



A Micro-Intertextual Approach to Ancient Thought

The Case of the Torpedo Fish from Plato to Galen

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1. Introduction

There are many ways of doing history of philosophy (or of ideas), at least as many as there are views about what the activity of thinking might be—whether from the standpoint of the historian or of the thinkers he considers.¹ I want to suggest here an approach to doing history of philosophy that mainly consists in interpreting texts by comparing them at a microscopic level with previous, contemporary, or subsequent texts. I have forged the label “micro-intertextual” *a posteriori*, on the basis of a set of studies I had conducted on ancient and medieval thought and that happened to share some common methodological patterns. But the components of this label are, of course, not new in themselves. My methodology shares an ambition to address important questions on the basis of restricted cases with the Italian tradition of “microhistory” initiated in the 1970s by Giovanni Levi, Edoardo Grendi, Carlo Poni, and Carlo Ginzburg.² As for the notion of “intertextuality,” which has been used by specialists of semiotics and literary criticism since the end of the 1960s in France,³ I use it in a sense that I will briefly characterize in this introduction on the basis of a few selected references.

A focus on intertextuality at a microscopic level seems to be particularly appropriate to the scientific traditions of antiquity and the middle ages, which were, as is well known, profoundly and often openly shaped by the process of re-thinking what was thought by others. However, I don’t primarily aim to assess the importance of authority in ancient thought as such,⁴ nor even to describe the conditions of transmission of the ideas; the relations between ancient texts that I emphasize are not necessarily something of which the authors in question were self-aware.

Rather, given the highly intertextual content of the products of ancient thought, I also extrapolate this feature and apply it to texts that do not refer to other texts with certainty, either because they don't contain a clear reference to the (previous or contemporary) texts with which they are compared, or because these texts are posterior in time: In the first case, the practitioner of the micro-intertextual method allows himself to interpret a text, A, in the light of a previous or contemporary text, B, despite the absence of any proper quotation of B in A.⁵ In the second case, where B *can't* be considered a source, a reference-point, or a target of A, this practitioner nevertheless chooses to interpret A in the light of B.⁶ These two ways of extrapolating intertextual relations will, of course, not be applied at random: the historian reconstructs such relations by *choosing* to emphasize *specific* similarities and differences between the texts, taking into account the contexts in which they were written.⁷ Hence, by "intertextual relations," I mean a set of relations consciously recognized or supposed by the reader between two (or more) texts, and I will use this concept as an interpretive tool to develop a certain way of doing history of philosophy.

To illustrate this approach and to show its interest, I will present one case study: the history of the (flat) torpedo ray, numbfish, or crampfish, famous since ancient times for causing numbness to other animals, including fishermen. Since the eighteenth century, the possibility that such a shock might be "electrical" began to be considered, so that anatomical experiments on this fish were an important source of inspiration for the invention of the electric battery by Alessandro Volta (1745–1827), who had designed, alongside Henry Cavendish (1731–1810), an artificial model of the torpedo fish by which the mechanism of producing an electric shock was visualized.⁸ But the torpedo fish attracted attention well before this, and incited discussions whose philosophical interest remains to be studied.⁹ Indeed, I think that such documents predating modern science can have an interest that goes beyond mere "historical curiosity" when one begins to really analyze them. This paper focuses on the beginning of a tradition in which the example of the fish entered philosophical discourse. The period considered goes from Plato to Galen, including the Stoic thinkers Pliny the Elder, Hero of Alexandria, and Plutarch of Chaeronea, as well as Theophrastus, Clearchus of Soli, and Strato of Lampsacus.¹⁰ After having sketched the appearances of the fish in Plato and Aristotle (§2), I follow up its further appearances to reconstruct the main conceptual steps in the early philosophical treatment of this fish (§§3–5). Finally, I highlight some important points in that history (§6).

2. Metaphorical Use and Biological Description: Plato and Aristotle

Various kinds of torpedo fish are common in the Mediterranean.¹¹ The Greek name given to them (νάρκη) seems to come from their capacity to cause a kind of insensibility in the hands of fishermen, accompanied by a near paralysis.¹² Plato makes reference to this fish in the *Meno*, a dialogue between Socrates and a young aristocrat who is inquiring whether virtue, or excellence, comes from teaching (*Men.* 70A). The reference occurs in a section that forms a turning point (*Men.* 79E5–80D)—whatever structure one admits for the dialogue¹³—situated at the end of the relatively unified section of the first ten Stephanus pages. This section contains a first approach to the issue, through a search for a definition of excellence (*Men.* 71B9–79E4), after which Socrates professes himself unable to answer Meno’s question. The search proves to be unsuccessful because none of Meno’s attempts at defining excellence are acceptable: his first definition is a mere list of particular kinds of excellence (*Men.* 71E–73C), and two subsequent formulations, according to which excellence is a ruling power (*Men.* 73C–77B) and the ability to acquire good things (*Men.* 77B–79E), are also rejected. After the third definition has collapsed, Socrates asks for yet another, but Meno admits that he has reached aporia:

Socrates, before I even met you I used to hear that all you do is get puzzled yourself and make others puzzled. And now, it seems to me, you are bewitching me, drugging me and simply overwhelming me with enchantment, so that I have been filled with puzzlement. If a little humor is in order, what you comprehensively remind me of, both in appearance and in other respects, is that marine creature, the torpedo fish. For it makes anyone who approaches and touches it grow numb, and I think you have now done something like that to me: my soul and mouth truly are numb, and I have no answer to give you.¹⁴

At this point, where all definitions given by Meno have been refuted and where the self-confident young man feels himself at a complete impasse, the fish’s paralyzing effect illustrates Socrates’ ability to pass his experience of being at a loss for answers on to others.¹⁵ But such a capacity to lure people into problems that they cannot solve themselves, far from numbing his victims into intellectual inactivity, rather helps to purge them of various unjustified criteria or prejudgments that prevent thinking; accordingly, the torpedo can have benefits comparable to that of the gadfly (*Apol.* 30C–31C), and it corresponds to a typical feature of Socrates’ educational abilities—once one admits, as Hannah Arendt does, that teaching consists in the transmission of one’s perplexity.¹⁶

The way in which such an ability is described by Meno and acknowledged by Socrates shortly thereafter (*Men.* 80C–D) implies that the torpedo fish is itself numb while also causing numbness to others, as Socrates is “more puzzled than anybody” (*Men.* 80C). This feature, which is essential to Plato’s comparison between the Socratic method and the numbing effect of the torpedo fish, is not echoed in the Aristotelian corpus.

Indeed, while the fish’s appearance in Plato serves as a metaphor, in Aristotle it is exclusively quoted for the purpose of biological inquiry. The torpedo fish is mentioned several times in the zoological corpus, specifically the *History of Animals*. In book 2 (*HA* II.13, 505a4, and II.15, 506b9), it is quoted as an example of an animal that has its gills down on its belly and has a gallbladder. In book 5 (*HA* V.5, 540b18), it is ranked in the sub-class of the *Selachii*, which includes cartilaginous fishes such as sharks, rays, dogfish, and skates. In book 6 (*HA* VI.10, 565b24–8), Aristotle indicates that a large individual of the species “torpedo” has been recorded with about eighty embryos inside it. In book 5 (*HA* V.11, 543b9), the animal is said to breed shortly before the autumnal equinox; this indication comes once again in book 6 (*HA* VI.11, 566a23–32), where it is also said that the torpedo belongs to the category of fishes that are oviparous at the first stage and then viviparous.¹⁷

Most importantly, in book 9 (*HA* IX.11, 620b19–24), the torpedo fish is noted for its impressive capacity to paralyze those who touch it:

And the torpedo by causing numbness [ναρκᾶν ποιῶσα] in whatever small fishes it intends to overcome, catching them by the means which it possesses in its body [τῷ τρόπῳ ὃν ἔχει ἐν τῷ σώματι], feeds on them; it hides itself in the sand and mud, and catches all the fishes that swim towards it and become numbed as they are carried near.¹⁸

Here, as in all the other passages of Aristotle’s zoological works where the torpedo is mentioned, its physical action is not explained, nor is it even actually described at length. The nature of the numbing power at stake (here referred to as the “means”) is not qualified in any way, and is very loosely located in the fish’s body. The brevity, and the very elusive character of these allusions to the torpedo fish, might be due to the fact that the project of the *History of Animals* basically aims at classifying different kinds of animals rather than explaining their behavior from a physiological perspective.¹⁹ Moreover, Aristotle actually has limited interest in what we now consider, since the eighteenth century, “electrical” phenomena, and he is not interested in the so-called “marvels of nature” more generally. However, an interest in all kinds of supposedly extraordinary phenomena emerges in the subsequent Peripatetic tradition, beginning with the first generation of scholars at the Lyceum.

3. The Fish at the Lyceum: A Bodily Power Passing through a Medium

In the case of the torpedo fish, as is also the case for several other important topics in the long Peripatetic tradition, Aristotle's silences stimulated his followers to clarify those notions that he had left vague and to develop explanations that he had never provided. Thus, while the Aristotelian corpus gives no explanation of the mechanism in the fish's body that gives rise to the numbness, this animal is subsequently referred to and discussed in various contexts. Evidence of the fascination that the phenomenon of the torpedo fish exerted among Peripatetic scholars at the time of the Lyceum is given in the immense work written by Athenaeus of Naucratis at around the end of the second century CE in Rome, *The Learned Banqueters* (also referred to as *The Banquet of the Learned*, *The Sophist's Banquet*, and *The Deipnosophists*).²⁰ This work consists in the tale of an extraordinarily extravagant dinner and drinking party, where one finds an abundance of quotations from ancient Greek literature and philosophy, from over a thousand authors, many of them known from no other sources.

