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'What is it?' This question is asked in different ways, with a view to different varieties of answers. Philosophers, especially within the Western tradition, have taken different varieties of knowledge to be associated with different ways of answering this question. One kind of 'what is it?' question had pride of place among ancient Greek philosophers: that which seeks to identify those core necessary features of a thing, attribute, or event by which other regular necessary features can be explained. The present book is devoted to what Plato and Aristotle have to say about this sort of account, one

that identifies what came to be known as the 'formal cause'. Ferejohn mostly steers clear of questions concerning the ontological status of that cause, instead focusing on epistemological questions. How can one come to be in possession of such an account? What must such an account include? How is it to be formulated linguistically, and what role do such formulations play within the context of an explanatory account? He begins with an account of the centrality of the 'what is it?' question to the Socratic elenchus. Special attention is paid to the *Meno's* proposal that *epistēmē* of a fact rests on an account that works through the reason why that fact is the case (97d-98b), and the *Euthyphro's* assertion that the sort of account that expresses what a virtue is will be that which identifies the cause of that virtue, its *eidos* (6d). Ferejohn then proceeds to Aristotle's development of that idea in the *Posterior Analytics*, according to which a definition expressing the 'what is it' of a regular and necessary feature of the world will play a crucial role in a demonstration, the sort of account by which that feature's cause is identified. Ferejohn traces developments in Aristotle's thought: while Aristotle began by emphasizing the role that definitions play in identifying the formal cause, he comes to believe that those definitions that express efficient causes play a more crucial role in scientific and metaphysical explanation. Ferejohn takes this shift to have its source in tensions already present within the account of scientific explanation offered in the *Posterior Analytics*.

Although I am not convinced by the main lines of the story Ferejohn tells, he asks new, important questions, and opens up new lines of interpretation well worth careful consideration.

Ferejohn takes as his starting point Aristotle's recognition of Socrates as the first to explicitly identify definition as a starting point of deduction (*Meta.* i6.987b1-3). Socrates evaluates knowledge claims on the basis of the presence or absence of certain conditions for knowledge; he thus qualifies as what Ferejohn calls a 'grade 1 epistemologist'. Socrates never offers what he takes to be an adequate definition of knowledge (by which his account would be an instance of what Ferejohn refers to as 'grade 2 epistemology'), let alone an evaluation of competing definitions of knowledge ('grade 3 epistemology'). The Socratic realization of the centrality of the account of the 'what is it' emerged from the commonsense insight that one

should know what one is talking about, and developed into the more precise position that, without knowing what F-ness is, one is unable to determine the second order properties of F or identify the instances of F. For example, without knowing what piety is, one knows neither whether piety is godbeloved, nor which actions or people are pious. A problem arises, famously raised by Geach: how can one proceed towards a definition of F, without knowledge that at least some particulars are F? Ferejohn persuasively argues that the apparent circle can be avoided. Socrates' assertion at 71b that if one does not know the *ti esti* one cannot know what sort of thing (*hopoion*) it is means not that no F can be recognized as such without a definition of F, but without such a definition, one is not in a position to evaluate the claims of *anything* to be an F.

Ferejohn points to *Euthyphro* 6e as evidence that, for Socrates, that adequate definition of a virtue is not only necessary, but is also sufficient for recognizing its instances. *Euthyphro* 10a-11b extends the explanatory scope of definitions to second order properties (such as being beloved by the gods). We begin to see 'grade 2 epistemology' in the *Meno*: knowledge (*epistēmē*) is said to require an explanatory account as it needs to be tied down by a *logismos* of a reason why (97d-98b). Definitions, as understood in the *Euthyphro* (as well as *Meno* 72c), will make such explanatory accounts possible.

Ferejohn raises an interesting puzzle. Socrates' refutation of actual attempts to define virtues show the inevitable failure of defining them by appeal to the sorts of behaviors characteristic of the virtuous; there are so many exceptions and possible cases that any such definition would take the form of a long disjunction lacking the requisite unity. Ferejohn argues that this undercuts the diagnostic function of definitions. For if a virtue is not definable in terms of one's behavior, it is to be defined by appeal to the state of soul, which is not subject to inspection (41-49). To this it can, perhaps, be countered that Socrates' prime concern is seeing whether there is virtue within oneself, not within another. Even if virtue were a purely psychological state, it might be thought to be visible through some kind of introspection.

