THE PROBLEM OF DEMONSTRATION IN ARISTOTLE

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INTRODUCTORY SYNOPSIS

"It is an interesting and largely unexplored question whether Aristotle is in practice faithful to the general idea of science, and to the rules of method, sketched in his Analytics."[1] It is this issue, "the Problem of Demonstration," which this study is concerned to explore.

The objective of this study is not so much to render a detailed and definitive solution to the problem, but rather to suggest a context within which such a solution may be reached. Further, this study is intended not as an historical critique of an historical question in a classical author but as a philosophical enquiry into the roots, in Aristotle, of a perennial philosophical question.

The structure of the study is as follows:

In the first chapter the problem is stated, and the possible modes of response to the problem are briefly canvassed, in order to set the framework of the response to be offered here.

The second chapter attempts, through an examination of certain texts from the Posterior Analytics and elsewhere, to specify and to raise objections to the particular elements in the traditional interpretation of Aristotle's methodological intentions which have generated the problem of demonstration.

Aristotle's teachings concerning the nature of knowledge include reference both to the distinctive object of knowledge and to the psychology of knowing. At one time Aristotle gives a more subjective and psychological, at other times a more object-based account of what

is essential to knowledge. In the third chapter it is suggested that we must examine the manner in which Aristotle accommodates these two aspects when he comes to design a methodology of science. Aristotle's views on the aim of science are, therefore, examined as a source of insight into the balance struck between these two aspects in his writings. It is here argued that when we attempt to understand Aristotle's methodological intentions concerning the apodeictic syllogism we must not underestimate the importance in Aristotle's thought of the doctrine which holds that ἐπιστήμη is a ἕξις , and, more particularly an ἀρετή . It is this doctrine which, chiefly, enables Aristotle to produce a methodological doctrine which is consistent with his accounts of the nature of knowledge.

Chapter four considers the evidence for understanding the Analytics as a training in critical technique, and why Aristotle feels that the apodeictic syllogism is unsuited to the task of communicating findings. The principal theme of this chapter is an examination of the Aristotelian doctrine which holds that the logical training as provided by the Analytics constitutes a παιδεία and, as such, is unsuited to the task of publication.

Chapter five draws together the results of the discussion, and attempts to reconstruct the specific Aristotelian context which renders Aristotle's theory and practice coherent, and which may make it possible to determine the degree of consistency operative throughout his works. A model is presented which, it is suggested, reflects the position intended by Aristotle for those bodies of demonstrated judgments prefigured in the Posterior Analytics within the economy of Aristotle's methodological theory and practice in science and philosophy.

CHAPTER I

THE PROBLEM

"The method which Aristotle follows in his scientific and philosophical treatises and the method which he prescribes for scientific and philosophical activity in the Posterior Analytics seem not to coincide."[1]

In these words Jonathan Barnes presents what he refers to as the "Problem of Demonstration" with which this study is concerned. Barnes goes on to provide a brief yet comprehensive survey of the variety of responses which have been made to this problem, and we need here only summarize this survey referring to his paper for fuller treatment.

In general terms, there have been two main sorts of response to the problem. Some[2] have regarded the inconsistency as real and irremediable and have chosen to recognise that, for whatever reasons, Aristotle did in fact ignore his own methodological theory when he came actually to engage in philosophical and scientific work. Others,[3] amongst whom Barnes finds himself, have taken the inconsistency to be apparent only, and founded upon misunderstandings of Aristotle's intention, which misunderstandings they each seek to isolate and remedy in their various ways.

The proposal which will be advanced in this study falls most naturally into the second of these two categories. That is, it will be argued that there has been a misunderstanding of Aristotle's

intention, and that through the isolation and correction of this misunderstanding we see the concept operating in Aristotle's thought which embraces both theory and practice in such a way that the conditions of their consistency are revealed.

