantly for present purposes, he holds that *primary* composition always results in a homoeomer, or in other words is always complexion, always *mizāj*.⁹ And the problems he faces are continuous with those which bothered his Greek predecessors with respect to κρᾶσις.

II. THE ANCIENT PROBLEMS OF COMPLEXION

It is important to realize that there was not just one such problem, but rather a whole nest of interrelated ones. All had to do with the relationship between: (1) the bodies or substances of the elements; (2) the primary qualities (hot, cold, moist, and dry); (3) the unified, homoeomerous body of the complex; and (4) the properties of the complex (which, in addition to qualities of medium heat / coldness and medium moisture / dryness, might include secondary sensible qualities, such as colors or odors, as well as faculties such as magnetism or dormitivity¹⁰). This multi-way relationship was multiply problematic.

First, there is the distinction between (1) and (2) – if, indeed, there is any such distinction to be made. This issue particularly exercises Galen, because Hippocratic texts sometimes speak of bodies as complexions of “powers” (δυνάμεις) – among which are the primary qualities – without mentioning any species of body in which they inhere,¹¹ and this was taken literally by some of Galen’s opponents.¹² For Aristotle, however, the elements are fire, air, water, and earth,

Aristotelian Tradition: Introduction to Reading Avicenna’s Philosophical Works (Leiden, 1988), pp. 289–90. (I do not understand Eichner’s skepticism about this, “Einleitende Studie,” pp. 184–5.)

⁷ See *GC* 1.10.328b22 and cf. Alexander, *De mixt.* 14.231,10–12; Galen, *De el.* 9.490–91K / 138,1–14 / 115,5–116,2.

⁸ See *Sh. T.*, *Kawn / fasād*, 6, 126,18–127,3, and see Eichner, “Einleitende Studie,” pp. 163–4, who reaches a similar conclusion. At 127,11, corresponding to *GC* 1.10.327b24, Avicenna actually “corrects” Aristotle’s τὰ μιχθέντα (which, as is clear from Averroes, *M.C. in GC* c. 84 [70,2], was translated in the standard way as *al-mukhtalaṭayn*) to *al-mumtazajāt* – unless, indeed, this is a sign that Avicenna used a different translation.

⁹ *Sh. T.*, *Af’āl / infi’ālāt*, 2.2, 266,4–6.

¹⁰ The dormitivity of opium, later made famous by Molière, is discussed by Galen at *De temp.* 1.7.585–6K / 48,20–49,16. Magnetism (and electricity) are discussed at *De el.* 14.507–8K / 156,10–11 / 138,7 and *De nat. fac.* (in *Scripta minora*, vol. 3, ed. G. Helmreich [Leipzig, 1893]), 2.3.85K / 162,18–20, 2.7.106K / 178,5–7. Both of these examples are important for Avicenna, and we will return to them below.

¹¹ See e.g. *De prisc. med.* (*De l’ancienne médecine*, ed. J. Jouanna [Paris, 1990]), 4.137,6–8, 9.144,5–7, and see the discussion in *Hippocrates: On Ancient Medicine*, ed. M.J. Schiefky [Leiden, 2005], pp. 252–4, 275, 288.

¹² Athenaeus of Attalia and his followers: see *De el.* 6, and see De Lacey’s discussion, pp. 185–7.

which he describes as species of body and of substance, while hot, cold, moist and dry are species of quality,¹³ which as such can never be found without substance.¹⁴ Thus, Galen assures us that the Hippocratic way of speaking merely involves naming the elements by the qualities which they *have* in the extreme; there cannot, strictly speaking, ever be qualities without underlying bodies.¹⁵

Given the distinctness of (1) and (2), however, there arises a difficult problem about the relationship between them. There must be some relationship, since Aristotle derives the number of elements from the permissible combinations of the primary qualities.¹⁶ Alexander gives what seems to be the standard Peripatetic understanding of this: an element – for example, fire – consists of extreme primary qualities – in this case, heat and dryness – in matter. Extreme heat and dryness are the differentiae of fire, and hence its essence (τὸ εἶναι τῷ πυρὶ πυρὶ), but its being includes also the matter.¹⁷ For Galen, similarly, the ultimate elements are composed of matter and qualities;¹⁸ when extreme heat comes into matter, then “that body will have become an element.”¹⁹ But, although this agrees well with Aristotle’s statements about the elements in particular, and also with his general statements to the effect that corporeal substances are differentiated by sensible qualities,²⁰ it nevertheless runs into two serious difficulties. First, it makes sensible substances into mere collections of accidents in matter, contradicting both (what was taken as) Aristotle’s definition of accident (that it is in its subject *not as a part*²¹) and his doctrine of the priority of substance – in particular, that a substance cannot be made up out of accidents.²² Second, if the being of, e.g., fire, consists of extreme heat, extreme dryness and matter, then what accounts for fire’s corporeity, *i.e.* for its being essentially a species of body?²³ In response to the

¹³ See e.g. *Metaph.* 3.5.1001b32–2a2, 7.2.1028b8–11, 5.14.1020b8–12; *Cat.* 8.9a28–31; *GC* 1.3.319a15–17. At *GC* 2.3.330a 30–b3, Aristotle refers to the primary qualities as “elements,” but nevertheless makes a clear distinction between them and the bodies of fire, air, water and earth. A.L. Peck, in his introduction to the Loeb edition of *PA* ([1983], pp. 30–31), suggests that Aristotle uses δύναντις to refer to the elements at 2.1.646a15 (an interpretation echoed by De Lacey in the introduction to *De el.*, p. 187). For alternative understandings of this passage, see below, pp. 105 and 112.

¹⁴ See *Cat.* 5.2b3–6; *GC* 1.5.320b24–5; 1.10.327b20–22. And see, following this, Galen, *De el.* 6.474K / 120,7–8 / 94,3; 9.479K / 124,19–22 / 100,4–5, and Alexander, *De mixt.* 13.228,13–16.

¹⁵ *De temp.* 1.6.542K / 21,18–19; 1.7.552K / 27,17–22; *De el.* 6.457K / 102,1–7 / 70,13–71,4; see also *De el.* 7.476–7K / 122,4–14 / 96,6–97,2.

¹⁶ See again *GC* 2.3.330a30–b7.

¹⁷ *De mixt.* 13.229,30–230,5 (and see *GC* 2.1.329a10–13, 24–35; *Ph.* 1.6.189a32–b1).

¹⁸ *De el.* 8.480K / 126,8–9 / 101,10.

¹⁹ *De el.* 9.481–2K / 128,6–7 / 104,3–4; see also, similarly, 6.469–70K / 114,16–20 / 86,4–6.

²⁰ *Cael.* 3.4.302b30–3a3; *GC* 1.1.314b17–20, 1.3.318b16–18.

²¹ *Cat.* 2.1a24–5.

²² *Ph.* 1.6.189a33–4. See also *Metaph.* 7.1.1028a31–3; *Top.* 6.6.144a23–7.