The third chapter is devoted to the structure of Aristotle's theory of explanation as initially presented in *Posterior Analytics* i. It is perhaps the clearest and most philosophically astute account that this theory has received. For Ferejohn, the key to understanding book 1 is to see it as Aristotle's attempt to work out with sufficient precision and detail the main lines of the Socratic account of *epistēmē*. Plato had said that *epistēmē* requires tying down one's belief with an explanatory account, one that works through the reason why the belief is true. This is a matter of showing how the belief in question follows logically from certain beliefs that do not themselves demand such a *logos*. For both, the truths that ground such explanation are (at least in large part) derived from definitions, which express the 'what is it' of the subject of the proposition in question. Aristotle follows Plato in taking such explanation to serve to show why the belief in question is necessary. Ferejohn departs from the standard interpretation of this, that the proposition in question expresses a certain kind of universal state of affairs, which must be the case. For Ferejohn, what the demonstration shows is that the truth is *certain* (for the one who follows the demonstration), that there is no possibility that one is wrong in believing that the state of affairs holds. Ferejohn nonetheless denies that an Aristotelian science is thereby foundationalist in regard to justification; although they are certain, the premises find warrant in the coherence of the whole demonstrative scheme with itself and with the observed facts.

Ferejohn concludes this chapter by turning to Aristotle's account of the first principles, the foundations of explanation. As the ultimate bases of demonstration, first principles must be immediate, not inferred on the basis of more basic premises. Rather, they are (somehow) given to one prior to demonstration. One of Aristotle's own examples of such an immediate predication is the perceptually grounded premise that planets do not twinkle (on the basis of which one can prove that the planets are near; *APo.* i 3.78a30-38). But the foundations of explanation must satisfy more than the formal, extensional criterion of immediacy; they must be maximally intelligible. For this reason they are to be *kath' hauta* ('catholic', as Ferejohn renders it.) Catholic predications must satisfy the intensional criterion that there is an analytic relation between terms. It is this that allows them to be explanatorily basic and is the ground for the

premise's character as immediate. (To this there is added the extensional criterion that the terms be coextensive; this ensures that the demonstration is formulated in such a way that the middle term reveals the explanatorily relevant feature of the subject term.) In appealing to analyticity, Ferejohn seems to be suggesting that the intelligibility of a demonstrative conclusion has its ultimate ground in use of language, not in the mind's direct insight into the structure of reality. But as Ferejohn recognizes, definitions are established and revised on the basis of their being suitable foundations of explanation. Accordingly, language itself develops in tandem with the explanatory accounts of the sciences. The epistemological foundation of intelligibility is the set of analytic truths expressed in a language, only when it is suitably reformed and refined.

In *APo.* ii 11 Aristotle asserts that, although demonstration, as he conceives it, constitutes an explanation through the identification of any variety of cause, that through the identification of a formal cause has pride of place, insofar as definitions, the most important variety of scientific principle, express the 'what is it' or formal cause. But the canonical model of demonstration, which reveals the formal cause, is incomplete, for it is unable to account for all of the ultimate premises of the demonstration of a *kath' hauto* property. For example, the demonstration that all triangles have the sum of their interior angles equal to two right angles requires a non-definitional premise. According to Ferejohn, the rest of *APo.* ii, and the further refinements and adaptations that Aristotle's theory of demonstration undergoes in other, later works indicate that Aristotle recognized that the theory of demonstration as developed in *APo.* i is too restrictive. The rest of the book is devoted to working through developments in Aristotle's account of demonstration.