An entire section of the work—corresponding to books 6 and 7—is devoted to fishes, in the course of which there is a chapter that specifically concerns the torpedo fish.²¹ This chapter begins with enthusiastic praise of the culinary quality of the fish when stewed, and immediately continues with a list of more philosophical testimonies. Among the sources listed, there is Plato,²² and then Clearchus of Soli,²³ who originally came from Cyprus and was active around 320 CE at the Lyceum, where Aristotle's school was located.²⁴ According to Athenaeus, Clearchus had written a treatise *On the Torpedo* (*Περὶ νάρκητος*) in which he supposedly “indicated the *cause* [εἶρηκε τὴν αἰτίαν]” of the torpor transmitted by the fish; however, Athenaeus simply refers the reader to the treatise itself without quoting it at all, because, he says, Clearchus' remarks “are rather extended” and Athenaeus himself has “forgotten them.”²⁵ Nothing other than this report survived of Clearchus' tract *On the Torpedo*, and the other scarce testimonies or fragments concerning this author contain no indication about his reading of the fish's action.²⁶

However—and fortunately for us—, in the same section of Athenaeus' *The Learned Banqueters*, there is a slightly more extended discussion of the understanding of the torpedo fish by another important philosopher among Aristotle's disciples at the beginning of the Athenian Lyceum: Theophrastus of Eresos, who was Aristotle's colleague for over twenty years and was active at the head of the school from 322 to around 287 BCE. Athenaeus reports that Theophrastus even discussed this animal in two different biological works, the first being devoted to

the natural habitats of animals, and the other devoted specifically to the customs of animals that affect human beings by biting or stinging them:

Theophrastus, in his *On Animals That Hibernate*, says that cold causes the crampfish to burrow underground. And in his *On Biting and Venomous Creatures*, he claims that it can send its power even through sticks and through fishing spears [διαπέμπεσθαί φησι τὴν νάρκησιν τὴν ἀφ' αὐτῆς δύναμιν καὶ διὰ τῶν ξύλων καὶ διὰ τῶν τριόδόντων], causing those who hold such implements in their hands to go numb.²⁷

Until now, this text has not received much attention: the torpedo fish is practically absent from Theophrastean studies.²⁸ This is understandable: not much can be done, historically and philosophically speaking, with such an economic report—at least if one sticks to it. However, it can become interesting to read this text in comparison to similar reports before and after Theophrastus. So let us first compare Theophrastus' description of the torpedo fish (according to Athenaeus' report) with Aristotle's description of the same phenomena. One can then note that Theophrastus' description contains two rather important words that don't figure in the corresponding passage in Aristotle (HA IX.11, 620b19–24): the notion of “power” (δύναμις), and the phrasal verb “send . . . through” (διαπέμπεσθαι). This double statement, as basic as it is, is nevertheless potentially telling, insofar as Theophrastus' description might be seen as an explanation.

So let us try to understand this supposed explanation, on the basis of some other texts by Theophrastus, as well as of the further developments in Peripatetic accounts of the torpedo fish. The first question that arises concerns the meaning of “power” (δύναμις). In the Theophrastean corpus, this means either the peculiar characteristic of a given body, or the dynamic capacity of this body, especially its ability to act on other substances, to react or fail to react to other substances. This second sense of the term, which is indicated at the beginning of Theophrastus' treatise *On Stones*,²⁹ is to be understood in his interpretation of the torpedo fish in Athenaeus' report. Accordingly, one understands that some “power” present in the fish's body reaches the fisherman's hand because it is “sent through” (διαπέμπεσθαι) the different kinds of tools he uses. The phrasal verb used to describe this communication (“send through”) is rather imprecise, but it makes a point that is by now unambiguous: the numbing power of the torpedo *passes* from one to another point in space (the body of the fish *to* that of the fisherman) *through* some intermediate parts (various fishing instruments).

Difficulties arise when one tries to be precise and qualify the process at stake. To do so, one has to refer to the general tenets of Theophrastus'

view on inanimate matter, on which there is actually no general agreement. One can distinguish two main readings: The first is that of Hans B. Gottschalk and Peter Steinmetz, who hold that Theophrastus makes use of an atomistic view of matter, using particles and pores to ultimately explain the structure of physical things, including inanimate bodies.³⁰ Such a reading was challenged by Victor Coutant, who assumed that atomistic notions do not relate to visible formations, but are rather “stochastic and conceptual in nature,”³¹ and who claimed that Theophrastus basically holds a thesis of the uniformity of matter. Faced with the many occurrences of “pores” in the tract *On Fire*, as well as in chapters 2 and 3 of the tract *On Stones*, Coutant maintains that “the invisible fine particles are assumed from grosser phenomena but are not conceived as fundamental building blocks.”³²

The debate between Steinmetz and Coutant is difficult to settle. Besides, even if one admits that Theophrastus holds a theory of microvoids in matter, it does not seem to have been entirely worked out, so that one is tempted to add some finer details, though without having the means to really assess them on the basis of any documentary evidence. Here are the main questions with which the reader of Theophrastus’ explanation of the torpedo fish is then faced: First, does this theory mean that, according to Theophrastus, the torpedo fish’s numbing power passes through a body by penetrating its pores, or by penetrating empty spaces? Second, is such a theory of the microvoid of matter supposed to account for the variances in the conductivity of different kinds of things (in this case the fishing tools)? These questions cannot be definitively answered, because the only claim explicitly made by Theophrastus in Athenaeus’ report is that the fish sends its power to the fishermen through the instruments they use. However, the question about whether the fish’s power moves from the agent to the patient through empty spaces in the intermediary body forms the background to the subsequent tradition about the fish, where this question will be answered in certain specific ways.

Indeed, the issue of the mode of the power’s transmission is faced more explicitly by a subsequent figure of Hellenistic scientific tradition, Hero of Alexandria, an Egyptian engineer known for his description of hydraulic machines. In the prologue of his *Pneumatics*—supposedly written during the first or second century CE—, Hero sets out some leading principles of his theory of matter and he provides a discussion on void, whose existence within material bodies is considered a preliminary condition required to explain the artifacts described in the work. To experimentally establish the existence of interstitial voids in all kinds of corporeal compounds, Hero lists the following cases: the sun’s light penetrating water; wine mixed with water producing a total

amount of liquid inferior to the sum of both quantities; many light rays occupying the same place at the same time.³³ At some point, he makes clear that there are voids not only in airy or liquid substances, but also in solid substances. And to illustrate this rather counterfactual claim, he cites the torpedo fish:

Again, one light traverses another [φέρεται . . . διὰ τοῦ ἐτέρου]; for, when several lamps are lighted, all objects are brilliantly illuminated, the rays passing in every direction through each other [τῶν αὐγῶν πάντη φερομένων δι' ἀλλήλων]. And indeed it is even possible to penetrate through bronze, iron, and all other bodies [καὶ διὰ χαλκοῦ καὶ σιδήρου . . . διεκπίπτει σωματῶν], as is seen in the instance of the marine torpedo.³⁴

This text has been mired in controversy ever since Hermann Diels, in an essay published in 1893, assumed that the digression on the void in the prologue to Hero's *Pneumatics* was an abbreviation of some lost work "on the void" by Strato of Lampsacus—Theophrastus' successor at the Lyceum from 288 to 268 BCE.³⁵ This view was challenged by the editor of Strato's fragments, Franz Wehrli. In the volume of the series *Die Schule des Aristoteles* devoted to Strato, Wehrli considers the latter's influence on Hero to be limited to mere technical aspects, whereas the sentence concerning the torpedo fish must be—he says—atomist in origin: he thus parenthesizes this sentence.³⁶ The extent of Hero's dependence on Strato has subsequently been the subject of a debate in the second half of the last century. In the 1960s, Hans B. Gottschalk basically shared Diels' rather optimistic evaluation of Strato's influence on Hero, but Hellmut Flashar was much more skeptical.³⁷ A similar contrast marked the subsequent Stratonian scholarship: in his book published in 1970, Matthias Gatzemeier minimalizes Hero's dependency on Strato,³⁸ whereas David J. Furley, in the 1980s, develops a slightly modified version of Gottschalk's view that very large portions of Hero's text can be regarded as directly or indirectly drawn from Strato.³⁹

Whether the fragment of Hero's *Pneumatics* goes back to Strato or not, this text provides good evidence of a feature that is characteristic of what I would call the "standard" view on the torpedo fish in the first century CE. Let us then clarify what this view holds. On the basis of a comparison between this text and Athenaeus' report on Theophrastus, a double statement can now be made. First, both passages indicate that the numbing power of the fish is sent *through* the intermediary bodies (see the preposition διὰ in both descriptions of the fish). Second, Hero's report more precisely clarifies the mode of such a transmission, in using the technical term for the local movement (φορά): the forms φέρεται and φερομένων refer to this specific kind of change that in the Aristotelian corpus is categorically distinct from other changes—alteration

(ἀλλοίωσις), growth (αὔξεισις), and diminution (φθίσις), as well as generation (γένεσις) and corruption (φθορά).⁴⁰ Following this categorization of natural changes made or suggested in Aristotle's works, one now learns that the fish's power is transmitted locally, that is, physically and from one point to another point in space. This also means that this power is corporeal⁴¹—which leads us to a third point that can be made concerning Hero's use of the torpedo fish.

On the basis of the argumentation in the prologue to Hero's *Pneumatics*, it is now clear that such a transmission of the power is possible because the body located between the animal's body and the fisherman's hands contains some interstitial voids, making local transmission possible. Thus, Hero's work has now answered the first question left open above at the end of our reading of Theophrastus (Does the torpedo fish's numbing power pass through the bodies by penetrating its pores?): Hero's reference to the fish makes it clear that the numbness thus transmitted implies a physical action that happens in a local and sequential way through the microvoids of the intermediary body. As for the second question left open (Is such a theory of matter's microvoids supposed to account for the variances in the conductivity of different kinds of things?), it cannot be answered as definitively as the first, but a "yes" answer is strongly suggested by the answer to the first question.

At any rate, these new data concerning the fish's action in Hero's *Pneumatics* impact our reading of Theophrastus, and present us with the temptation of recognizing him as a "precursor" of Hero (and of Strato), insofar as he holds to a decided atomism.⁴² Nevertheless, I think that it is particularly important to remember what Theophrastus did *not* say, to better appreciate the further evolution in the model. The same actually holds true for Hero's explanation, which in turn proves to be imprecise once compared with further descriptions of the phenomenon—as remains to be seen in what follows.

4. Derivative Uses of the Fish in Imperial Times: A Possible Medium

The idea that the power sent by the torpedo fish to the fisherman's hands falls under the category of *local change* belongs to the basic assumptions shared throughout the Hellenistic period after Theophrastus, within the Peripatetic tradition as well as outside it. A refined version of this model seems to inform two documents that I want to consider at this point and that reflect a "derivative use" of the torpedo fish—or, to put it otherwise, a reference to this particular animal in order to conceptualize other kinds of impressive natural processes. The first document is to be found in the fourth-century author Calcidius, specifically

a passage of the chapter of his *Commentary on the Timaeus* devoted to the theories of human sight.⁴³ For the Stoics—Calcidius says—visual data depend on the physical arrangements or “shaping” of matter, which are transmitted to the mind by a physical “spirit” that is extended from the eyes through the air in the shape of a cone to the object seen (the base of the cone being situated along the object, and its vertex coinciding with the place of the eyes); vision occurs when this spirit is “struck” (in French, *percuté*) in accordance with the different colors and sizes of the object, and these “percussions” are then, so to speak, “translated” to the human mind, the latter being accordingly “struck” in turn.⁴⁴ Here are Calcidius’ conclusions from this explanation:

Besides, [the Stoics] think that the mind perceives as if it were stricken by a spirit that transmits to the most internal parts of the mind what it itself suffers under the action of a complex of visible species [*qui id quod ipse patitur . . . mentis intimis tradit*], given that when it is distressed and relaxed, it announces [to the most internal parts of the mind] that the things seen are clear, whereas when it is confused and impure, it announces that they are obscure and dirty. Its affection is similar to that which affects those who are numbed due to the contact with the marine fish, the venom entering the net, the stick and the hands so as to penetrate the deepest of the sensible faculty [*siquidem per linum et harundinem perque manus serpat virus illud penetretque intimum sensum*].⁴⁵

Among the numerous testimonies on the Stoic theory of vision, this is the only one that refers to the torpedo fish, so it is not definitively certain that such a use of the torpedo fish is Stoic in origin.⁴⁶ However, Calcidius’ presentation of this model is certainly Stoic in spirit. This text makes clear that the Stoics explained sight in parallel to touch, reducing it to a corporeal process occurring throughout the spirit. Basically, this explanation runs as follows: the visual features of the object seen are perceived by the mind (*mens*) because the visual spirit goes outside the human body through the eyes to capture visual data and then carry them to the internal sense (*intimus sensus*), which is the most internal and united part of the sensitive soul. In this explanation, the torpedo fish is supposed to account for the second step of the process, namely not the transmission of the visual data from the object to the eye, but its translation from the eye to the center of perception.⁴⁷ So, the animal has an heuristic function, namely to help to clarify the role of the visual spirit in the “translation” of the information to the center of perception, by means of the following analogy: similar to the way the numbing venom produced by the fish reaches the fisherman’s mind after having entered the nets, the sticks, and the fisherman’s hands, the sense data reach the center of perception after having been conveyed in or along the Stoic visual spirit:

Fish's Venom: fish → net → sticks → fisherman's hands → fisherman's mind = Visual Data: object seen → visual spirit → perceiver's mind.