²³ In all fairness, Alexander and Galen may, like the Stoics before them and like Philoponus later on, not make a distinction between matter and (qualitiless) body (see *GC* 1.5.320b14–17).

first problem, later Neoplatonic commentators accepted one version or another of Porphyry's theory of "substantial quality" – *i.e.* that heat in fire, for example, though indeed a quality, is not an accident, precisely because it is essential to and "completive" of a substance.²⁴ Responses to the second problem were far more complicated, in part because Aristotle in some places defines body as a species of quantity,²⁵ and in part because of Plato's view of the elements as composed of triangles – a view which he defends by appeal to the fact that they are species of body,²⁶ and which Aristotle attacks.²⁷ There is no room to go into the details here.²⁸ Important for our purposes is only that, in some way or other, although the elements are differentiated by extreme primary qualities, their being or substance as a whole involves, in addition to these qualities and matter, also corporeity, hence bulk and three-dimensional extension.

It is in this context that we should understand the dispute between the Stoics and the Peripatetics over the relationship between (1) and (3) above. As both Galen and Alexander report it, the Stoics maintain that complexion is according to the entire substance of the ingredients, which, given that complexion is by definition complete and total mixture, means that, in this case, different bodies are completely extended through one another. But Aristotle says that bodies cannot extend through each other,²⁹ and so the Peripatetics hold, in contrast, that complete and total mixture is of qualities only, not of substances, *i.e.* bodies.³⁰ This Peripatetic doctrine (with which Galen also agrees) is then to be understood as follows. The primary qualities not only differentiate the elements; they also are or confer the power to change the qualities of another substance in such a way

²⁴ For extensive discussion of the background and variants of this view, see F.A.J. de Haas, *John Philoponus' New Definition of Prime Matter: Aspects of its Background in Neoplatonism and the Ancient Commentary Tradition* (Leiden, 1997), pp. 180–250, although I do not agree with everything he says there. See also my own brief discussion, "Simplicius and Avicenna on the essential corporeity of material substance," in R. Wisnovsky (ed.), *Aspects of Avicenna* (Princeton, 2001), pp. 87–8.

²⁵ *Cat.* 6.4b24; *Cael.* 1.1.268a6–8; *Metaph.* 5.6.1016b27–8.

²⁶ *Tim.* 53c4–d6.

²⁷ *Cael.* 3.1, 4.2.

²⁸ For some discussion, see de Haas, *New Definition*, ch. 2, and again my "Simplicius and Avicenna." However, I must correct one claim which I make there (91), namely that Simplicius never speaks of qualitless body as "second matter" or "second subject." He does, in fact, say the latter – not in the passages from the *Physics* and *Categories* commentaries on which I based myself there, but elsewhere, in his *De Caelo* commentary (CAG 7, ed. I.L. Heiberg [1894], 3.1, 565,2–3; 3.2, 599,4–5). I must now admit that I find this point of Simplicius' view obscure.

²⁹ *GC* 1.5.321a 8–9, b15–16.

³⁰ See Galen *De el.* 9.489K/136,15–18/113,14–114,3: the disagreement is how δι' ὅλων κεράννυται τὰ κεραννόμενα κράσις δι' ὅλων = *tamtazaj al-ashyā' allatī tamtazaj*: whether τῶν ποιοτήτων μονῶν [sc. δι' ἀλλήλων ἰουσῶν] = *bi-'amal kayfiyātihā faqaṭ ba'ḍ fī ba'ḍ*, or τῶν σωματικῶν οὐσίῶν δι' ἀλλήλων ἰουσῶν = *bi-tatafarrad jawāhiruhā ba'ḍ fī ba'ḍ, wa-mudākhila ba'ḍ li-ba'ḍ*. (Note that Ḥunayn and I disagree slightly with De Lacey's translation of the Greek here.) See also *De nat. fac.* 1.2.5K/104,11–15, and see *Enn.* 2.7, where Plotinus deals with the same controversy, though without naming the disputants.

as to change its species. It follows that when bodies of different elements are apposed, there will be a mutual interaction by which one or both may be changed in species. When the qualities of one body overpower those of the other, the weaker is assimilated in quality to the stronger,³¹ and this results in *augmentation* (growth in magnitude) of the stronger body (16.238,17–20). The growing body can be said to grow “everywhere” (πάντως) (236,26–7), even though bodies cannot flow through each other, so that corporeal substance is added to only one place, from the outside (where the weaker body once was), because what counts as growing is the (increasing) portion of matter in which its *form* – *i.e.*, its complement of primary qualities – is present (235,34–236,14).³² If, on the other hand, the qualities, *i.e.* δυνάμεις, of the two bodies are evenly matched, then they mutually suffer a change in quality, to the point where both take on a new, medium quality, and the result is complexion. Here, again, the complexion happens “everywhere” – meaning that the form, *i.e.* quality, of the new homoeomer is everywhere the same, even though the original corporeal substances are not literally extended throughout the same space.³³

This relatively straightforward view also provides straightforward interpretations of some key Aristotelian texts. The discussion in *GC* 1.10 can, after substituting “complexion” for Aristotle’s term “mixture,” be read literally: the ingredients must be capable of mutual action and passion (328a17–23); where one ingredient predominates we get augmentation rather than “mixture,” *i.e.*, complexion (ll. 23–8); when the δυνάμεις of the two are equal, “each changes to the conquering [complex quality] from its own nature, and does not become the other, but rather [something] intermediate and common” (ll. 28–31); “mixture,” *i.e.* complexion, is “the unification of the ingredients via their alteration” (328b22). Furthermore, Aristotle’s statement that the ingredients in the “mixture” (*i.e.*, complex) “neither remain ἐνεργεία . . . nor are either one or both corrupted: for their δυνάμεις is preserved” (327b 29–31) can now be understood to mean that, while the elements are not actually present throughout the mixture, their δυνάμεις, *i.e.* qualities, remain. Finally, the passage at *PA* 2.1.646a 12–15, where Aristotle says, “one might posit that primary [composition] is out of those [things] which are called by some ‘elements,’ such as earth, air, water, and fire,” and then adds: “but it would be better perhaps to say: out of δυνάμεων,” can be understood to mean that it is, strictly speaking, elemental δυνάμεις,

³¹ Alexander, *De mixt.* 13.230,7–13.

³² All this is based on Aristotle, *GC* 1.5.321b10–322a4. Galen’s view appears to be similar: see *De nat. fac.* 1.7, 1.11, 2.3.

³³ See Alexander *De mixt.* 14.230,30–34; 15.231,15–16; and see again Galen, *De el.* 9.490K / 138,1–14 / 115,5–116,10 and Philoponus, *In GC* 1.2, 22,23–5.

i.e. qualities, that are mixed in the complex, rather than the bodies of the elements themselves.