The first non-canonical form of demonstration is that whereby a demonstrated conclusion is applied to a subgroup of the subject. One can, for example, easily explain why all isosceles triangles have the sum of their interior angles equal to two right angles, if it has been demonstrated that all triangles have this characteristic. While this would not meet the standards of a canonical demonstration, as the middle term triangle does not convert with isosceles, the whole deduction does render the conclusion intelligible, and Ferejohn rightly

points out that there is no reason to doubt that Aristotle seems willing to call it a 'demonstration' in a loose sense and to grant such inferences a role in the sciences.

More controversial and philosophically interesting is Ferejohn's take on the non-canonical demonstration discussed in ii 8, a variety of deduction by which a definition can (in a sense) be demonstrated. As Ferejohn understands it, the demonstration that makes clear the definition of a (lunar) eclipse shows how a certain occasional variety of blocking of light is regularly predicated of the moon; that which makes clear the definition of thunder shows how a certain regular representative sound is often predicated of clouds. The crucial middle term here is not going to be derived from the essence of the subject, as it is in a canonical demonstration. Instead of expressing a formal cause, the crucial middle term in these cases expresses an efficient cause. Ferejohn interprets Aristotle's assertion that this sort of demonstration is possible when the definiendum 'has some other cause' (*APo.* ii 8.93a7, ii 9.93b21-8) as drawing a contrast between the canonical case, in which the middle term is the same as the subject (insofar as it is definitional of it, and hence is part of its essence) and that in which the middle term expresses an efficient cause (which is temporally prior to effects, and is accordingly something different from it). It is this new understanding of demonstration that Ferejohn takes to be at work in Aristotle's later philosophy of science, in which, on his view, efficient causation comes to supplant formal causation in both metaphysics and the physical sciences.

This interpretation is questionable. Had Aristotle wished to distinguish these sorts of demonstrations as those involving the efficient cause, he would have said as much; *APo.* ii 11.94a22 shows that Aristotle was already clear on the notion of the efficient cause. Instead, he uses the phrase 'what has some other cause'. The phrase is unusual, but it is not the only time it is used. At *Meta.* v 18.1022a32-35, Aristotle writes that the phrase *kath' hauto* is used to refer to a certain kind of entity, that which does *not* have a cause different from itself. His example is 'human being': the elements in the essence of human being are in some sense the cause of a human being, but insofar as these all express (in an indeterminate way) what

a human being is, they are not causes other than human beings. The implication is that any basic subject, with an essence, is that which has no other cause. It would follow that any characteristic that is not a basic subject, including properties like having the interior angles equal to two right angles, would be that which has a cause other than itself. That this is not a late, anomalous notion is confirmed by a passage in the *Posterior Analytics*, in which Aristotle is distinguishing the senses of the same term under consideration in *Meta. v 18: kath' hauto*. Aristotle says that one sense of *kath' hauto* is in reference not to predications but to things: 'that which is not said of some other subject, as, for example, that which is walking is something different, walking, and white..., but substance, and everything that signifies a this, is precisely what it is, not being something different' (*APo. i 4.73b5-8*). Here the basic subject is what it is *kata* itself; predicates like walking or white exist only *kata* something else. If *kata* here has its sense of signifying the cause (*Meta. v 18.1022a19-22*) as is likely, Aristotle is referring to the same distinction in ii 8 and 9.

I suggest that what has a cause other than itself, the sort of entity subject to a demonstration of a definition, is a nonsubstantial demonstrated predicate, what Aristotle elsewhere calls a *kath' hauto sumbebēkos*. This will include both geometrical properties, such as having the interior angles equal to two right angles, and the characteristics of being subject to certain frequent or regularly occurring predicates, like those discussed in *APo. ii 8*. I have elsewhere (*Explaining an Eclipse: Aristotle's Posterior Analytics 2.1-10*, Ann Arbor: University of Michigan Press, 1996) worked out how such demonstrations can be integrated within the demonstrative theory of *APo. i*. Ferejohn leaves as a puzzle how the geometrical demonstration that triangles have two right angles as the sum of their angles fits within Aristotle's theory. Insofar as he understands Aristotle to hold that the sort of demonstration discussed in *APo. ii 8* requires filling in immediate predications (which at 93b13-14 Aristotle calls 'remaining reasons') he expresses puzzlement that Aristotle does not make a similar point concerning the demonstration that triangles have the sum of their angles equal to two right angles (143n35); the puzzle disappears if the two varieties of demonstration are the same. Likewise, he is puzzled by Aristotle's apparent assertion that the sort of demonstration under discussion will reveal the definition of a