Though the analogy is expressed in a rather straightforward way, its basic function deserves closer attention, as do certain details of the model. First, the main purpose of the parallelism is, in accordance with Stoic corporealism, to insist on the corporeality of visual perception: in that respect, the sense data coming to the mind are truly comparable to the venom sent by the fish to the fisherman's mind. Second, and accordingly, both processes imply a total interpenetration between the bodies (the venom in the fisherman's hands and instruments,⁴⁸ and the visual data in the visual spirit), a kind of mixture that is supposed to make physical transmission possible in Stoic physics.⁴⁹ Third, and most importantly for us, this bodily transmission implies that the intervening bodies themselves suffer from the "passion" under consideration. Indeed, Calcidius explicitly states in the first sentence of the passage quoted above that the visual spirit is supposed to function as a transmitter *in being itself affected* by the affection it carries; accordingly, this must also be true of the medium of the torpedo fish's paralyzing action—that is, not only the fisherman's hands, but also his fishing instruments, be they nets or sticks.

Since no other independent source confirms the attribution of the passibility of the medium thesis to the Stoics, it is impossible to determine if it corresponds to the authentically Stoic view, or rather to its rendering by Calcidius. In these circumstances, a prudent attitude toward this feature is to interpret it—as we did above with the prologue to Hero's *Pneumatics*—regardless of the problematic issue of its ultimate sources, and to consider it, accordingly, as good evidence of the reading of the torpedo fish in the Imperial period. And it is from this perspective that I suggest taking into account a second text of that period, reflecting a derivative use of the torpedo fish and holding the very same assumption concerning the medium of the torpedo fish's action, namely a chapter of the treatise *On the Intelligence of Animals* (also referred to as *Whether Land or Sea Animals are Cleverer*), by the Greek historian and essayist Plutarch of Chaeronea (ca. 46–120 CE).⁵⁰ In this work, which was written sometime between 60 and 70 CE, Plutarch aims to demonstrate the existence of some kind of cleverness in animals, and in particular in marine animals. In this framework, the torpedo fish's paralyzing power is described at length in the following way:

You know, of course, the property of the torpedo: not only does it paralyze all those who touch it, but even through the net creates a

heavy numbness in the hands of the trawlers. And some who have experimented further with it report that if it is washed ashore alive and you pour water on it from above, you may perceive the numbness rising back up to the hand [του πάθους ανατρέχοντος ἐπὶ τὴν χεῖρα] and dulling your sense of touch *by way of the water which*, so it seems, *suffers a change and is first affected* [ὡς ἔοικε διὰ τοῦ ὕδατος τρεπομένου καὶ προπεπονθότος]. Having, therefore, an innate sense of this power, it never makes a frontal attack or endangers itself; rather, it swims in a circle around its prey and discharges its shocks as if they were darts, thus poisoning first the water, then through the water the creature which can neither defend itself nor escape, being held fast as if by chains and frozen stiff.⁵¹

This description has to be understood in its very argumentative framework, namely insofar as it is aimed at establishing the innate sense (ἔχουσα σύμφυτον αἴσθησιν [CA 978C8]) that this fish has of its power, in order to infer its cleverness. In this framework, the very detailed character of the description of the torpedo fish is all the more striking. Why was Plutarch interested in specifying that the numbing power would “rise back up to the hand” (CA 978C5) and that the water “suffers a change and is first affected” (CA 978C6)? I think that one can reasonably answer that such details were of no interest as such. Indeed, although it was necessary to give a convincing description of the process at stake in order to assign true intelligence to the fish, it was certainly not necessary to give *these* particular details; the argument could have been as convincing with any description of the process, provided that it was sophisticated and efficient enough to attest to some kind of intelligence. To put it otherwise: since the aim of Plutarch’s text is *not* to explain the power of the torpedo fish at a physical level, the idea that the numbness travels through the water to the hands, and that the water is itself affected, are not in themselves necessary for the argument; thus, these ideas probably correspond to some “available” views or commonplaces about the fish.⁵²

If what I have just said is correct, it is now reasonable to search for the origin of the two ideas just highlighted, and then to situate them accordingly in the ancient conceptual trajectory of the torpedo fish. Concerning the origin of the idea, it is useful to have a look at some ancient sources on which Plutarch could draw to write his tract *On the Intelligence of Animals*, and in particular, compendia or encyclopedic works on zoology.⁵³ The most ancient work of that kind extant, namely the compendium of Aristotle’s works on animals by Aristophanes of Byzantium (ca. 257–185/180 BCE), contained at least two extracts on the torpedo fish, but these passages concern the animal’s reproduction and some taxonomical issues, and not at all the two ideas highlighted

above in Plutarch.⁵⁴ The same must be said of a later encyclopedic work that could reflect sources used by Plutarch, namely *On Animals* by Claudius Aelianus (ca. 175–235 CE): there is no explanation of the torpedo fish’s power at a physical or physiological level.⁵⁵ However, a slightly earlier source offers a more interesting feature: a passage of Oppian of Corycus’ didactic poem on fish and on fishing (*Haliutica*), composed in the second century CE, says that the pain that gives the torpedo its name “runs straightway through the horse-hair and through the rod” before “lighting in the right hand of the fisher.”⁵⁶ Such a claim recalls Plutarch’s view that the torpor “rises back up to the hand,”⁵⁷ and could point to some common source in the tradition of the Lyceum.

Hence, the sources—if any—that could have influenced Plutarch’s reading of the fish are probably to be found elsewhere than in the biological tradition. And indeed, the two particular features highlighted in Plutarch’s strategy to illustrate the complexity of the process at stake with the torpedo fish can be precisely traced back in the “philosophical” history of this animal at the Lyceum as well as in Calcidius. The first feature, namely the idea that the numbing power is transmitted to the hand in a way that is truly physical—as is indicated by the phrasal verb τρέχω (τοῦ πάθους ἀνατρέχοντος [CA 978C5])—clearly belongs to the picture from the Lyceum, with Theophrastus and possibly Strato (if one admits that this author lies behind Hero’s text).⁵⁸ Things are different, however, with the idea that the body that serves as an intermediary between these bodies, namely the water, is itself affected and changed (διὰ τοῦ ὕδατος τρεπομένου καὶ προπεπονθότος [CA 978C6]). No matter how one understands the *apparent* dimension ascribed to this phenomenon (ὡς ἔοικε: “it seems”), this feature is not present in Peripatetic sources of that time, though we encounter it in Calcidius’ report on the Stoic doctrine of vision. It remains difficult to say if this idea originally belongs to Stoic doctrines on vision, or if it rather constitutes a feature proper to some medio-platonist view on the fish.⁵⁹ At any rate, these two features, which form the “standard” view on the torpedo fish in the first century CE, will be challenged by Galen of Pergamon.

5. The Galenic Turn: Alteration and the Neutralization of the Medium

The tradition of derivative uses of the torpedo fish, documented in two authors of the Imperial period—Plutarch of Chaeronea (second century CE) and Calcidius (fourth century CE)—can be considered typical for that period, where the fish is referred to as a paradigm for reflection on other phenomena, mostly physiological in nature. A text that is signifi-

cant in this respect is Pliny's *Natural History*, a zoological compilation whose preface is dated 77 CE; that is, around the time when Plutarch's treatise *On the Intelligence of Animals* was composed.⁶⁰ In a chapter of book 32 on pharmacology, the power of drugs is established in reference to the torpedo fish as follows: given that this animal, Pliny says, is able to affect our limbs at a distance by emitting his force (*vis*) "by smell alone, and by a certain kind of breath from the creature's body [*odore tantum et quadam aura corporis sui*]," what limits the potency of all remedies?⁶¹ Such a use of the torpedo fish in a physiological framework is more frequent in Galen of Pergamon, a physician who advocated the necessity of being a philosopher, and whose physiological and philosophical thought has become the subject of increasing interest in the last decades.

It is worth noticing that the case of the torpedo fish was not taken into consideration in the books on Galen written by historians of *philosophy*, and that this is the case even in the studies recently published concerning his natural philosophy; apparently, this animal's action does not belong to the topics that are nowadays considered philosophical.⁶² Galen makes use of the fish in the discussion of two particular issues: the explanation of the causes of asphyxia, and that of the causes of a kind of hysteria. Hence, the animal attracted some attention in the studies written by specialists of ancient physiology. Indeed, the torpedo fish is mentioned in the numerous and detailed studies on Galen's system of medicine published by Rudolph E. Siegel in the 1960s and 1970s.⁶³ More recently, Galen's texts that mention the fish appear in studies on the same topic by Armelle Debru, whether incidentally in her book on Galen's physiological thought or in more depth in two essays published thereafter, which are entirely devoted to this particular case as a pathological model.⁶⁴

In what follows, I want to offer a reading of the relevant texts that does not contradict these readings, but that goes further and deeper in its analysis, using the micro-historical approach. Let us consider these documents in chronological order, starting with Galen's treatise *On the Use of Breathing*, supposedly written during the first Roman period (162–166 CE).⁶⁵ In this treatise, which is devoted to the mechanism of respiration as well as to its role in the life of the animal as a whole organism, the physician develops a notion of respiration as a form of combustion, based on a thorough discussion of the existing view set forth and classified in its first chapter. Two main options are thus identified: (a) the idea that the use of breathing lies in the *substance* of air, and (b) the idea that it lies in its *quality*. Option (a) is then criticized (chapter 2), and option (b) is adopted (chapters 3–5), finally leading to the idea that organisms actually breathe to preserve their innate heat.⁶⁶

In the course of this section, there is in chapter 4 a fictive dialogue with some followers of Erasistratus, who claimed that asphyxia was caused by the inappropriate size of the air's atoms:

“But,” they say, “if you find fault with Erasistratus’ explanation, tell us another.” I reply: “If you will first tell me how it is to be explained that we are numbed when we touch the sea-animal the crampfish. If you are unable to say anything, perhaps you will agree to my saying so much, that the numbing power of the animal upon those that touch it is so *strong that the affection easily runs back up to the fisherman’s hands through the trident implanted in it* [ὥστε καὶ διὰ τοῦ πεπηγότος αὐτοῦ τριόδοντος εἰς τὰς χεῖρας τῶν ἀλιέων ῥαδίως ἀνατρέχειν τὸ πάθος]. Now, will you agree that there are certain qualities and powers, of which one bring numbness, another torpor, another chilling, another putrefaction, and other some other ill, and will you nevertheless deny that there is any such power in air?”⁶⁷

As in the Stoic explanation quoted by Calcidius, and also in Pliny’s *Natural History*, the torpedo fish illustrates the ability of one affection (the visual data or the healing power of a drug) to be transmitted through several bodily parts (the center of perception or the limb to be healed). But contrary to the Stoics and Pliny, Galen does not stress the corporeality of the process at stake, and he makes no use of any bodily substance to explain the action of the fish. Certainly, the verb used to characterize this particular kind of transmission (ἀνατρέχειν) is the same as that used in Plutarch’s treatise *On the Intelligence of Animals*, and this term certainly has some corporeal, or at least some local, connotation (“to run”). However, this connotation, far from being emphasized, is rather mitigated by the absence of any bodily substance in Galen’s description. Surely, this absence as such could be judged unimportant if the story just started there. But a further appearance of the torpedo fish in the Galenic corpus precisely suggests that this silence indicates some “positive” content—that is, that Galen had decided on this option over some other available options—concerning the kind of process at stake in the case of the fish.

This further appearance of the torpedo fish occurs in Galen’s treatise *On the Affected Parts*, written between 192 CE and Galen’s death.⁶⁸ Following the example of Archigenes who had composed a treatise under the same title, Galen tries to put therapy on a rational basis by establishing a logic of the diagnosis. The torpedo fish already appears (LA 72; AP 44) in the section devoted to general pathology (books 1–2), but its most interesting appearance occurs in a later section (books 3–6) devoted to a description of diseases of the body’s physiological systems and to their diagnoses. Chapter 5 of book 6 contains a description of the so-called “uterine apnea,” a hysterical disease supposedly caused by the

retention of semen in the woman's body as a result of excessively thin menstruations. Galen faces a possible objection to this explanation: is it—he asks—rational to consider such violent symptoms as resulting from such a minor cause located in such a small part of the body (i.e., the uterus)? Yes, he answers: certain substances present in very small bodily parts can affect the whole of a large organism by just their quality.⁶⁹ It is to establish this possibility that he quotes the torpedo fish, along with other examples taken from the natural world that can be “daily observed.”

The aim of this list is to make plausible his theory that the excessive retention of semen may be a cause of many illnesses. The method applied here by Galen consists in taking as evidence many examples of processes indicating the great power that can be exerted by very small things; in so doing, the cause of the uterine apnea will not be “astonishing” anymore, because all the processes mentioned are actually more astonishing (θαυμασίωτερον [LA 421; AP 185])—though experienced “daily.” This argument consists in a “proof” not in the demonstrative sense of the term,⁷⁰ but as a kind of strategy that is similar to that followed by Pliny in book 32 of his *Natural History*, concerning the power of drugs, which anticipates a type of argument that Alexander of Aphrodisias will name παραμυθία, a sort of “persuasion.”⁷¹ However, compared to Pliny's corresponding passage, Galen develops a much longer and more complex series of examples. While this series has been generally treated in the secondary literature as a neutral list of examples, I would like to try to understand the rationale for its organization, highlighting some details in the description of each case.

Galen's list first refers to the bite of a venomous spider (LA 421; AP 185); second, to the bite of the scorpion (ibid.); third to the action of the torpedo (LA 421–2; AP 185–6); and fourth, to the attractive power of the magnetic stone (LA 422; AP 186). The first example, that of the spider's bite, attests to the power of “a small amount (of venom)”: once introduced into the body “through a very narrow hole” (LA 421; AP 185), it is able to cause sickness in the whole body.⁷² Secondly, “the effect produced by scorpions” is presented as “even more astonishing” (ibid.), because the most violent symptoms—namely the whole body's falling into faintness—occur “very rapidly” (σφοδρότατα [ibid.]). Despite the fact that this affection seems to be caused without any physical intromission (“the sting seeming not to be punctured” [ibid.]), Galen finally admits the possibility that the cause of the sickness might be a “certain spirit” or “tenuous humor” (πνεύματος τινος ἢ λεπτῆς ὑγρότητος [ibid.]).⁷³ As for the third and fourth cases, they include the torpedo fish, and are described and theorized in much more depth:

Some do think that some substances might, even by the mere contact [καὶ τῷ ψαύσαι μόνον], alter the bodies that are touched by the mere potency of their qualities; such a nature can also be seen in the case of the marine torpedoes, that have so strong a power [δύναμιν ἰσχυρὰν οὕτως ἔχουσαν] that the alteration is communicated to the hands even through the fisherman's trident [ὥς καὶ διὰ τοῦ τῶν ἀλιέων τριόδοντος ἀναδιδομένης τῆς ἀλλοιώσεως εἰς τὴν χεῖρα], and that the hand is numbed at once [παραχρήμα]. These are signs [τεκμήρια] that attest sufficiently that a little amount of substance might produce important alterations by a mere contact [μόνον τῷ ψαύσαι]. This happens also in the case of Heracles' stone, which is called *magnetis*: when a piece of iron which comes in contact with the magnet became adherent without being tied to it, another second piece will equally adhere by contact to the first piece, and so it is with a third one which touches the second iron. (LA 421–2; AP 185–6)

Let us first compare this passage with the description of the fish in the treatise *On the Use of Breathing*. A first change lies in the description of the transmission: instead of the Plutarchean term “to run back” (ἀνατρέχειν) used in the previous treatise, here the term ἀναδίδομαι [LA 422; AP 185] suggests a less corporeal kind, or at least a more indefinite kind of transmission—which I have translated as “communicate.” Secondly, the Greek term rendered by “alteration” (ἀλλοιώσις [ibid.]), which is also new in this text, confirms the incorporeality of the transmission at stake by specifying its category; in the categorization taken up by Galen, “alteration” means a change related to quality and opposed to the mere local change.⁷⁴ Thirdly, the presence of the case of iron attracted by magnetic stones, as a second instance of alteration after the torpedo fish, is worth noticing: in Galen's conceptual framework, this typical case of action at a distance is never explained in terms of the penetration of “breath” or “humors.” Hence, in comparison with Galen's earlier treatise on respiration, this text marks a clear-cut specification of the categorical status of this change: contrary to previous Peripatetic scholars who assumed that the numbness was transmitted locally (see §2 above), Galen considers it an alteration. Moreover, this text seems to mark a decisive emphasis on the incorporeality of the phenomenon at stake in the case of the numbness caused by the fish.

Let us now focus on the whole relevant passage in Galen's treatise *On the Affected Parts*, namely the list of examples. On the basis of the details just highlighted, the list of examples chosen by Galen seems not only to contrast two cases of local change with two cases of alteration, but to distinguish different types of each of these categories, at least in the category of local change. In so doing, the text is actually progressing in a *crescendo* from a corporeal to a more incorporeal kind of transmission. In this progression, the torpedo fish's ability to numb is situated in a

middle position between the cases of “biting” and magnetism. Indeed, on the one hand, the torpedo fish distinguishes itself from the insects by its ability to exert its power without any material stuff being introduced into the affected body, while the biting by insects was described in terms of the penetration of some venom through the holes of the organic body—an explanation formulated categorically for the spider (LA 421; AP 185), and less categorically for the scorpion (*ibid.*). When specifically compared, however, to the scorpion alone, the fish seems to present a further distinctive feature, namely its ability to cause its effects “at once” (*παραχρήμα* [LA 422; AP 185]), while the scorpion’s action seems too ambiguous in this respect: after having said that the scorpion transmitted its venom “very rapidly” (*σφοδρότατα* [LA 421; AP 185]), the author says that it does so “immediately” (*εὐθέως* [*ibid.*]). This ambiguity seems to be linked with Galen’s hesitation as to whether the scorpion’s action proceeds through some corporeal intromission or not.⁷⁵

On the other hand, it is less easy to determine if the intervention of the magnetic stone at the end of the list, after the torpedo, does in fact introduce a further distinction into the category of qualitative changes. At any rate, it remains clear that the magnet constitutes, in Galen’s argument, a second case of a process contrasting with the actions of the insects listed before, in that the magnet’s action happens in an incorporeal way. Actually, only one aspect of the stone’s “marvelous” action seems to be considered here by Galen: not its attractive power as such (which produces its action at a distance), but its ability to transmit such a power to pieces of iron. In this particular respect, the action of the fish and that of the magnet stone share these common features: (1) The two processes happen without any material or bodily modification in the substances at stake, but rather by a qualitative change, or alteration. (2) In both processes, a contact between the “active body” (the magnet and the fish) and the receptor of the quality transmitted by it (the pieces of iron and the fishermen’s bodies) is at the same time necessary *and* sufficient to cause the process.⁷⁶ Therefore, the torpedo fish’s action, as well as that of the magnetic stone, seems to exceed, in a sense, the initial purpose of Galen’s argument, which was just to illustrate that a small amount of substance can cause large effects. The last two items confirm that the list contains more than a loose enumeration of marvelous facts where a little amount of substance causes large-scale bodily effects; this list seems to suggest, in addition to that, some tentative categorization of kinds of physical transmission. I think that this categorization, which is implicit in this text, constitutes a subtle but important refinement in the explicit, and so to speak “official,” catego-

rization of changes that is generally acknowledged on the basis of Galen's explicit statements.