This Peripatetic view, however, has two big disadvantages. The first concerns the sense in which the elements remain and are preserved in the complex. A superficial reading of the slogan, that the qualities are mixed while the bodies or substances are not, might be that small particles of water, fire, etc. remain in place, while their qualities spread out and combine. If the ingredients are later separated out, each particle would take back its own qualities.³⁴ But, of course, this cannot be correct, if it is the sensible qualities themselves that, when added to matter, make a given body into water or fire. A true homoeomer is not a mere apposition of small parts which *appears* homoeomerous (to those of us who don't have the eyes of Lynceus); if its body has really been "unified," no particles of the elements can remain.³⁵ As Alexander explains, it is not numerically the same water which goes into the complex that emerges from it upon separation; rather, separation involves each ingredient coming out of every part of the complex.³⁶ But how, then, can the Peripatetics understand the relationship between (1) and (3): how is a complex a type of mixture, of which the elements are parts, rather than a new substance which has come into being with the perishing of its "ingredients"? Yet Aristotle defines the elements as bodies which "cannot be divided into [parts] which differ in form,"³⁷ implying that composites can be, and he also insists that mixture (*i.e.*, complexion) is *not* the same as generation and corruption.³⁸

Alexander clearly worries about this problem,³⁹ but it becomes much worse given the Porphyrean scruples about the categories mentioned above. If substance is strictly prior to accidents, then we must carefully distinguish ordinary change in quality (alteration) from change in *substantial* quality (generation and corruption).⁴⁰

³⁴ For example, one might get that impression from Galen's description of a substance like blood or milk: it is not strictly one (ἐν ἄκριβῶς = *wāḥīdan bi-al-ḥaqīqa*), but composed out of different and opposite parts; while they are complexed, they make it medium (μέσον = *mutawassat*) in quality, but, once separated out (διακριθέντα = *idhā tamayyazā*) each shows its own idea or nature (ἰδέα = *tabr'a*) (*De el.* 11.495–6K / 142,17–23 / 121,4–122,3).

³⁵ For the eyes of Lynceus, see *GC* 1.10.328a13–15.

³⁶ *De mixt.* 15.231,24–9. The last part is based on Aristotle's own argument at *GC* 2.7.334a31–5 (on which see further below, p. 111).

³⁷ Aristotle, *Cael.* 3.3.302a15–18, and see Galen's definitions: "the first and simplest / separate [ἀπλοῦστατα = *mufrada*] by nature, which can't be analyzed / partitioned [διαλυθῆναι = *tutajazza*] into anything else" (*De el.* 1.414–15K / 58,2–3 / 12,8–9); "the smallest, first, and simplest parts" (8.480K / 126,11–12 / 102,1–2).

³⁸ *GC* 1.2.317a23–7.

³⁹ He tries to explain, I think rather unconvincingly, why the separation of the ingredients doesn't, on his view, involve παντελής γένεσις καὶ μεταβολή (*De mixt.* 15.231,17–22).

⁴⁰ "Alteration" strictly speaking refers to the former: "motion in quality . . . not the quality which is in the substance [ἐν τῇ οὐσίᾳ = *fī al-jawhar*] (for the differentia is also a quality), but the affective [quality] [τὸ παθητικόν = *al-infi'āl*]" (*Ph.* 5.2.226a26–9). See also

But the change in quality which is supposed to occur in complexion cannot be either: not the latter because, as we have just seen, complexion must be distinguished from generation and corruption; not the former because a mere alteration could never change the *primary* qualities. Substances in general can receive the contraries of qualities they have received, but not the contraries of qualities in which they “substantiate” – as fire, for example “substantiates in” heat.⁴¹ Or as Philoponus puts it: it could not receive a lesser degree of heat and still remain fire, because fire as such (τὸ πῦρ ἢ πῦρ) is the extremely hot.⁴² This difficulty is reflected in Alexander’s terminology: whereas Galen consistently uses “alteration” for the change involved – or, more precisely, καθ’ ὅλην τὴν οὐσίαν ἀλλοίωσις⁴³ – Alexander uses simply “change” (μεταβολή).⁴⁴ Among the later Neoplatonists, it gave rise to intricate arguments as to whether and how the (substantial) forms and / or qualities of the elements remain in the complex.⁴⁵

So much for the first disadvantage mentioned above. The second is less flashy, but perhaps more serious, because it concerns the empirical adequacy of the whole theory. It has to do with the relationship between (3) and (4). The problem is that composite substances are not generally well-characterized simply by their position on a two-dimensional field defined by the hot-cold and dry-moist axes. On the contrary: every composite has secondary sensible qualities, such as color and odor, and not all such qualities seem to be accidental.⁴⁶ Moreover, some if not all composite substances have other, non-sensible δυνάμεις. Galen is most sensitive to this worry, and it is easy to see why from the two examples mentioned above: the dormitivity of opium and the attractivity of magnets. As a physician he was, of course, very interested in the faculties of drugs, and attraction is crucial to his anatomical theories: he argues

GC 1.5.320a12–14; *Cat.* 14.15a13–33. Despite what de Haas says (*New Definition*, 138), GC 1.2.317a22–7 seems to be about the same issue. Cf. Philoponus, *In GC* 1.2, 42,12–17; and see also 2.4, 231,28–232,6, and Gannagé, *Alexander on GC* 2.2–5, 63.

⁴¹ Porphyry *In Cat.* (CAG 4.1, ed. A. Busse [1887]), 99,6–10; cf., similarly, *Isagoge* (also in CAG 4.1) 9,16–18 / *Isāghūjī, li-Furfurīyūs al-šūrī, naql Abī Uthmān al-Dimashqī*, ed. Ahmed Fouad al-Ahwani (Cairo, 1952), 78; Simplicius, *In Cat.* (CAG 8, ed. C. Kalbfleisch [1907]), 5, 98,13–19.

⁴² *In GC* 2.7, 271,32.

⁴³ *De nat. fac.* 1.2.4K / 103,20–21.

⁴⁴ See, e.g., *De mixt.* 14.231,11, where διὰ μεταβολῆς corresponds to Aristotle’s ἀλλοιωθέντων (GC 1.10.328b22).

⁴⁵ See especially Simplicius *In Cael.* 3.3, 601–2; 3.7, 659–61; Philoponus *In GC* 2.7; and see de Haas, “Mixture in Philoponus,” for further sources.

⁴⁶ Philoponus lists the sweetness of honey and the whiteness of white lead and snow as substantial qualities (see *De aeternitate mundi contra Proclum* [Leipzig, 1899] 11.5.424,24–5; for snow and white lead see Aristotle, *EN* 1.4.1096b23 and Plotinus, *Enn.* 2.6.1.20–22, 31–33). De Haas, *New Definition*, pp. 167 n. 10, 231, claims that “strictly speaking” these are only inseparable accidents. But although Simplicius apparently agrees (see *In Cat.* 5, 98,16–17), I see no sign that Philoponus does.

vigorously that bodily organs have their own proper attractive, repulsive, assimilative, and retentive faculties, against those (such as Asclepiades and Erasistratus) who explained such phenomena mechanically.⁴⁷ Galen even says (perhaps exaggerating) that *every being* has an attractive δύναμις by which it attracts what is appropriate to it,⁴⁸ and applies this to the organs of the body, as well as (following Hippocratic texts) the nutrition of plants and the action of drugs.⁴⁹ The magnet (ἡ Ἡράκλεια λίθος = *al-hajar al-maghnaṭīs*) is mentioned as an obvious example of such an attractive faculty.⁵⁰

But how can any of this be explained in terms of the primary qualities or any medium between them? It will not be easy.⁵¹ And yet Galen, and anyone else who follows the above Peripatetic view, seems committed to the claim that the medium quality *is* the (substantial) form of a homoeomerous complex.⁵² And ought we not to understand, if we know what the form of some substance is, why certain qualities or faculties are consequent to that?⁵³ Thus we have the seed that will eventually flower into the problem of occult qualities or faculties – faculties which cannot be explained by the known essential characteristics, or primary qualities, of bodies (and note that the most infamous examples, dormitivity and attraction,

⁴⁷ The entire *De nat. fac.* is devoted to this argument. For the attractive (ἐλκτική) and repulsive (or “propulsive”: προωστική) faculties, see *De nat. fac.* 3.6.160K / 216,22–4, and see Avicenna, *al-Qānūn fī al-ṭibb*, ed. Sa’īd al-Laḥḥam (Beirut, 1994), 1.1.6.1.3, p. 133. For the mechanism of Galen’s opponents – their view that biological processes are “steered only by material impulses” – see *De nat. fac.* 2.3.80K / 159,11–12.