musical concord (147n38): the relevant cause seems to be the formal cause of mathematical relationships, not the efficient cause of plucking of the strings. But we can take all of these demonstrations to be of a single kind. The demonstrated predicate is either predicated of a complex (a concatenation of simple subjects) or results from the state in which the efficient cause is in the appropriate relation to the subject. This eliminates the puzzles, and does not involve reading into the text distinctions not explicitly made. Further, Ferejohn's interpretation does not permit an integrated reading of Aristotle's atypically full accounts of demonstration in *APo.* ii 16 and 17, which present two ways in which Aristotle sketches an explanatory demonstration explaining why broad-leafed plants shed their leaves. On one account, the demonstration has as a middle term the essence of broad-leafed plants. On the other, the demonstration has as its middle term the coagulation of the sap at the joint of the leaves, which Ferejohn takes to be the identification of the efficient cause. Ferejohn thinks that Aristotle never manages to integrate the two schemes. But, if it can be shown that broad-leafed plants are the sort of subject that is regularly subject to said coagulation, the integration would be straightforward enough. So understood, the full demonstration rests on the identification of a formal cause, not an efficient cause, except indirectly. The causal model does not threaten the canonical model, as Ferejohn says it does; it is rather a special application of it.

Ferejohn makes great hay of the new model of demonstration, as he understands it. While the canonical model of demonstration is based on a Platonic point of view, according to which making sense of the world is a matter of revealing stable relations among essences, demonstration as later conceived by Aristotle is suited towards a more dynamic account of reality. Physical explanations appeal to nature, which is a cluster of capacities, not an essence or form. How then do we interpret Aristotle's assertion that nature is first and foremost form (*Phys.* ii 1.193b7-12)? Is form here primarily an efficient cause, not a formal cause?

Ferejohn concludes the book with a brief foray into the waters of *Metaphysics* vii. Aristotle's task is to understand substances by asking the 'what is it' question of substance itself. Book 7 on his account mirrors the story line he discerns in the development of Aristotle's

account of explanation. *Metaphysics* vii 1-4 seek the cause of substance in substantial essence, which is the same as substance. Such a strategy is unable to account for those features of a substance that emerge in time through the actualization of the potentialities inherent in matter. However, the introduction of matter in an account of what substance is threatens the unity of substance, as it is now understood as form plus matter. What Ferejohn takes to be Aristotle's definitive account of substance is presented in the fresh start of vii 17. The cause of substance responsible for its unity is form considered as the efficient cause of the coming to be of the composite. The question of the logical unity of substance is transformed into a question of natural science: how exactly is it that a formal element shapes and directs matter to allow it to become a substance of a certain kind?

The story line of book 7 that Ferejohn presents is somewhat schematic, as the scope of his book does not permit the sort of close analysis that dominates most treatments of book 7. Nonetheless, the general account he gives is plausible, and has the benefit of being supported by a new and creative account of the structure of the sorts of demonstrations to which Aristotle appeals in vii 17. It stands even without the support of the new interpretation of the role of efficient causation in the demonstrative theory of the *Posterior Analytics*.

Ferejohn has devoted much of his career to shedding much needed light on Aristotle's epistemology and philosophy of science; *Formal Causes* continues the project. The first part, which takes Aristotle's thought on these matters to be a direct and self-conscious furthering of Socratic methodology, can be recommended without reservation. Its account of the fundamental strategy and purpose of the *Posterior Analytics* is among the best introductions to this work. I find much of the second part unconvincing, but the history of the interpretation of *APo.* ii 8-10 shows that it is very unlikely that any line of interpretation of these important and difficult chapters will ever meet universal approval. Ferejohn successfully leads us to ask new questions and the interpretative strategies he works through will surely be included among the main options.