The suggestion to be advanced in this study does not call for the rewriting of Aristotle's scientific and philosophical works so that they exhibit apodeictic form,[4] nor does it call for the attenuation of the formal definition of ἀπόδειξις in order to accommodate Aristotle's practice.[5] Consequently there will be no occasion in this study to embark on any strictly logical examination of the logical doctrines of the Analytics. Further, it is not suggested in this work that the Posterior Analytics was written with a view to some special science (e.g. the mathematical sciences[6]), or to the sciences in general under some special circumstances (e.g. as "a formal model of how teachers should IMPART knowledge"[7]). The suggestion to be offered assumes that the method sketched in the Posterior Analytics was intended by Aristotle to apply to all the sciences, and further that the extant scientific and philosophical works express doctrines which owe their origin and growth, in large measure at least, to the actual practice of that method.

The thesis to be developed in fact bears some resemblance to that proposed by Jonathan Barnes[8] in that both studies maintain the view that the Posterior Analytics is concerned with education. Barnes, however, holds that the Posterior Analytics "is concerned exclusively with the teaching of facts already won," and "does not describe how scientists do, or ought to, ACQUIRE knowledge," but "offers a formal model of how teachers should IMPART knowledge."[9] It will be argued here that, on the contrary, the Posterior Analytics is intended to

equip students, scientists, and philosophers with certain of the tools necessary to the acquisition of knowledge. As such, Aristotle regards the lessons of the Analytics as tools indispensible to the scientist-philosopher[10] in his search for knowledge (while, in fact, as will be shown, Aristotle regards the actual apodeictic form as something of a liability to the scientist in the final publication of his findings).[11]

The Posterior Analytics is concerned with enabling people to attain knowledge - it forms part of a παιδεία.[12] Barnes would seem clearly to be right in seeing διδασκαλία as the proper context within which to find the solution to the Problem of Demonstration. This theme will be examined in somewhat greater detail in this work in an attempt to perceive precisely how Aristotle wants the apodeictic syllogism to operate within the context of διδασκαλία . It will be suggested that Aristotle intends that the apodeictic syllogism should be deployed in a somewhat more complex manner than simply as a device for the publication of facts duly supported by causes. It will be argued that the apodeictic syllogism is intended by Aristotle to be deployed not only as an expository device but also as a critical tool, a heuristic instrument to be used by the learning, the researching intellect within the didactic context.

CHAPTER II

THE QUESTION

> It must not be supposed that these works, /i.e. the Organon/ alone present the whole of Aristotle's theory of knowledge. Indeed, while he is occupied with formal logic he tends to brush aside the more fundamental questions about the origin and validity of human knowledge. And many of his most interesting observations on scientific procedure are to be found in prefatory passages to his own works dealing with the special sciences. It is an interesting and largely unexplored question whether Aristotle is in practice faithful to the general idea of science, and to the rules of method sketched in his Analytics.[1]

Clearly, the Organon is concerned more explicitly with logic than with epistemology. Yet Aristotle's relative silence in the Organon on these "more fundamental" issues seems itself to require some explanation, especially in view of the fact that we possess no other treatise devoted explicitly to these questions. We may be justified, then, in asking whether it is simply that he "tends to brush aside" epistemological concerns here or whether it is rather the case that in writing the Organon Aristotle is acting on the assumption that his audience shares with him a certain common understanding as to the nature of ἐπιστήμη.[2]

In attempting to isolate aspects of Aristotle's thought which might offer some insight into his methodological intentions and thus aid in the resolution of the problem of demonstration it is reasonable to begin the search in the general area of our understanding of Aristotle's conception of ἐπιστήμη. It is possible that the problem of demonstration has arisen through our failure to see the teaching of the Posterior Analytics as lying within the broader context of Aristotle's

own doctrines relating to ἐπιστήμη.

For instance, in the course of his discussion of the problem Jonathan Barnes comments: "'Science' is here of course to be understood in the broad sense of the Greek 'ἐπιστήμη'."[3] It would seem more appropriate, however, in this particular context to ask whether a more precise understanding is required in terms of the specific conventions within which Aristotle and his audience may be operating.