Finally—and even more importantly for us—, in Galen's treatise *On the Affected Parts*, as well in his earlier treatise *On the Use of Breathing*, there is a further detail that strikes the reader who has in mind the appearances of the torpedo fish in the Stoics quoted by Calcidius and Plutarch (as seen in §3 above): namely Galen's silence regarding the role played by the medium in the process and its "reaction" to the quality conveyed through it. When one considers the subsequent debates concerning the fish, such a silence is at least as important as the explicit claims made by the physician. Indeed, Galen's silence regarding the condition and the very role of the medium in the transmission at stake in the case of the fish's action proves to have been creative. In a study complementary to the present essay that is now in preparation, I suggest that it is on the basis of Galen's dynamics and his treatment of the torpedo fish that the Aristotelian commentator Alexander of Aphrodisias was allowed to explicitly claim—for the very first time and in a cosmological context that is also new for the fish—that the medium of a movement can play this role even if it remains itself unaffected by the affection that is transmitted through it.⁷⁷ This innovative interpretation of the torpedo fish gave rise to many new debates inside the Peripatetic tradition and outside it—but that is another story.⁷⁸

6. Concluding Note on the Interest of a Micro-Intertextual Method

The trajectory of the torpedo fish just reconstructed shows two complementary aspects. On the one hand, there were attempts to clarify the ontology of the process at stake—that is, to define the nature of the numbness and its mode of transmission: such attempts are attested in the Lyceum with Theophrastus and Clearchus, who basically construed the transmission of the numbness as a form of locomotion. On the other hand, the fish was used to indirectly reflect on other processes: such uses are present in Plato (to illustrate the paralyzing effect of the Socratic method), as well as in Hellenistic and Imperial sources, where the torpedo served to experimentally attest to the existence of interstitial voids in matter (Hero, possibly following Strato), to testify and exemplify the cleverness of animals (Plutarch, seemingly following an earlier tradition), and above all, to clarify, by analogy or by mere comparison, some special cases of transmission internal to organic bodies. These analogical and comparative uses of the fish gave occasion to modify the interpretation of its action. A decisive step in that respect is indi-

cated in Calcidius' report concerning the Stoic explanation of the transmission of the visual data to the internal sense, by analogy with the transmission of the fish's action to the fisherman's mind: on both sides of the analogy, the intermediaries of the transmission (the fisherman's instruments and the visual spirit) are assumed to be themselves affected. A similar assumption is expressed in a passage of Plutarch, where we considered that it was an already established commonplace about the torpedo fish. This pattern, along with the idea that the transmission of the numbness is local, were challenged by Galen when using the fish as a tool to reflect on other kinds of physiological phenomena. In Galen's late speculation (as reflected in his treatise *On the Affected Parts*), the numbness is caused by the fish independently of any bodily stuff: it does not consist in a locomotion, but is rather an alteration that is communicated from one point to another without any sequential transfer throughout the medium. Shortly thereafter, a new debate arose, starting with Alexander of Aphrodisias and continuing with Plotinus, Themistius, and Averroes. These discussions—which remain to be studied—concern the issues left open at the end of the first episode reconstructed above: Must the medium be affected to play its role in the process? If yes, in what ways must it be affected?

* * *

For now, it is time to end this story and come back to the following question: what kind of interest does such a micro-intertextual approach hold? In what follows, I distinguish various kinds of relevance, depending on the aspects taken into consideration in the fish's story that I have reconstructed. Firstly, this method makes it possible to understand some texts that would otherwise have almost no conceptual interest, because they are too short to allow for an isolated interpretation, or because they do philosophy in a way that is less direct and less explicit than manifestly "philosophical" texts. An instance of the first kind of text is Athenaeus' report on Theophrastus' description of the torpedo fish, which could receive some theoretical content only once compared to the appearances of the same kind of fish in Aristotle and the subsequent tradition. As for the second case, it is exemplified by what we discovered in Galen's texts about the fish and in particular in his treatise *On the Affected Parts*. Even if these passages do not 'officially' reflect on the process by which the numbness is caused by the fish (this is certainly not the author's main purpose in these texts!), the micro-intertextual approach reveals that they do so indirectly, by the very way in which this action is treated in comparison to other phenomena—from the biting insects to electromagnetism. In this case, as in the case of very short documents like Athenaeus' report on Theophrastus, the historian

of philosophy decides to focus on what these texts actually *do*, regardless of the supposed *intention* of the author. Indeed, a characteristic feature of “valuable” works could be that they go beyond the effects planned by their author. At any rate, the micro-intertextual method can supplement the standard approaches of ancient thought that basically focus on intentional conceptual distinctions and explicit statements.

A second kind of interest of the method is that it makes palpable the important role played by silences in the construction of a philosophical tradition. Indeed, the case of the torpedo fish illustrates the fact that what is omitted in a given explanation can be as important and ripe for philosophical interpretation as what is explicitly and unambiguously stated. Of course, this is not the case for all kinds of silence, and it is precisely one of the tasks of the historian of ideas to locate the significant silences and to analyze them accordingly. Significant silences appear against the background of a micro-intertextual approach to the texts; that is, by means of their microscopic comparison with other texts written either before or after them. Compared to previous claims in earlier texts, the silences located in a given text can be considered “eloquent”—insofar as they correspond to some positive option of their author—, while compared to later claims, they can be “productive,” as far as they stimulated further philosophical imagination in the subsequent tradition. These two possible significances of silence have been shown in Galen’s reading of the torpedo fish: on the one hand, what this physician did not say about the mode of the transmission at stake in this process, and in particular about the condition of the intermediary body (the fishing instruments and the water), was shown to be *eloquent* when compared to the ancient (Peripatetic) and contemporary (Plutarchean) views on the torpedo fish’s action as a corporeal process, and to the thesis of the passibility of the medium in Plutarch and in Calcidius’s report on the Stoic doctrine of vision. On the other hand, the same silences found in Galen prove to be *productive* once compared to the subsequent discussions of the torpedo fish, insofar as these debates precisely concern the very condition of the supposedly impassible medium of such a transmission.

The two kinds of interest of this approach share a common characteristic, which can be considered a third and more general interest of the micro-intertextual approach: this method makes apparent that a reader of texts (ancient or otherwise) cannot escape comparison, or to put it otherwise, that the “meaning” of a document is always produced by the reader in relation to a complex network of texts activated in his mind by the reading process as such. The approach just illustrated makes apparent that such an assumption, which has been admitted for a long time within (postmodern) literary scholarship, can also be taken

seriously when doing history of ideas or history of philosophy. Of course, in this case, the reading process and the historical construction that results from it correspond to a highly rational, conscious, and self-controlled activity, by which the reader deliberately selects the features that he chooses to highlight in the documents and to *construct* their meaning accordingly. But the role played by “construction” is as important—at least—in less conscious and less controlled cases of reading, be it in philosophy or in other disciplines. To put it in a nutshell: by carefully applying this method, the historian of ideas who adopts the micro-intertextual approach admits, and at the same time illustrates, the fact that any single claim—as well as any potentially significant silence—makes sense in relation to other claims. In other words, in philosophy as in science and in any other activity of human thought, everything is a matter of interpretation (which doesn’t mean, of course, that just any interpretation is possible). This is actually a truism. But it is perhaps not a truism to reflect on the conceptual and methodological consequences of a truism. In this paper, I have simply tried to give an illustration of what the history of ideas can or could be, and in doing so, I hope to have shown that, if it is true that a little amount of history can get us away from philosophy, it is even more true that a substantial amount of history can bring us closer to it.

NOTES

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1. For a survey of general histories of philosophy since the Renaissance, see Giovanni Santinello, ed., *Storia delle storie generali della filosofia* (Brescia: La Scuola, 1979); partially translated as Giovanni Santinello et al., eds., *From Its Origins in the Renaissance to the ‘Historia Philosophica’*, vol. 1 of *Models of the History of Philosophy* (Dordrecht: Kluwer, 1993), and Giovanni Santinello and Gregorio Piaia, eds., *From the Cartesian Age to Brucker*, vol. 2 of *Models of the History of Philosophy* (Dordrecht: Kluwer, 2011).

2. On the history and prehistory of this tradition, see Carlo Ginzburg, "Microhistory: Two or Three Things That I Know About It," trans. John Tedeschi and Anne C. Tedeschi, *Critical Inquiry* 20:1 (1993), pp. 10–35; also published as chap. 14 of *Threads and Traces: True False Fictive*, trans. Anne C. Tedeschi and John Tedeschi (Berkeley: University of California Press, 2012), pp. 193–214.
3. The first appearances of the terms "intertextual" and "intertextuality" are to be found in Julia Kristeva's articles "Pour une sémiologie des paragrammes," *Tel Quel* 29:1 (1967), pp. 53–75; and "Bakhtine: Le mot, le dialogue et le roman," *Critique* 239:1 (1967), pp. 438–65, republished as "Le mot, le dialogue et le roman," chap. 3 of *Σημειωτική: Recherches pour une sémanalyse* (Paris: Editions du Seuil, 1969), pp. 143–73. See also Roland Barthes, "Texte (théorie du)," in *Encyclopædia Universalis*, 1st ed., ed. Claude Grégory (Paris: Encyclo-pædia Universalis, 1973), vol. 15, pp. 1013–7.
4. For a linguistic analysis of this kind of argument, see Oswald Ducrot, "L'argumentation par autorité," chap. 7 of *Le dire et le dit* (Paris: Minuit, 1984), pp. 149–69. Actually, the importance of authority was generally far more recognized in the middle ages than in antiquity (as is the case, e.g., in Antoine Compagnon, *La seconde main: ou le travail de la citation* [Paris: Editions du Seuil, 1979], pp. 95–231), but even a little familiarity with ancient philosophy is sufficient to see that the same holds true for this period as well.
5. Indeed, the interpretation of a text, A, in the light of a text, B, that is previous or contemporary to A gives rise *a priori* to two main kinds of intertextuality: (1) A contains some kind of unambiguous reference to B, be it by a quotation of a part of B, or an explicit or implicit mention of the views expressed in B ("Plato says that . . ." or "some affirm that . . ." or "it is not true to claim that . . ."); (2) A contains nothing like that, but only similarities, e.g., in the philosophical issue considered and in the way in which it is addressed, in which case the micro-intertextual historian might sometimes postulate an intertextuality between the texts and read A in the light of B, to better understand A. A similar distinction was made by Gérard Genette, *Palimpsestes: La littérature au second degré* (Paris: Editions du Seuil, 1982); *Palimpsests: Literature in the Second Degree*, trans. Channa Newman and Claude Doubinsky (Lincoln: University of Nebraska Press, 1997). But Genette restricted the notion of "intertextuality" to case (1), where the presence of a text in another is *actual*, whereas (2) is labelled "transtextuality," a category that is larger and includes intertextuality. I will not discuss Genette's further classifications, which are—despite their great interest—hardly useful for the ancient argumentative texts I take into account here. Even the two categories distinguished above can't always be clearly separated in these texts: I have simply made this distinction to stress the fact that my method, by also including cases of (2), is not necessarily dependent on the existence of a clear reference, historically attested, from one text to another.
6. In this case, the intertextual relation between A and B is *necessarily* a result of the historian's interpretation—whereas in case (2) above (see n. 5), it is only *possibly* so. This "anticipative" use of intertextuality was

developed throughout the 1970s by Michael Riffaterre in “La trace de l’intertexte,” *La Pensée: revue du rationalisme moderne* 215:1 (1980), pp. 4–18. However, my own application of such an anticipative intertextuality relies on different methodological and ideological assumptions.