⁴⁸ *De el.* 14.507K / 156,10 / 138,6–7; *De nat. fac.* 1.14.55K / 141,5–8. See also *De nat. fac.* 1.15.60K / 145,3–6.

⁴⁹ *De nat. fac.* 1.12.29–30K / 122,9–12, 1.14.53K / 139,26–140,4; *De el.* 14.507K / 156,1–6 / 137,10–138,1, citing Hippocrates, *De nat. hom.* 6.3 (*La nature de l’homme*, ed. Jacques Jouanna [Berlin, 2002], 180,10–15 / *Kitāb Buqrāt fī ṭabī‘at al-insān*, ed. J.N. Mattock and M.C. Lyons [Cambridge, 1968], 9,13–15).

⁵⁰ *De el.* 14.507–8K / 156,10–11 / 138,7; *De nat. fac.* 1.14.44–5K / 133,16–20. Although Avicenna does not, to my knowledge, anywhere repeat Galen’s wide claim about there being an attractive faculty in every being (ἐκάστῳ τῶν ὄντων = *fī kull wāḥid min al-ashyā’ al-mawjūda*), he does echo all the particular points about plants, organs, drugs, and magnets: for plants and organs, see *Sh. Ṭ.*, *Nabāt*, 1, 3,5–7; for drugs and magnets, see further below.

⁵¹ See *De temp.* 1.7.586K / 49,4–6, against those who take it for granted that the dormitivity of opium is explained by the moisture and cold of its complexion: this kind of thing is not “simply and easily known,” but rather “requires a vast amount of investigation” (παμπόλλης τῆς ζητήσεως δεόμενον).

⁵² See explicitly *Quod animi mores corporis temperamenta sequuntur* 3.774K / 37,16–20 / 13,17–20 (Greek edition: in *Scripta minora*, vol. 3, ed. G. Helmreich; Arabic edition: *Galenus Traktat “Daß die Kräfte der Seele den Mischungen des Körpers folgen” in arabischer Übersetzung*, ed. H.H. Biesterfeldt [Wiesbaden, 1973]). (The view is attributed there to Aristotle, but Galen agrees: see 5.785K / 46,17–23 / 20,14–17; 787K / 48,3–4 / 21,13–14).

⁵³ Hence the full end of the above cited passage is: “requires a vast amount of investigation, and perhaps will not be discovered, if one does not first know how to understand the complexion of damp and dry and cold and hot.” See also *De nat. fac.* 3.7.167K / 221,24–22,2, where Erasistratus is ridiculed for not accepting that all ἐνέργεια that exist in the parts of the body are due solely to the complexion of the primary qualities. And see Philoponus, *In GC* 2.4, 232,6–12.

get in on the ground floor). But although the problem begins in Galen, the occultation is due to Avicenna.

III. AVICENNA'S NEW SOLUTION

The above problems are laid out in texts which were well-known to Avicenna (for, even if he did not have the *De mixtione*, he would have found everything in Galen and Philoponus, and most likely in Alexander's own *In GC*). But he approached them with a new tool in hand – a tool which may have been, if not forged just for this purpose, at least adopted by Avicenna for it: namely, a new picture of the relationship between substance and quality.

The roots of the new doctrine are to be found already in Alfarabi. To gauge the magnitude of the change, recall that Porphyry says fire cannot receive the contrary of heat because it “substantiates in” heat. Now contrast Alfarabi's explanation of how corporeal things like fire are imperfect, in comparison with the immaterial intellects: in order to achieve its effects, fire is in need of “an organ [*āla*] external to its essence,” something merely “consequent upon that in which fire substantiates,” namely heat.⁵⁴ Elsewhere he explains his view more clearly, and distinguishes between different ranks of corporeal substance, as well. Celestial bodies, he says, cannot act on other things “unless they acquire another being external to their substance and to the things in which they substantiate,” meaning “a quantum or a quale or some other [thing] from among the remaining categories.”⁵⁵ Sublunar substances are more imperfect still: they cannot even achieve their own perfections or entelechies (*kamālāt*) without “other beings external to their substance from among the other remaining categories” – for example, magnitude, figure, place, hardness, color, heat, or cold.⁵⁶ The main motivation here seems to be metaphysical: Porphyry's fudge of “substantial quality” is now rejected; a firm line is drawn between substances and members of the other categories, such that there cannot be anything intermediate.

Alfarabi does not, however, emphasize the radicality of his break with his predecessors in this regard, or seem overly interested in either the problems or the advantages of the new position. The major problem is the difficulty of explaining just what are the “things” in which substances “substantiate.” But Alfarabi, to my knowledge, does not address that issue. As for advantages, the only one which

⁵⁴ *Al-Farabi on the Perfect State: Abū Naṣr al-Fārābī's Mabādī' ārā' ahl al-madīna al-fāḍila*, ed. R. Walzer (Oxford, 1985), 2, §1, 92,10–12; 10, §9, 174,8.

⁵⁵ *Al-Fārābī's The Political Regime (Al-siyāsa al-madaniya, also known as the Treatise on the Principles of Beings)*, ed. F.M. Najjar (Beirut, 1964), 53,15–54,1.

⁵⁶ *Ibid.*, 66,9–12. See also Alfarabi's paraphrase of the *Isagoge*, where heat is classed as an inseparable accident (rather than a differentia) of fire (D.M. Dunlop, “Alfarabi's *Eisagoge*,” *Islamic Quarterly*, 3 [1956]: 117–138, p. 125,12).

clearly attracts him is the extra systematicity he is able to introduce into his cosmic scale of perfection – always something near and dear to his heart. The possibilities for resolving problems about mixture remain unexplored. Alfarabi does attach great importance to the hierarchy, within the sublunar world, of more and less composite “mixtures” or “complexions” – he makes no clear distinction between the terms⁵⁷ – but he is characteristically abstract and hazy about the details. How, for example, is a human being supposed to result from the “mixture” of a lower animal with – what?⁵⁸ Moreover, the few details he does give are not encouraging. On the one hand he says that the ingredients (*akhlāt*) from which something, e.g. a drug, is compounded, are its matter, whereas its form (*ṣīgha* or *ṣūra*) is “the faculty by which it acts” (*al-qūwa bi-hā yaf‘al fi’lahu*).⁵⁹ In cases like this, he says – that is, in the case of some artificial substances (such as wine and drugs) and of “most” natural ones – the form is not sensible; only its effects (*af‘āl*) are observed.⁶⁰ This perhaps suggests a way of dealing with the problem of secondary qualities and faculties (it certainly puts him in a better position than Galen). But it also implies that some natural substances *do* have sensible forms, and if these include the elements, as seems plausible, many if not all of the problems about primary mixture will remain the same as before.