The issue becomes more critical - and the search for the specific origins of the problem of demonstration narrows - when we note a significant omission from Barnes' presentation of the basic conditions which differentiate an ἀπόδειξις from the other varieties of syllogism. Barnes writes: A demonstration "is differentiated from other varieties of syllogism by the following characteristics: the premisses of a demonstration must be (a) true; (b) necessary and universal; (c) immediate; and (d) causally related to the conclusion, which must itself be true, necessary, and universal."[4] The Aristotelian locus to which Barnes refers[5] reads as follows:

εἰ τοίνυν ἐστὶ τὸ ἐπίστασθαι οἷον ἐθέμεν, ἀνάγκη καὶ τὴν ἀποδεικτικὴν ἐπιστήμην ἐξ ἀληθῶν τ' εἶναι καὶ πρώτων καὶ ἀμέσων καὶ γνωριμωτέρων καὶ προτέρων καὶ αἰτίων τοῦ συμπεράσματος. (Post.An. 71^{b}19)

It will be noted that Barnes has omitted any reference[6] to the phrase γνωριμωτέρων καὶ προτέρων in his account. Yet the importance to Aristotle of the characteristics represented in the text by these terms is signalled by the fact that in the subsequent text he returns to elaborate on this theme (71^{b}31f) at some length, and does so again at 72^{a}25-72^{b}. At 71^{b}31 Aristotle writes: Καὶ προγινωσκόμενα οὐ μόνον τὸν ἕτερον τρόπον τῷ ξυνιέναι, ἀλλὰ καὶ τῷ εἰδέναι ὅτι ἔστιν. πρότερα δ' ἐστὶ καὶ γνωριμώτερα διττῶς·

οὐ γὰρ ταὐτὸν πρότερον τῇ φύσει καὶ πρὸς ἡμᾶς πρότερον, οὐδὲ γνωριμώτερον καὶ ἡμῖν γνωριμώτερον. λέγω δὲ πρὸς ἡμᾶς μὲν πρότερα καὶ γνωριμώτερα τὰ ἐγγύτερον τῆς αἰσθήσεως, ἁπλῶς δὲ πρότερα καὶ γνωριμώτερα τὰ πορρώτερον. ἔστι δὲ πορρωτάτω μὲν τὰ καθόλου μάλιστα, ἐγγυτάτω δὲ τὰ καθ' ἕκαστα· καὶ ἀντίκειται ταῦτ' ἀλλήλοις.

> Antecedently known, this antecedent knowledge being not our mere understanding of the meaning, but knowledge of the fact as well. Now 'prior' and 'better known' are ambiguous terms, for there is a difference between what is prior and better known in the order of being and what is prior and better known to man. I mean that objects nearer to sense are prior and better known to man; objects without qualification prior and better known are those further from sense. Now the most universal causes are furthest from sense and particular causes are nearest to sense, and they are thus exactly opposed to one another.[7]

Barnes' omission may seem explicable[8] on the grounds that such criteria as are represented by the terms γνωριμωτέρων καὶ προτέρων seem to some extent tautological and to be subsumed under the term αἰτίων. Aristotle himself might even be taken to lend support to this view, with regard at least to the term προτέρων, at line 71^{b}31 (καὶ πρότερα, εἴπερ αἴτια), and further extension of this to embrace γνωριμωτέρων is easily made.

Further, the omission may seem defensible on the grounds that these terms do not denote characteristics which may be readily treated as formal characteristics of the apodeictic syllogism per se, but seem to intrude, perhaps gratuitously, considerations relating to the intellectual condition of the one who is constructing the ἀπόδειξις. As such, these characteristics may be taken as not materially affecting the form of the demonstration itself (as does, for instance, the characteristic represented by the term αἰτίων).

Ross suggests,[9] in effect, that it is best to see the term γνωριμωτέρων as expressing a secondary formal characteristic of the

premisses themselves rather than to interpret it in the natural sense expressing a consideration relating to the intellectual condition of the demonstrator.