7. To put it otherwise: I recognize the importance of cultural history for a convincing analysis of discourse. In short, the theoretical presuppositions of my method can be traced back to some achievements of discourse analysis developed after Charles Sanders Peirce and Ferdinand de Saussure, in particular to Michel Foucault’s *Les mots et les choses: une archéologie des sciences humaines* (Paris: Gallimard, 1966); *The Order of Things: An Archaeology of the Human Sciences* (New York: Pantheon, 1970); and *L’archéologie du savoir* (Paris: Gallimard: 1969); *The Archaeology of Knowledge*, trans. A. M. Sheridan Smith (London: Routledge, 1972). On some of these basic presuppositions, see Foucault’s interview with André Bertin at the Université Catholique de Louvain in Belgium on May 7, 1981, recently published as Michel Foucault, “Une histoire de la manière dont les choses font problème,” in *Critique de la raison criminologique*, ed. Didier Bigo et al. (Paris: L’Harmattan, 2014), pp. 99–109, esp. 107. It must be noted that this interview has not been revised by Foucault, and was transcribed on the basis of a recording.
8. See Marco Piccolino and Marco Bresadola, “Volta’s Research on Electric Fishes and the Invention of the Electric Battery,” §4 of “The Electrophysiological Work of Alessandro Volta,” chap. 8 of *Shocking Frogs: Galvani, Volta, and the Electric Origins of Neuroscience*, trans. Nicholas Wade (Oxford: Oxford University Press, 2013), pp. 249–68; *Rane, torpedini e scintille: Galvani, Volta e l’elettricità animale* (Torino: Bollati Boringhieri, 2003).
9. An overview of the fish’s appearances is given by Stanley Finger and Marco Piccolino, *The Shocking History of Electric Fishes: From Ancient Epochs to the Birth of Modern Neurophysiology* (Oxford: Oxford University Press, 2011).
10. In accordance with the methodological assumptions made above, I naturally do not aim at an exhaustive account of the mentions made of the animal in ancient times; rather, I purposely select some texts that are relevant for constructing a line of discussion that is able to illustrate the method I am advocating.
11. See Wilhelm Capelle, “Narke,” in *Paulys Realencyclopädie der classischen Altertumswissenschaft*, ed. Friedrich Pauly and Georg Wissowa (Stuttgart: J.B. Metzler, 1935), vol. 16, pp. 1719–21. The genus “torpedo” is nowadays ranked under the family of the *torpedinidæ*, the order of the *torpediniformes*, and the class of the *elasmobranchii*. Among the most common species, there are the *torpedo torpedo* (common torpedo), the *torpedo marmorata* (marbled electric ray) and the *torpedo nobiliana*.
12. See, for instance, the Greek rhetorician Aelian (175–235 CE): “The fish known as Torpedo produces the effect implied in its name on whatever it touches and makes it ‘torpid’ or numb” (Aelian, *On the Characteristics of the Animals*, trans. Alwyn Faber Scholfield [Cambridge: Harvard

- University Press, 1971], I.36, vol. 1, p. 55); and “I have often heard my mother say, when I was a child, that if a man touches a Torpedo, his hand is seized with the affliction corresponding to its name (torpor)” (Aelian, *On the Characteristics of the Animals*, IX.14, vol. 2, p. 233).
13. Dominic Scott, for example, in “The Stingray: 79e–80d,” chap. 6 of *Plato’s Meno* (Cambridge: Cambridge University Press, 2006), pp. 69–74, considers *Men.* 79E5–80D as a unit. Jane M. Day, by contrast, in her introduction to *Plato’s Meno in Focus*, ed. Jane M. Day (London: Routledge, 1994), pp. 1–4, integrates this part into a larger section covering *Men.* 79E5–86C3.
 14. Plato, *Meno*, in *Plato: Meno and Phaedo*, trans. Alex Long, ed. David Sedley and Alex Long (Cambridge: Cambridge University Press, 2011), 80A1–B2; trans. mod.
 15. See Harold Tarrant, *Recollecting Plato’s Meno* (London: Duckworth, 2005), pp. 30–4.
 16. On this particular view of education and teaching, see Hannah Arendt, “Thinking and Moral Considerations,” *Social Research* 38:3 (1979), pp. 431–4, where she discusses such a conception of education in reference to the electric fish in the *Meno*. I thank Professor Richard J. Bernstein for bringing this text to my attention.
 17. In other words, the female torpedo fish becomes viviparous after having laid her eggs. On this, see Pierre Louis’ note on the text in Aristotle, *Histoire des Animaux*, trans. and ed. Pierre Louis (Paris: Les Belles Lettres, 1968), vol. 2, p. 86n. 3.
 18. Aristotle, *History of Animals*, trans. David M. Balme (Cambridge: Harvard University Press, 1991), vol. 3, VIII(IX).37, 620b19–24.
 19. On the place of the *History of Animals* in Aristotle’s biological enterprise and the criteria of the corresponding classification, see most recently, Allan Gotthelf, *Teleology, First Principles, and Scientific Method in Aristotle’s Biology* (Oxford: Oxford University Press, 2012), pp. 261–92.
 20. See Steven Douglas Olson, introduction to Athenaeus, *The Learned Banqueters*, trans. Steven Douglas Olson (Cambridge: Harvard University Press, 2006), vol. 1, pp. vii–xvi.
 21. Athenaeus, *The Learned Banqueters*, trans. Steven Douglas Olson (Cambridge: Harvard University Press, 2008), vol. 3, bk. VII, 314A8–314E2; this section has recently been translated separately into French as Athenaeus of Naucratis, *Mots de poissons: le banquet des sophistes, livres 6 et 7 d’Athénée de Naucratis, traduction et commentaire*, trans. Benoît Louyest (Villeneuve d’Ascq: Presses Universitaires du Septentrion, 2009); the passage that concerns us appears on p. 187.
 22. Athenaeus, *The Learned Banqueters*, vol. 3, bk. VII, 314A7–B2.
 23. *Ibid.*, 314C3–D1.

24. For a recent account of Clearchus' biography and origin, see Stavros Tsitsiridis, *Beiträge zu den Fragmenten des Klearchos von Soloi* (Berlin: De Gruyter, 2013), pp. 1–8.
25. The full passage reads: “Clearchus of Soli in his *On the Electric Ray* offers an explanation of this; but because his remarks are rather extended, I have forgotten them, and I refer you to the treatise itself” (Athenaeus, *The Learned Banqueters*, vol. 3, bk. VII, 314C4–6).
26. The testimonies on Clearchus have been edited by Fritz Wehrli; see Clearchus, “Frag. 105,” in *Klearchos*, vol. 3 of *Die Schule des Aristoteles: Texte und Kommentar*, ed. Fritz Wehrli (Basel: Schwabe, 1948), pp. 36–9, for the torpedo fragment, which appears in the section on natural philosophy. Other extant fragments suggest that Clearchus was mostly interested in ethics and in natural philosophy. See Jean-Pierre Schneider, “Cléarque de Soles,” in *Babélyca d'Argos à Dyscolius*, vol. 3 of *Dictionnaire des philosophes antiques*, ed. Richard Goulet (Paris: CNRS Editions, 1994), pp. 415–20; Tiziano Dorandi, “Le traité *Sur le Sommeil* de Cléarque de Soles: Catalepsie et immortalité de l'âme,” *Exemparia Classica* 10:1 (2006), pp. 31–52.
27. Athenaeus, *The Learned Banqueters*, vol. 3, bk. VII, 314C4–6. This translation has been slightly modified insofar as I have substituted the original “electric ray” with the term “crampfish,” and I have rendered more clearly the insistence of the Greek text on the fact that this fish “can send its power *even* through sticks and through fishing spears.” This testimony is labelled “fragment 369” in the catalog of sources published as Robert Sharples, ed., *Sources on Biology (Human Physiology, Living creatures, Botany: Texts 328–435)*, vol. 5 of *Theophrastus of Eresus: Sources for His Life, Writings, Thought and Influence*, trans. and ed. William Fortenbaugh, Pamela M. Huby, Robert Sharples, and Dmitri Gutas (Leiden: Brill, 1995), pp. 100–1.
28. Except for Sharples' inevitable but short discussion of the corresponding fragment in his catalog of the sources on Theophrastus (see n. 27 above)—where he criticizes the reading according to which this author explained the torpor as the result of cold—I have found no mentions of the torpedo fish in the following studies or collections: Ingemar Düring, ed., *Naturphilosophie bei Aristoteles und Theophrast: Verhandlungen des 4. Symposium Aristotelicum veranstaltet in Göteborg, August 1966* (Heidelberg: Lothar Stiehm, 1969); Johannes M. van Ophuijsen and Marlein van Raalte, eds., *Theophrastus: Reappraising the Sources* (New Brunswick, NJ: Transaction Publishers, 1998); David Sider and Carl Wolfram Brunschön, eds., *Theophrastus of Eresus: On Weather Signs* (Leiden: Brill, 2007); and William Fortenbaugh and Georg Wöhrle, eds., *On the Opuscula of Theophrastus* (Stuttgart: Franz Steiner, 2002). On the reception of Theophrastus' treatise *On Biting and Venomous Creatures* in the writings of Priscian of Lydia, see Arnaud Zucker, “Théophraste à mots découverts: *Sur les animaux qui mordent ou piquent* selon Priscien,” in *Culture classique et christianisme: Mélanges offerts à Jean Bouffartigue*, ed. Danièle Auger and Étienne Wolff (Paris: Picard, 2008), pp. 331–40.

29. See Theophrastus, *On Stones*, in *Theophrastus: De Lapidibus*, trans. and ed. D.E. Eichholz (Oxford: Clarendon Press, 1965), chap. 1, §1, pp. 56–7; see pp. 86–7 for further references and commentary.
30. See Hans B. Gottschalk, “The Authorship of *Meteorologica*, Book IV,” *The Classical Quarterly* 11:1 (1961), p. 72; “*De Coloribus* and Its Author,” *Hermes: Zeitschrift für klassische Philologie* 92:1 (1964), p. 80. See also Peter Steinmetz, *Die Physik des Theophrast von Eresos* (Ph.D. diss., Saarland University, 1964), pp. 170–1. Steinmetz bases his conclusions on Theophrastus’ *De Igne*, §§42, 45, 49, and 65 (see n. 31 below). See also Hans B. Gottschalk, “Theophrastus and the Peripatos,” in *Theophrastus: Reappraising the Sources*, p. 286.
31. Victor Coutant, introduction to Theophrastus, *De Igne: A Post-Aristotelian View of the Nature of Fire*, trans. and ed. Victor Coutant (Assen: Van Gorcum, 1971), pp. xvii–xviii.
32. *Ibid.*, p. xviii.
33. The key passage in question reads: “Again, that some voids exist may be seen from the following considerations: for, if there were not such spaces, neither light, nor heat, nor any other material force [οὐδ’ ἄλλη δύναμις οὐδεμία σοματικὴ] could penetrate [διεκπίπτειν] through water, or air, or any body whatever. Then, how could the rays of the sun, for example, penetrate through water to the bottom of the vessel? If there were no pores in the fluid, and the rays thrust the water aside by force, the consequence would be that full vessels would overflow, which however does not take place” (Hero of Alexandria, *Pneumatica*, in *Pneumatica et Automata*, trans. and ed. Walter Schmidt, vol. 1 of *Opera Quae Supersunt Omnia* [Leipzig: Teubner, 1899], pp. 24, 26; translations of this text are my own).
34. Hero of Alexandria, *Pneumatica*, p. 26.
35. Hermann Diels, “Über das physikalische System des Straton,” *Sitzungsberichte der Akademie von Berlin* 27:1 (1893), pp. 101–27, esp. 115; reprinted in *Hermann Diels: Kleine Schriften zur Geschichte der antiken Philosophie*, ed. Walter Burkert (Hildesheim: Georg Olms, 1969), pp. 239–65, esp. 253.
36. Strato of Lampsacus, “Frag. 66,” in *Straton von Lampsakos*, vol. 5 of *Die Schule des Aristoteles: Texte und Kommentar*, ed. Fritz Wehrli (Basel: Schwabe, 1950), frag. 66, p. 23.
37. See Hans B. Gottschalk, in his commentary to *Strato of Lampsacus: Some Texts Edited with Commentary*, ed. Hans B. Gottschalk (Leeds: W.S. Maney and Son, 1965), pp. 95–182, esp. 135–41; and Hellmut Flashar, review of *Strato of Lampsacus: Some Texts Edited with a Commentary*, by Hans B. Gottschalk, *Gnomon* 39:7 (1967), pp. 681–4.
38. See Matthias Gatzemeier, *Die Naturphilosophie des Straton von Lampsakos: Zur Geschichte des Problems der Bewegung im Bereich des frühen Peripatos* (Meisenheim am Glan: Hain, 1970), pp. 22–5, 27–8, and 93–6.