In any case, Avicenna’s view is unequivocal.⁶¹ The difference between substance and accident is a difference in mode of being, hence *a fortiori* a difference in essential character, *i.e.* in species:

It is impossible for there to be a single thing whose quiddity is so deficient in being that there is any thing at all in which it exists as a thing in a subject, and whose quiddity nevertheless does not require that there be any thing whatsoever in which it exists as a thing in a subject.⁶²

It follows that no term at all could apply univocally both to accidents and to the essential characteristics of substances: in particular, the elements cannot be differentiated by heat, cold, or any other sensible quality. As we have seen, Avicenna is following Alfarabi in maintaining this. But he is far more emphatic, and far more vociferous in denouncing the opposite view.⁶³ More importantly, he says

⁵⁷ See *Ārā’* 8, §1, 134,17–136,1: *ikhtilāt al-ashyā’ . . . wa-imtizājātuhā* 136,1: *tilka al-imtizājāt*; §2, 138,3–4: *al-ikhtilāt wa-al-imtizājāt*; §3, 140,7 (and throughout the preceding paragraph): *al-ikhtilāt*.

⁵⁸ See again 8, §3.

⁵⁹ *Iḥṣā’ al-‘ulūm*, ed. Osman Amine (Cairo, 1968), 4, p. 115.

⁶⁰ *Ibid.*, pp. 114–15.

⁶¹ For an earlier discussion, with some differences in emphasis, see my “Simplicius and Avicenna,” pp. 86–8; see also my article “Avicenna,” forthcoming in A. Balestra, G. Segalerba and H. Gutschmidt (eds.), *Substantia: sic et non* (Basel: Schwabe-Verlag).

⁶² *Sh. M.*, *Maqūlāt*, 1.6, 46,16–19.

⁶³ “This is false and impossible, and these examples are all false” (*Sh. M.*, *Maqūlāt*, 1.6, 46,8); “this is a great error” (*Sh. Il.* 2.1, 58,14–15).

something about what the essential characteristics of substances in general, and of the elements in particular, actually are. In the case of a simple body such as water, he explains, the “nature,” *i.e.* “that from which there proceeds [*yaşdur*] the motion or alteration, and likewise the rest and quiescence, which are generated from its essence” is identical to the “form” or “quiddity.”⁶⁴ Thus although the form or quiddity of water, in which it substantiates, is nameless and non-sensible, we do know it qua nature, *i.e.* as a faculty (*qūwa* = δύνάμις) from which sensible effects, such as cold, moisture, and weight, “proceed,” in the absence of impediment. The form can therefore “borrow” its name from the names of those naturally concomitant effects.⁶⁵

As indicated by the talk about modes of being and their relative deficiency, Avicenna, like Alfarabi, is partly motivated by the desire to assign a categorical status to the differentiae while avoiding embarrassing entities of ambiguous ontological rank. To make his solution work he needs to say, and does say, a lot more about the status of the true differentiae themselves. For our purposes, however, what is important is not the ontological payoff, but rather the new light cast on the relationship between the bodies of the elements and the primary qualities.

We can best approach this by thinking of Avicenna as interpreting, first and foremost, not any specific passage in Aristotle, but rather the Peripatetic doctrine reported by Galen and Alexander: that only qualities are complected, and not, as the Stoics maintained, bodies or substances. Since Galen and Alexander themselves hold that the extreme primary qualities are constitutive of the elements, this doctrine meant for them that there are no longer bodies of *the elements* present in the complex at all; only their qualities or δυνάμεις are still present, insofar as the new qualities of the complex are medium between those extremes. Hence the definition of complexion as “the unification of the ingredients via their alteration” means that a single unified body emerges out of the small apposed bodies of the ingredients – not, indeed, because one body flows or extends through another, but because the *constitutive* qualities, by which the bodies of the ingredients were differentiated from one another, change and become uniform. For Avicenna, however, there are no such things as constitutive qualities. That only qualities, not bodies,

⁶⁴ *Sh. T.*, *Simā'*, 1.6, 34,8–9, 11 (where the understanding of the term “nature” derives, of course, from Aristotle’s definition at *Ph.* 2.1.192b21–3). In the case of “composite” bodies, on the other hand, the nature, while still a part of the form, is not to be simply identified with it (*Sh. T.*, *Simā'*, 1.6, 35,7–10). But “composite” here probably does not include homoeomers; apparently he has in mind bodies which, in addition to a nature, have also on or more types of soul. See *Sh. T.*, *Simā'*, 1.5, 30,7–10; *Qānūn* 1.1.6.1.1, p. 130 (and cf. Galen, *De nat. fac.* 1.1.1K / 101,1–8).

⁶⁵ *Sh. T.*, *Simā'*, 1.6, 34,11–35,2; *Kawn / fasād*, 6, 131,6–10 (and cf. Galen, *De nat. fac.* 3.3.149K / 208,22–4).

are complected, must therefore mean something different. In what is, in effect, Avicenna's version of *GC* 1.10.327b23–31, there are again two possible outcomes – augmentation and complexion – when “the elemental bodies are in contact” and “act upon one another.”⁶⁶ But these are now described as follows:

Either one dominates the other, and changes it to its [own] substance, and there is generation of the species of the dominant one, and corruption of the dominated; or neither achieves domination over the other to the point of changing its substance, but it changes its quality to a point at which the action and passion stabilize, and there arises in it a uniform quality, which is called the complex [*mizāj*]; and this combination is called complexion [*imtijāz*].⁶⁷

Aristotle's definition of complexion, in other words, now means that there is no truly unified *substance*: the ingredients are united *merely* by alteration, while their substances remain unchanged. So while the qualities are complected, the original corporeal substances – the small elemental bodies – are still in place, numerically the same as before.

If, moreover, a true essential characteristic is a *qūwa*, *i.e.* δύναμις, we also get a new, surprising understanding of the statement that the ingredients are not corrupted because “their δύναμις is preserved.” For Alexander and Galen, δύναμις refers there to the primary qualities, which remain behind when the substances of the elements are no longer present. For Avicenna it is the opposite, as he makes clear in a passage where, unusually, he explicitly emphasizes his dependence on Aristotle's text:

Then the First Teacher said, after that: “for the ingredients are preserved in *qūwa*,” and he said, “but their *qūwa* is preserved,” and he meant: [they are preserved] in the active *qūwa* which is the form, and he did not mean: in the *qūwa* with respect to passions, which belongs to matter in its essence. For the man wanted to refer only to something which belongs to them along with their not being corrupted. But that can only be if the *qūwa* which is their essential form remains.⁶⁸

PA 2.1.646a12–15 can also be interpreted in the same spirit.