> 'Prior' and 'better known' state two characteristics both of which follow from the premisses' being causes, i.e. statements of the ground on which the fact stated in the conclusion depends. Both 'prior' and 'better known' are used in a special, non-natural sense. Aristotle would not claim that the facts stated in the premisses are necessarily prior in time; for in mathematics there is no temporal succession between ground and consequent. . . . 'Prior' therefore must mean 'more fundamental in the nature of things.' And again 'more known' does not mean 'more familiar,' nor 'foreknown,' 'known earlier in time.'[10]

Yet Barnes' omission and Ross' interpretation seem not to account for Aristotle's own treatment of these themes at such passages as $71^{b}31$f (quoted above) or $72^{a}25$-$^{b}4$ (quoted, in part, below). Nor yet do they seem even to entertain the possibility that these characteristics may have a connection with the initial and all important theme of Posterior Analytics I,i. "All instruction given or received by way of argument proceeds from pre-existent knowledge." Ross' appeal to the principle that "the same thing is not more known by nature and more known to us" (Post.An.72^{b}I) seems in a sense to jeapordize his own argument against any natural interpretation to these terms. The true scientist-philosopher is represented by Aristotle as the one who has achieved the state[11] where he is in fact more convinced of the premisses, the highest appropriate universals, than he is of those things which were more familiar ἡμῖν.

τὸν δὲ μέλλοντα ἕξειν τὴν ἐπιστήμην τὴν δι' ἀποδείξεως οὐ μόνον δεῖ τὰς ἀρχὰς μᾶλλον γνωρίζειν καὶ μᾶλλον αὐταῖς πιστεύειν ἢ τῷ δεικνυμένῳ, ἀλλὰ μηδ' ἄλλο αὐτῷ πιστότερον εἶναι μηδὲ γνωριμώτερον τῶν ἀντικειμένων ταῖς ἀρχαῖς ἐξ ὧν ἔσται συλλογισμὸς ὁ τῆς ἐναντίας ἀπάτης, εἴπερ δεῖ τὸν ἐπιστάμενον ἁπλῶς ἀμετάπειστον εἶναι . (Post.An.72^{a}37f)[12]

Similarly, Ross' comments to the effect that "Aristotle would not claim that the facts stated in the premisses are necessarily prior in time," seem somewhat one-sided. Our prior knowledge (even in the sense canvassed at the end of Post.An.I,i) is clearly as much at issue in this context as is the priority "in the nature of things" of the facts stated in the premisses.[13] It is not the priority in time of the premisses which is in question but the priority in time of our knowledge of those premisses which are of course prior in the order of being, not in time.

In short, we must see that these terms demand something of a more natural interpretation than Ross allows. It is of course true that Aristotle contrasts 'prior' and 'better known' τῇ φύσει with the 'more familiar' ἡμῖν . Yet in his recent work, Die Aristotelische Physik, Wolfgang Wieland has argued that γνώριμον means 'known' (erkannt) rather than 'knowable' (erkennbar) (but cf. e.g. von Fritz, p. 32) even within this anthithesis of φύσει and ἡμῖν .[14] Such an interpretation takes into account the context of Aristotle's discussion here which insists upon the attainment of a particular intellectual state as a condition for the occasion of true ἀποδείξεις . It is thus clear that these characteristics, while they are predicable by virtue of considerations of the "order of things," are also so predicable by virtue of the fact that Aristotle sees it as a necessary condition of ἀποδείξις that the demonstrator be himself more convinced of the premisses than he is of the conclusions.

Ἐπεὶ δὲ δεῖ πιστεύειν τε καὶ εἰδέναι τὸ πρᾶγμα τῷ τοιοῦτον ἔχειν συλλογισμὸν οὗ καλοῦμεν ἀπόδειξιν, ἔστι δ' οὗτος τῷ ταδὰ εἶναι ἐξ ὧν ὁ συλλογισμός, ἀνάγκη μὴ μόνιν προγινώσκειν τὰ πρῶτα, ἢ πάντα ἢ ἔνια, ἀλλὰ καὶ μᾶλλον· ..... μᾶλλον γὰρ ἀνάγκη πιστεύειν ταῖς

ἀρχαῖς δ' πάσαις δ' εἰσὶ τοῦ συμπεράσματος.
. (72[a]25f)

> Now since the required ground of our knowledge - i.e. of our conviction - of a fact is the possession of such a syllogism as we call demonstration, and the ground of the syllogism is the facts constituting its premisses, we must not only know the primary premisses - some if not all of them - beforehand, but know them better than the conclusion. . . . A man must believe in some, if not in all, of the basic truths more than in the conclusion.