39. David J. Furley, “Strato’s Theory of the Void,” in *Aristoteles und seine Schule*, vol. 1 of *Aristoteles: Werk und Wirkung*, ed. Jürgen Wiesner (Berlin: De Gruyter, 1987), pp. 594–609, esp. 596–600, 604; reprinted as chap. 13 of *Cosmic Problems: Essays on Greek and Roman Philosophy of Nature* (Cambridge: Cambridge University Press, 1989), pp. 149–60; and “Cosmology,” chap. 12 of *The Cambridge History of Hellenistic Philosophy*, ed. Keimpe Algra et al. (Cambridge: Cambridge University Press, 1999), pp. 412–51.
40. The complete list appears in Aristotle, *Physics* III.1, 200b27–8; 200b32–201a01; 201a3–9; 201a10–5; 201b26–7; and 202a07–10. The label given to these categories varies throughout the corpus: in some passages they are said to correspond to “kinds of motion” (*Phys.* III.3, 202b29: καὶ περὶ τῶν ἄλλων κινήσεων ἐκάστης; *Phys.* V.1, 225b7–8 and *Met.* Θ.12, 1068a10–1: ἀνάγκη τοεῖς εἶναι κινήσεις; *Gen. et Corr.* I.2, 15a28: καὶ περὶ τὰς ἄλλας κινήσεις), while other passages (e.g., *Gen. et Corr.* I.4, 319b31–320a7) speak of kinds of “change” (μεταβολή). The label “category” appears in *Met.* Z.7, 1032a12–5: “πάντα δὲ τὰ γινόμενα ὑπὸ τέ τινος γίνεταί καὶ ἐκ τινος καὶ τί. τὸ δὲ τί λέγω καθ’ ἐκάστην κατηγορίαν (my emphasis; see also *Phys.* V.1, 224b27, *Cat.* 14, 15a13–20, and *Top.* IV.2, 122a24 and 122a29). On this, see Valérie Cordonier, “Problématique passion: les catégories aristotéliennes du changement selon Alexandre d’Aphrodise et en particulier dans la *Question* I.21,” in *Qu’est-ce qu’une catégorie? Interprétations d’Aristote Université de Paris X-Nanterre, 8–10 November 2007*, ed. Juliette Lemaire and Véronique Brière (Louvain: Presses Universitaires de Louvain, forthcoming 2016).
41. Cf. Hero of Alexandria, *Pneumatica*, p. 24, 26: “δύναμις . . . σωματική.”
42. There is actually a close correspondence between the debate of Steinmetz and Coutant concerning Theophrastus’ *Physics* indicated above, and the discussions concerning the philosophical meaning of Strato’s doctrine of the void, as to whether the microvoids he postulated in matter are “true”—that is, actually empty—voids or only potential voids, which are always filled up with some matter. On this debate, into which it is impossible to enter in the present essay, see the references indicated in n. 30 and n. 31 above.
43. See Calcidius, *Timaeus, a Calcidio translatus commentarioque instructus*, ed. Jan Hendrik Waszink, vol. 4 of *Plato Latinus*, ed. Raymund Klibansky (London: Warburg Institute, 1962), §§236–48; translations of this text are my own. On Calcidius, the composition of his commentary, and the sources used, see Jan Hendrik Waszink’s preface to the volume, pp. ix–cvi. Since this edition, two translations in modern languages have appeared, the first in Italian and the second in French: see Calcidius, *Commentario al Timeo di Platone: Testo latino a fronte*, trans. and ed. Claudio Moreschini (Milan: Bompiani, 2003), and Calcidius, *Commentaire au Timée de Platon*, trans. and ed. Béatrice Bakhouché (Paris: Vrin, 2012).
44. Calcidius, *Commentary on Plato’s Timaeus*, §237, pp. 249–50.
45. *Ibid.*, p. 250.

46. On the various sources about the Stoic doctrine of visual perception, see David E. Hahm, “Early Hellenistic Theories of Vision and the Perception of Color,” chap. 3 of *Studies in Perception: Interrelations in the History and Philosophy of Science*, ed. Peter K. Machamer and Robert G. Turnbull (Columbus: Ohio State University Press, 1978), pp. 65–95, esp. 85.
47. Although these two steps seem to be ontologically distinct (*contra* Hahm, see n. 46), it is actually not clear that they are chronologically distinct. Moreover, I am inclined to connect Calcidius’ report precisely to Chrysippus of Soli (ca. 279–206 BCE), whose doctrine is described in very similar terms by some different and independent sources, which refer to a “spirit” being struck by the visual affection, causing a tension in it (*intentio*, in Calcidius’ report). I hope to have the opportunity to come back to this set of testimonies on Chrysippus in a further study.
48. It can seem rather strange to find the fisherman’s hands in this very position, next to the nets and sticks. However, this position is demanded by the function of the analogy, which is supposed to account for the transmission of the affection (“being numbed”) to the mind. So from this perspective, the hands are considered “instruments” of this transmission exactly as the nets and the sticks are—and this assumption is, by the way, in harmony with the idea that the bodily organs are “instruments” (according to the etymology of the Greek term for “organ”).
49. On this process, see the source materials collected in “Mixture,” §48 of *Translations of the Principal Sources with Philosophical Commentary*, vol. 1 of *The Hellenistic Philosophers*, trans. and ed. Alex Long and David N. Sedley (Cambridge: Cambridge University Press, 1987), pp. 290–4.
50. An earlier example of a similar use of the torpedo fish to illustrate cleverness in animals is to be found in Cicero’s *On the Nature of the Gods*, where many examples of animal self-defense are used to attest the existence of divine providence: “Again we observe how various species defend themselves against violence and danger with their own weapons, bulls with their horns, boars with their tusks, lions with their bite; some species protect themselves by flight, some by hiding, the cuttle-fish by emitting an inky fluid, the torpedo by causing cramp [*torpore torpedines*], and also a number of creatures drive away their pursuers by their insufferably disgusting odor” (Cicero, *De Natura Deorum*, in *De Natura Deorum, Academica*, trans. and ed. Harris Rackham [Cambridge: Harvard University Press, 1951], II.127, pp. 244–5; trans. mod.).
51. Plutarch of Chaeronea, *On the Cleverness of Animals*, trans. Harold Cherniss and William Hembold, vol. 12 of *Moralia* (Cambridge: Harvard University Press, 1957), 978B12–D2, my emphasis; henceforth CA, followed by line number. A new edition of the text has now appeared: *L’Intelligence des animaux Plutarque*, trans. and ed. Jean Bouffartigue, pt. 1 of vol. 14 of *Plutarque: Œuvres morales* (Paris: Les Belles Lettres, 2012).
52. Indeed, is not a commonplace precisely that which is said (i.e., repeated) even in contexts where the related information is of no use, in itself, for the argument? I thank my colleagues Dr. Silvia Di Donato and Dr. Mehrnaz Katouzian-Safadi for having helped me, with their critical

remarks, to clarify this part of my argument, on the occasion of the seminar entitled “Modèles de transmission physique dans la tradition péripatéticienne” that I had the opportunity to lead in the Centre National de la Recherche Scientifique, UMR 7219 (Université Paris Diderot—Paris 7), alongside Professor Ahmad Hasnaoui.

53. For an analytic survey of Plutarch’s position regarding the intelligence of animals in his three main treatises dealing with this issue—*On the Intelligence of Animals* (*De sollertia animalium*), *The Eating of Flesh* (*De esu carniū*), and *Gryllos* (*Bruta animalia ratione uti*)—and a survey of the previous sources on which he could draw, see Jean Bouffartigues, introduction to Plutarch, *L’Intelligence des animaux Plutarque*, pp. xxiv–viii.
54. These extracts are to be found in a compendium composed by the Byzantine emperor Constantine VII Porphyrogenetos (905–959 CE): *Excerptorum Constantini de Natura Animalium Libri Duo: Aristophanis Historiæ Animalium Epitome*, ed. Spyridon P. Lambros, pt. 1 of vol. 1 of *Supplementum Aristotelicum* (Berlin: G. Reimer, 1885), frag. A2, pp. 1–2, and frag. A41, p. 11. Three further extracts from this work are preserved through other sources, but do not concern the fish: see Aristophanes of Byzantium, *Aristophanis Byzantii Fragmenta: Post A. Nauck collegit, testimonii ornavit, brevi commentario instruxit*, ed. William J. Slater, bk. 6 of *Sammlung griechischer und lateinischer Grammatiker*, ed. Klaus Alpers and Ian Cunningham (Berlin: De Gruyter, 1986), pp. 141–2. Slater’s text is a completed and revised edition of Augustus Nauck, ed., *Aristophanis Byzantii Grammatici Alexandrini Fragmenta* (Halis: Sumptibus Lipperti et Schmidtii, 1848).
55. The two relevant passages in Aelian’s book, *On the Characteristics of the Animals*, are quoted above in n. 12.
56. Oppian of Corycus, *Halieutica, or Fishing*, in *Oppian Colluthus Tryphiodorus*, trans. and ed. Alexander W. Mair (London: W. Heinemann, 1928), pp. 358–9; trans. mod.
57. See CA 978B12–D2, quoted above on p. 26.
58. On the possibility that Hero’s prologue is based on Strato, see §3 above, esp. nn. 35–9.
59. These two options do not exclude one another and it could be that the distinction in itself is made rather in vain, because such labels—that often actually prevent their users from reading the texts and understanding the arguments at stake—are of no help at all in clarifying what happens in cases such as that of the crampfish: the issue of the mode of the physical transmission through a medium not only cuts across the disciplinary fields of ancient science, but also across the traditionally distinguished philosophical “schools.”
60. Many studies on Pliny have recently been published: Roger K. French and Frank Greenaway, eds., *Science in the Early Roman Empire: Pliny the Elder, His Sources and Influence* (London: Croom Helm, 1986); John F. Healy, *Pliny the Elder on Science and Technology* (Oxford: Oxford