The interpretation may have been helped along by the fact that both ἐνέργεια and ποιεῖν are standardly translated using the same forms of *f-'l*. In the above quote, for example, the phrase *al-qūwa al-fi'liyya* is surely supposed to translate ἡ ποιητικὴ δύναμις. Similarly in the continuation, where Avicenna distinguishes between the nature of an elemental body (which as we know is also its form) and a “*fi'l* which proceeds from it,” which is a quality or other accident.

⁶⁶ *Sh. T.*, *Kawn / fasād*, 6, 126,11–12.

⁶⁷ *Ibid.*, 126,15–127,1; see also *Sh. T.*, *Simā'*, 1.9, 50,16–51,8.

⁶⁸ *Sh. T.*, *Kawn / fasād*, 6, 127,11–15; see also 7, 138,16–17; and see Eichner, “Einleitende Studie,” pp. 165–6.

Since the word ἐνεργεία in Aristotle's phrase ἐνεργεία μὲν ἑτέρου ὄντος τοῦ γεγονότος ἐξ αὐτῶν (327b24–5) would no doubt have been translated *bi-al-fi'*,⁶⁹ it seems possible that Avicenna understood the phrase to mean, in effect: being different in *sensible quality* from (the complex) that is generated out of them.⁷⁰

In any case, even with all the help it can get from ambiguities of translation, the theory that small elemental bodies are still present in the complex is at first sight difficult to attribute to Aristotle, since, in both *GC* 1.10 and 2.7, he seems at pains to deny precisely that. Hence Simplicius and Philoponus, in defending (or imagining a defense of) a very similar view, maintain (or imagine its proponents maintaining), against Aristotle, that flesh and bone are not truly homoeomerous.⁷¹ The same thinking is evident in Maier's treatment of Avicenna. After accurately describing his understanding of *qūwa* = δύναμις and of ἔνωσις ἀλλοιωθέντων, she goes on to say that the resulting view was unacceptable to his successors because “a *mixtum* in the strict sense is supposed to be a homogeneous stuff, whose smallest parts are *eiusdem rationis* with the whole,” so that Avicenna's theory could only mean that multiple elemental forms are present *in every part* of the mixture.⁷² Her own reason for declaring that latter conclusion unacceptable is perhaps not so convincing.⁷³ But we can supply a stronger reason: since the elements are corporeal substances, *i.e.* their substances are bodies, Maier's unacceptable conclusion is precisely the view that all Aristotelians and Neoplatonists reject: namely, the Stoic view of complexion as one body extending through another.

Maier's argument, so strengthened, is irresistible. But, whatever his Latin successors may have thought, what it implies for Avicenna himself is that he somehow holds *both* that small particles of the elements remain in the complex *and* that a *mixtum*, or rather a *complectum*, is a “homogeneous stuff.”⁷⁴ How can he reconcile these

⁶⁹ See the Arabo-Hebrew translation, ed. Tessier: *be-fo'al*.

⁷⁰ However, a different reading is suggested by *Sh. Ṭ.*, *Kawn / fasād*, 6, 131,17–132,1.

⁷¹ See Philoponus *In GC* 2.7, 269,25–270,5; Simplicius *In Cael.* 3.7, 660,18–661,14.

⁷² “Struktur,” pp. 25–8.

⁷³ She says that “the essence of elemental form consists in the fact that it immediately and exclusively informs prime matter,” so that “matter can, indeed, take on different elemental forms one after another, but not simultaneously” (*ibid.*, p. 27). The “immediately” would be outright denied by Avicenna (and by others who accept some version of corporeal form or “unqualified body” as an intermediate subject), and the “exclusively” – which is the heart of the matter – has no obvious source in Aristotle, so far as I know.

⁷⁴ Although Maier is aware of the *Kawn / fasād* texts, which she cites from manuscript, she may nevertheless have been misled here because she approaches Avicenna by way of the later Latin tradition, which, however, was mostly dependent on Averroes' (accurate but incomplete) report of Avicenna's position (*In Cael.*, 3 c. 67, 635,115–39 [227rb–va]), and to a lesser extent on Avicenna's brief remarks in *Sh. Ṭ.*, *Simā'*, 1.6. See Maier, “Struktur,” pp. 23, 93 n. 15; S. van Riet, “Le *De generatione et corruptione* d'Avicenne dans la tradition latine,” in Thijssen and Braakhuis (eds.), *The Commentary Tradition*, pp. 69–77; and see Eichner, “Einleitende Studie,” pp. 139–45.

two? The basic answer is that, as we have already seen, he has a metaphysical distinction not available to Philoponus and Simplicius. Since, from their point of view, the elements are constituted by sensible qualities, a complex in which bodies of the elements remain would be, as Simplicius puts it, like a cloak made of different colored threads: it might seem to have a uniform quality from far off, but if we could only examine it more closely – if we had the eyes of Lynceus, or the tactile equivalent – we would observe its non-uniform microstructure. But for Avicenna this is no longer the case. The complex, he can freely admit, is not homoeomerous *in substance*. Of course it isn't, since, on his understanding, that would be the Stoic view, that there is complexion of the bodies of the elements. According to us (Avicennan) Peripatetics, on the other hand, only qualities are complexed – and the result is what we should expect, namely perfectly uniform medium *qualities*. But only these uniform accidental qualities, not the differing substantial forms, are sensible. So in the case of a compound unified by complexion, “sense sees it as homoeomerous.”⁷⁵ Lynceus, in other words, could no more discover a lack of uniformity here than can we.

This puts Avicenna on the right side of Aristotle's arguments in *GC* 1.10. More difficult to understand is how he can be reconciled with the text of 2.7. There Aristotle objects to a view (which he ascribes to Empedocles) according to which a homoeomerous substance like flesh consists of “preserved elements apposed to one another in small parts,” on the grounds that, in that case, “fire and water will not be generated out of just any part of flesh”; rather, “as stone and brick [are generated] from a wall, each out of a different place and part.”⁷⁶ Not only does Avicenna's position seem to have exactly this implication, but he actually relies on that feature of it in chapter 7 of the *Kawn / fasād*, which is devoted to a polemic against his Baghdadi opponents, who maintain that the ingredients in complexion “divest themselves of their forms . . . and then put on a single form, so that they come to have a single matter and a single form.”⁷⁷ Against this, Avicenna points out that complexes are not uniformly affected by external influences: that exposure to flame, for example (in an alembic), typically results in some parts of them going up as vapor and others remaining behind. Relying (as always) on a principle of sufficient reason, he concludes that there must already have been some difference in “aptitude” between different parts of the complex before the heating began. A further argument, the details of which are not important for our purposes, then

⁷⁵ *Sh. T.*, *Af'āl / in fi'ālāt*, 2.2, 266,4–5.

⁷⁶ *GC* 2.7.334a 34–b2.

⁷⁷ *Sh. T.*, *Kawn / fasād*, 7, 133,5–7. For this identification of the (unnamed) “modern” opponents attacked here, see Eichner, “Einleitende Studie,” pp. 170–2.

establishes that this difference must be due to a distinction (*tamāyuz*) in substantial form – that is, a distinction of bodies.⁷⁸ The complex qua complex, in other words, is not a unified body, but rather a collection of bodies united by cohesion and by common sensible qualities. So we return to the doctrine we saw above – but now apparently via the claim, directly against Aristotle, that the disintegration of the complex *will* be just like taking stone and brick out of a wall.

Since, however, Avicenna emphasizes his agreement with Aristotle on just this point, he must understand *GC* 2.7 differently. Most likely he begins with the fact that the chapter actually poses a dilemma: *both* those (like Empedocles) who do not allow the elements to be generated out of one another *and* those (like Aristotle) who do have trouble explaining the generation of homoeomers (334a18–23). Empedocles, as we have seen, cannot explain how each ingredient can re-emerge out of any part of the complex. But Aristotle has his own explaining to do. If none of the elements remain in the complex, why isn't the result simply a complete absence of primary quality and / or elemental form – *i.e.*, nothing but (prime) matter (334b4–6)? As in 1.10, then, the dilemma is this: if the elements are preserved, there is no true homoeomery; but if they are not, we get corruption, rather than complexion. The solution, moreover, sounds similar: homoeomerous bodies come to be from “the contraries [*i.e.*, the primary qualities] or the elements being mixed”; the elements can then re-emerge because those same contraries exist in the complex “somehow potentially [δυνάμει]” – but, Aristotle adds, “not in such a way as the matter” (334b16–19). Now recall that Avicenna, in his interpretation of 1.10, contrasts “the *qūwa* . . . which belongs to matter” with “the active *qūwa* which is the form,” and claims that Aristotle's statement about the ingredients' remaining in *qūwa* refers to the latter.⁷⁹ So on Avicenna's reading, Aristotle escapes his own horn of the dilemma precisely via the doctrine that the *substances* of the elements are preserved. Why doesn't he, then, land straight on the other horn? Presumably because he, unlike Empedocles, *does* allow the elements to be transformed into one another. Fire or water can come out of any part of the flesh, but only in an extreme case in which fire or water might come to be out of, *e.g.*, pure earth – a case in which, perhaps, the entire piece of flesh might come to be one or the other. Meanwhile, Avicenna emphasizes, in more normal cases, in which the ingredients are merely separated, rather than transformed, the last thing we expect is for just any ingredient to emerge from just any part of the complex. In fact, he turns the tables against his opponents, pointing out that, if that were the case, we could find

⁷⁸ For the full argument see *Sh. T., Kawn / fasād*, 7, 134,2–135,4.

⁷⁹ *Sh. T., Kawn / fasād*, 6, 127,12–13 (and see also, again, *Ph.* 5.2.226a26–9).

a piece of flesh which, when heated in the alembic, would entirely evaporate, or one which would entirely turn to sediment.⁸⁰

Given these interpretative moves, Avicenna can reconcile his position with Aristotle while avoiding the first disadvantage which we noted in the Peripatetic view espoused by Alexander and Galen. Because the primary qualities are no longer thought of as constitutive, the elements can easily lose these qualities, in whole or in part, without being corrupted.⁸¹ Avicenna is well aware of the crucial metaphysical move which allows him this solution, denied to his predecessors: “the commentators,” he explains, are confused because they fail to distinguish between “forms and accidents,” *i.e.* between “the natural forms of these [elemental] bodies and their qualities”:

And since they thought that these qualities, all or some of them, are the forms of these bodies . . . the one of them who followed the best path [*i.e.*, Philoponus] said: the qualities are preserved, but thwarted in force, whereas the bodies are [only] potentially pure.⁸²

He then goes on to refute this view, and several variants, using the powerful new metaphysical tool he has taken from Alfarabi.

But what of the second disadvantage in the Peripatetic position – namely, the problem of explaining secondary qualities and faculties? Clearly the situation is changed dramatically by the demotion of the primary qualities. The change is not all for the better, however.

One immediate result has nothing to do with complexion, but rather with properties of the elements themselves. If fire, for example, is constituted by heat and dryness, and earth by cold and

⁸⁰ *Sh. T.*, *Kawn / fasād*, 7, 135,2–3.

⁸¹ Hence de Haas’s initial framing of the problem in terms of change of constitutive qualities (“Mixture in Philoponus,” pp. 28–9) would already be unacceptable to Avicenna. Like Maier, de Haas (and / or his source, Zaborella) may have been misled by Averroes. The latter treats as an absurd consequence of Avicenna’s view, that fire might be fully present in the complete absence of heat and dryness (*In Cael.*, 3 c. 67, 635,132–6 [227rb]) – implying that Avicenna still does give some constitutive role to the primary qualities. But, precisely because Avicenna does not give any qualities that role, he would see no absurdity in the case Averroes describes: he takes ice, for example, to be water in which the sensible quality of moisture is completely absent (*Sh. T.*, *Kawn / fasād*, 6, 130,14–16; *Af’āl / infi’ālāt*, 2.1, 255,12). (Cf. Galen’s treatment of ice as water which – like all water – is moist in the extreme, but which lacks the softness normally associated with moisture: *De temp.* 2.3.598K / 12–18. Philoponus, on the other hand, seems indecisive on this issue: see *In GC* 1.7, 147,4–9. The source for all of these views is Aristotle, *Metaph.* 8.2.1043a9–10.)

⁸² *Sh. T.*, *Kawn / fasād*, 6, 127,18–128,4. For Philoponus, see *In GC* 2.7, 271,25–272,10. “Thwarted in force” (*maksūr al-sawā*) thus translates κεκολασμένον (271,5–6). (Here I am in disagreement with Eichner, “Einleitende Studie,” pp. 185–6, n. 137. No doubt this is an odd translation of κεκολασμένον, but Philoponus’ use of the term is itself odd and invites loose translation – cf., e.g., Kupreeva’s decision to translate it as “inhibited” (*Philoponus on Aristotle’s “Coming-to-Be and Perishing 2.5–11”* [Ithaca, 2005], p. 62). That the Latin translator rendered Avicenna’s term with *fractus* rather than *castigatus* does not seem relevant, nor would it have posed much of a barrier to a Latin reader familiar with Philoponus in identifying the origin of the phrase.)

dryness, why is it that fire tends upwards and earth downwards? What connection is there between levity and heat, or gravity and cold? Similarly, why should the transition from cold and moist water to hot and moist air result in a change in volume, *i.e.* in quantity? This problem is now solved, in a manner of speaking, by the fact that heat and dryness have no closer – and therefore no more distant – a connection with the true differentia of fire than do levity and bulk:

Every one of the elements has a form by which it is what it is, and consequent to that substantial form are entelechies [*kamālāt*] of the category [*bāb*] of quale, and of the category of quantum, and of the category of where. And there is proper to each one of them heat or cold . . . and dryness or moisture . . . and a natural measure of quantity, and natural motion and natural rest.⁸³

This “solution,” however, alleviates the mystery as to why, say, water is heavy only by generating an equally intractable mystery as to why it is moist. Both are results of the same nameless occult faculty.