- University Press, 1999); Trevor Murphy, *Pliny the Elder's Natural History: The Empire in the Encyclopedia* (Oxford: Oxford University Press, 2004); and Roy K. Gibson and Ruth Morello, eds., *Pliny the Elder: Themes and Contexts* (Leiden: Brill, 2011).
61. Pliny the Elder, *Natural History*, trans. W.H.S. Jones (Cambridge: Harvard University Press, 1963), XXXII.2, vol. 8, pp. 468–9: “But surely, even without this example, evidence enough by itself could be found in the torpedo fish—which also is a sea creature. Even at a distance, and that a long distance, or if it is touched with a spear or rod, to think that the strongest arms are numbed, feet as swift in racing as you like are paralysed! But if this example forces us to confess that there is some force which by smell alone, and by a certain kind of breath from the creature’s body, so affects our limbs [*esse vim aliquam, quae odore tantum et quadam aura corporis sui adficiat membra*], what limits are there to our hopes based on the potency of all remedies?” I have slightly modified Jones’ translation by changing “electric ray” to “torpedo fish,” and in rendering more clearly the indeterminate—and potentially equivocal—description of the fish’s numbing power.
 62. Seminal studies were written by Paul Moraux, “Galien comme philosophe: La philosophie de la nature,” in *Galien: Problems and Prospects*, ed. Vivian Nutton (London: Wellcome Institute for the History of Medicine, 1981), pp. 87–116; and Pier Luigi Donini, “Motivi filosofici in Galeno,” *La Parola del Passato: Rivista di Studi Antichi* 194:1 (1980), pp. 333–70. More recently, there are, among others, the following books: Jonathan Barnes and Jacques Jouanna, eds., *Galien et la philosophie: Huit exposés suivis de discussions*, vol. 49 of *Entretiens sur l’Antiquité classique* (Geneva: Fondation Hardt, 2003); Christopher Gill, Tim Whitmarsh, and John Wilkins, eds., *Galien and the World of Knowledge* (Cambridge: Cambridge University Press, 2009); and Peter Adamson, Rotraud Hansberger, and James Wilberding, eds., *Philosophical Themes in Galen*, supp. 114 (2014) of *Bulletin of the Institute of Classical Studies*, ed. John North.
 63. See Rudolph E. Siegel, *Galien’s System of Physiology and Medicine: An Analysis of his Doctrines and Observations on Blood Flow, Respiration, Humors and Internal Diseases* (Basel: Karger, 1968), p. 177; *Galien On Psychology, Psychopathology, and Function and Diseases of the Nervous System: An Analysis of his Doctrines, Observations and Experiments* (Basel: Karger, 1973), p. 244. However, the fish is absent from this interesting study: Julius Rocca, *Galien on the Brain: Anatomical Knowledge and Physiological Speculation in the Second Century A.D.* (Leiden: Brill, 2003).
 64. See Armelle Debru, *Le corps respirant: La pensée physiologique chez Galien* (Leiden: Brill, 1996), p. 224n. 8; “The Power of Torpedo Fish as a Pathological Model to the Understanding of Nervous Transmission in Antiquity,” *Comptes Rendus Biologies* 329:5–6 (2006), pp. 298–302; and “Les enseignements de la torpille dans la médecine antique,” in *Le médecin initié par l’animal: Animaux et médecine dans l’Antiquité grecque et latine*, ed. Isabelle Boehm and Pascal Luccioni, vol. 39 of *Collection de la maison de l’orient et de la Méditerranée* (Lyon: Maison de l’Orient de la Méditerranée-Jean Pouilloux, 2008), pp. 39–47.

65. Galen, *De utilitate respirationis*, in vol. 4 of *Claudii Galeni Opera Omnia*, ed. Karl Gottlob Kühn (Leipzig: Cnobloch, 1823), pp. 470–511; *On the Use of Breathing*, in *On Respiration and the Arteries*, trans. and ed. David J. Furley and J.S. Wilkie (Princeton: Princeton University Press, 2014), pp. 71–133. For a biography of Galen and a chronology of his works, see Véronique Boudon-Millot, “Galien,” in *D’Eccélos à Juvénal*, vol. 3 of *Dictionnaire des philosophes antiques*, ed. Richard Goulet (Paris: CNRS Éditions, 2000), pp. 440–66.
66. See the general summary of the work by Furley and Wilkie in their preface material to Galen, *On Respiration and the Arteries*, pp. 75–7.
67. Galen, *De utilitate respirationis*, p. 497; *On the Use of Breathing*, pp. 114–7; my emphasis. I have modified the translation as follows: I have replaced “the numbing fish” with “the crampfish,” and I have rendered ἀνατρέχειν as “to run back” instead of “to rise back.” Besides, I follow Furley in adopting the reading of the Latin translation for “the sea-animal” (*ibid.*, p. 255n. 46).
68. Galen, *De locis affectis*, in vol. 8 of *Claudii Galeni Opera Omnia*, ed. Karl Gottlob Kühn (Leipzig: Cnobloch, 1824); henceforth LA, followed by page number. An English translation is available as Galen, *On the Affected Parts*, in *Galen on the Affected Parts: Translation from the Greek Text with Explanatory Notes*, trans. Rudolph Siegel (Basel: Samuel Karger, 1976), pp. 16–197; henceforth AP, followed by page number. All translations from this text are my own, in order to be closer to the specific terms used by Galen; however, the Siegel translation is also cited to aid the reader in locating the relevant passages in English. The treatise is dated to a period when Galen had retired to Pergamon at the age of 60. On this dating, see Rudolph Siegel, introduction to *Galen on the Affected Parts*, p. ix; and Luis García Ballester, *Galeno: Sobre la localización de las enfermedades (De locis affectis)*, *introducciones, traducción y notas* (Madrid: Gredos, 1997), pp. 69–74.
69. Galen states that “those who consider that it is unlikely [ἀπίθανον], when considerable symptoms happen in the whole <organic> body, to ascribe these symptoms to a small amount of humor contained in one <bodily> part, they seem to me to have really forgotten what can be daily observed” (LA 421; AP 185).
70. Galen speaks of the examples listed in terms of τεκμήρια (LA 422; AP 185), a term that I have translated as “signs” (Siegel renders it as “proof”).
71. This can be found in Alexander of Aphrodisias’ commentaries on Aristotle—among others, in a passage of his commentary on Aristotle’s *De Sensu* concerning sight (see Alexander of Aphrodisias, *Alexandri in Librum De Sensu*, ed. Paul Wendland, pt. 1 of vol. 3 of *Commentaria in Aristotelem Græca* [Berlin: Georg Reimer, 1901], p. 80), a passage of his commentary on Aristotle’s *Meteorologica* on solar heat (see Alexander of Aphrodisias, *Alexandri in Meteorologicorum libros commentaria*, ed. Michael Hayduck, pt. 2 of vol. 3 of *Commentaria in Aristotelem Græca* [Berlin: Georg Reimer, 1899], p. 18), where there is a reference to the torpedo fish (see n. 77 below), as well as at the beginning of his commentary

- on Aristotle's famous treatise *On the Soul* (see Alexander of Aphrodisias, *Alexandri De Anima cum Mantissa*, ed. Ivo Bruns, pt. 1 of *Alexandri Aphrodisiensis Praeter Commentaria Scripta Minora*, vol. 2 of *Supplementum Aristotelicum* [Berlin: Georg Reimer, 1892], p. 2). On the latter work, see Valérie Cordonier, "Matière, qualités, mélange: La physique élémentaire d'Aristote chez Galien et Alexandre d'Aphrodise," *Quaestio* 7:1 (2007), pp. 79–103; "Corps, matière et contact: La cohérence du sensible selon Alexandre d'Aphrodise," *Les Études Philosophiques* 86:3 (2008), pp. 353–78.
72. The full passage reads: "Indeed, as a result of the bite from some venomous spider, one sees the whole body getting sick even if this is a small amount <of venom> that has penetrated through a very narrow hole" (LA 421; AP 185).
73. The full passage reads: "The effect produced by scorpions is even more astonishing because <in this case> the most violent symptoms occur very rapidly; though, what it throws when it stings is a very small thing, or absolutely nothing, the sting seeming not to be punctured; however, it is necessary to suppose that it is not because the body has been pricked as it would by a needle that it seems hit with hail and that one falls immediately [εὐθέως] into faintness; but it is more credible to admit that these accidents are caused by the introduction of a certain spirit or of some tenuous humor" (ibid.).
74. This basic distinction between alteration and local change is fundamental for Galen's dynamics and appears many times in his work, for example in *On the Natural Faculties* (*De naturalibus facultatibus*), trans. and ed. Arthur John Brock (Cambridge: Harvard University Press, 1991), I.2, pp. 12–3. For an overview of Galen's classification of organic powers in terms of a reorganization of the Aristotelian list of the categories, see Inna Kupreeva, "Aristotelian Dynamics in the 2nd Century School Debates: Galen and Alexander of Aphrodisias on Organic Powers and Movements," in vol. 1 of *Philosophy, Science and Exegesis in Greek, Arabic, and Latin Commentaries*, ed. Peter Adamson, H. Baltussen, and Martin William Francis Stone, special issue of *Bulletin of the Institute of Classical Studies* 47:1 (2004), pp. 71–95. On the origins of such a categorization in Aristotle, see n. 40 above.
75. There is, indeed, a correspondence between the fact that the process implies the bodily transmission of a certain amount of matter from one place to another, and the fact that this process happens in time.
76. See, indeed, the following expressions: "καὶ τῷ ψαῦσαι μόνον" (LA 421; AP 185), and "μόνον τῷ ψαῦσαι" (LA 422; AP 186). On magnetism, see Robert Halleux, *Le problème des métaux dans la science antique* (Paris: Les Belles Lettres, 1974), pp. 122–6; and Albert Radl, *Der Magnetstein in der Antike: Quellen und Zusammenhänge* (Stuttgart: Steiner, 1988), pp. 65–74.
77. See Alexander of Aphrodisias, *Alexandri in Meteorologicorum libros commentaria*, p. 18. I have done a close reading of this text in the following essay: Valérie Cordonier, "La transmission de la chaleur solaire comme mouvement médiatisé chez Alexandre d'Aphrodise: Naissance d'un prob-

lème et ambiguïté d'un modèle à l'origine de la tradition médiévale," in *Lieu, espace, mouvement: physique, métaphysique et cosmologie (XIIIe-XIVe siècles)*, ed. Tiziana Suarez-Nani et al. (Porto: Federation of Institutes for Medieval Studies, forthcoming 2016).

78. On the developments of the concept by Plotinus in the context of his discussion of visual perception, see Valérie Cordonier, "De la transmission à la sympathie: Plotin et la désaffection du milieu perceptif (*Enn.* IV, 5 [29])," *Philosophie Antique* 9:1 (2009), pp. 35–69.