As for complex substances, notice, first of all, that we have not yet accounted for their existence, on Avicenna's view. For Alexander or Galen, a new set of primary qualities automatically constitutes a new substance; the question is only how a substance so constituted could give rise to new secondary qualities and faculties. But for Avicenna the complexion, *i.e.* the medium tangible quality itself, is merely an accident. If the question is how that tangible quality can give rise to, for example, a color, then the answer is that it certainly cannot, “because the complexion is a tangible quality, and color is not tangible.”⁸⁴ Thus it seems impossible to understand the origin, not just of secondary qualities and faculties, but of complex *substances* as such. If complexions are accidental qualities, where will we ever get a substantial forms other than those of the elements? The answer, to make a long story short, is (a limited form of) occasionalism:

What must be said about all this is one thing, and that is that the compound body is adapted, by its complexion, to receive a disposition, or a form, or a proper faculty, and this emanates to it from the giver of forms and of faculties, and no other. And their emanation from it is due to its liberality, and because it does not fail whatever is worthy and adapted.⁸⁵

Some complexes do not receive any such added emanation at all, and some receive only another accidental property – for example, a color. But some also receive a new substantial form: the form of

⁸³ *Sh. T.*, *Kawn / fasād*, 6, 129,15–130,1.

⁸⁴ *Sh. T.*, *Af'āl / infī'ālāt*, 2.1, 254,9.

⁸⁵ *Sh. T.*, *Af'āl / infī'ālāt*, 2.1, 256,9–11. The “giver of forms” here is God (l. 14); elsewhere, however, as in Alfarabi, it seems to be the Active Intellect (*Sh. II.* 9.5, 410,14–16, 411,9).

a homoeomerous complex substance.⁸⁶ The new substantial form then enters into each small elemental particle, such that each becomes, for example, an actual particle of fire which is *also* flesh; consequently, the entire composite body becomes a single body of flesh.⁸⁷

Now, in some sense, this doctrine is obviously a disaster for the explanation of secondary qualities and faculties of complex substances. Galen and Alexander give us a clear explanation of how a new substance could result from a change in the primary qualities, and some (albeit faint) hope of explaining all its properties on that basis. Avicenna, on the other hand, leaves us with nothing but unspecified interactions between nameless and unknown faculties, which, in some unknown and unpredictable way, call down new forms and qualities from the heavens. As he puts it: “there is no way to grasp the correspondence between particular complexions and the faculties and dispositions which are consequent to them.”⁸⁸ On the other hand, there is some gain in that those previously mysterious qualities and faculties are now no more mysterious than anything else. The apparent problem about them arose, as Avicenna explains, from people’s natural tendency to wonder at what is unusual:

The majority of them are not concerned to know why fire can burn a great city in a single hour, or why cold dries [*i.e.*, freezes] water, but they are concerned to know why a magnet attracts iron. . . . So that if one were to ask why cold does this they would not know, and would say: because that is its nature . . . and similarly with respect to fire. . . . And the discerning among them . . . says: because the matter of fire has acquired a form which essentially has this effect [*fi’l*]. . . . But then he is not content, similarly, to say of the magnet: because the complexion is the cause of the composite’s acquiring a faculty which by its essence and nature attracts iron.⁸⁹

The truly wise will, of course, content themselves with the latter answer. And similarly in the case of drugs – those that act, not “by their qualities,” *i.e.* by their complexion of elements, but “by their substance,” *i.e.* by the new, consequent specific substantial form:⁹⁰ here, too, Avicenna would advise exactly the answer infamously given by Molière’s bachelor to the question about opium: *quia est in eo virtus dormitiva*.⁹¹

⁸⁶ For all these possible outcomes, see *Sh. T., Af’āl / inḥī’ālāt*, 2.2, 261,4–13.

⁸⁷ *Sh. T., Kawn / fasād*, 7, 136,13–16. (This consequence of Avicenna’s view is put in the mouth of his Baghdadi opponents as an objection, but he ends up accepting it.)

⁸⁸ *Sh. T., Af’āl / inḥī’ālāt*, 2.1, 255,7–8.

⁸⁹ *Ibid.*, 255,11–256,6.

⁹⁰ *Ibid.*, 2.2, 262,1–2. Cf. Galen’s description of the difference between food and drugs: in the case of food we need the “substance” (*i.e.*, corporeal bulk) of what we ingest; in the case of a drug, we need its qualities, and ingest the substance only because the qualities can never be found on their own (*De el.* 6.474K / 120,3–9 / 93,5–94,4).

⁹¹ *Le malade imaginaire*, in *Œuvres complètes* (Paris, 1962), vol. 2, p. 848.

As that last quote suggests, the long-term effects of Avicenna's choices here was quite significant.⁹² The doctrine specifically about complexion was, as Maier correctly points out, never popular with his successors – in part, perhaps, as I have indicated, because they had no accurate report of it. But the new view on the relationship between substance and accident was extremely influential. Hence Thomas Aquinas, in the *De ente et essentia* – an early work, parts of which are virtually transcribed from the *Shifā'* – explains that the proper differentiae of angels are “hidden” (*occulte*) from us, and then adds: “For even in sensible things the essential differentiae themselves are unknown, so that they are [instead] signified by accidental differentiae which arise from the essential ones, as a cause is signified by its effects.”⁹³ In his much later *GC* commentary, he takes exactly the same position, and applies it to the primary qualities:

Substantial differentiae, because they are unknown, are manifested by accidental differentiae. And thus we often use accidental differentiae in place of substantial ones. And in this way the Philosopher says here that hot and cold are the substantial forms of fire and earth. For heat and cold, since they are proper passions of those bodies, are proper effects of their substantial forms.⁹⁴

Moreover, although Thomas is generally known as an opponent of Avicenna's occasionalism, he takes over intact the key part of it: namely, that sublunar causes can only dispose the matter to receive substantial forms, while the actual source of those forms is the angels and celestial bodies.⁹⁵ If it is true, as I have suggested, that Avicenna adopted these metaphysical positions in part because of their usefulness in his theory of complexions, then that despised and misunderstood theory had the most far-reaching possible consequences. For, as is well known, it was precisely the rejection of these seemingly idle and unknowable substantial forms, along with their attendant, non-explanatory, occult faculties, that would eventually drive the most important developments of early modern philosophy.

⁹² Note that δύναιμις and *qūwa* are often rendered in Latin as *virtus*: see, e.g., Burgundio of Pisa's translation of *GC* 1.10.327b31 (Aristoteles Latinus, vol. 9.1, ed. J. Judycka [Leiden, 1986]), and the translation of *Sh. T., Simā'*, 1.6, 35,8 (*Liber primus naturalium: tractatus primus: De causis et principiis naturalium*, ed. S. Van Riet [Leiden, 1992]). Although I have not located the passage, I consider it likely that Molière is quoting (perhaps indirectly) from the *Qānūn*.

⁹³ *De ente et essentia*, c. 5, tom. 43 of *S. Thomae Aquinatis Doctoris Angelici Opera omnia, iussu impensaue Leonis XIII P.M. edita* (Rome, 1976), p. 379a, ll. 75–80.

⁹⁴ *Sententia super libros De generatione et corruptione* c. 3 lect. 8, ad 1.3.318b14, tom. 3 of *Opera omnia* (Rome, 1886), p. 293a.

⁹⁵ See *Quaestiones disputatae de potentia Dei* q. 5 a. 1c.; *Summa theologiae* I q. 115 a. 3 ad 2.