And herein for our purposes lies the significance of Barnes' omission. Barnes ignores these conditions, in his treatment of the issue, since they derive from considerations which are, to some extent, extralogical. They derive from considerations of the thinking process, of the psychology of knowing, so to speak. They derive from considerations of what it is to know (ἐπίστασθαι) rather than from considerations of what it is that one has when one has knowledge (ἐπιστήμην ἔχειν). The distinction raised here is somewhat reminiscent of Socrates' admonition to Theaetetus (146[d]f).

This distinction is raised by Aristotle himself at Post.An. 74[b]21-24. It is raised in the context of a discussion of necessity as it applies to the premisses of demonstration. Aristotle's point is that while we may reason from true premisses without demonstrating this is not so if we reason from necessary premisses (74[b]15). Thus we object to premisses which are true but not necessary, whether because we think the premisses altogether devoid of necessity, or simply insofar as the argument is concerned. As an example Aristotle offers the following: "This shows how naïve it is to suppose one's basic truths rightly chosen if one starts with a proposition which is (1) popularly accepted, and (2) true, such as the sophists' assumption that to know is the same as to possess knowledge."

δῆλον δ' ἐκ τούτων καὶ ὅτι εὐήθως οἱ λαμβάνειν οἰόμενοι καλῶς τὰς ἀρχάς, ἐὰν ἔνδοξος ἢ ἡ πρότασις καὶ ἀληθής, οἷον οἱ σοφισταὶ ὅτι τὸ ἐπίστασθαι τὸ ἐπιστήμην ἔχειν. (74^{b}21-24)

Why does Aristotle choose this particular premiss to exemplify his point here? Ross suggests[15] that it is drawn from the Euthydemos at 277^{b} where this premiss is used by the sophist Dionysodorus in just such a manner as Aristotle condemns here. It is popularly accepted and true, but, as Socrates points out (277^{e}-278^{a}), it is not appropriately used in this argument since it rests on an ambiguity.[16] It is, to be sure, a familiar sophistical quibble, and as such may have been used here by Aristotle simply because it was ready to hand. Yet it is appropriate to note that Aristotle has already on two occasions (71^{b}10; 74^{a}28) alluded to the sophistic kind of knowing (that which is simply content with proving the accidents rather than with proving the accidents through the real causes), and he seems anxious to discriminate his apodeictic syllogistic from their specious kind of reasoning.

Indeed, even in the Euthydemos, Plato surely intends something by putting this premiss in the mouth of Dionysodorus. Plato's object is to ridicule not only the sophists' abuse of language but also their epistemological irresponsibility. They proceed on the assumption that once they have provided a method of proving their point they have provided a means of attaining knowledge. What they fail to recognize is that any valid scientific method must be a method which engenders understanding. (278^{a-b})

It seems quite likely that Aristotle's intention here is to make the same general point (note the use of the plural σοφισταί in

line 23). The apodeictic syllogism provides a medium not merely for proving the essential accidents, but also for our understanding of them as well. "We suppose ourselves to possess unqualified scientific knowledge of a thing, as opposed to knowing it in the accidental way in which the sophist knows, when we think that we know the cause on which the fact depends, as the cause of that fact and of no other, and, further, that the fact could not be other than it is." (71^b9f)

While it is generally accepted and true, that to know is the same as to have knowledge, this is an inappropriate premiss from which to begin one's search for the methods of attaining knowledge. It is this premiss which the sophists have adopted, irresponsibly, in designing their own methodology - a methodology which fails to take as its goal that essential component in ἐπίστασθαι which is understanding.

Yet the distinction raised here by Aristotle may seem to have little or no bearing on the omission noted above from Barnes' paper, nor on Ross' refusal to admit any natural interpretation to the terms γνωριμωτέρων and προτέρων. Barnes does include the characteristic, "causally related to the conclusion" (αἰτίων . . . (71^b22), which seems to cover this whole issue in Aristotle's conception of what constitutes a science. Barnes' treatment certainly would not let us confuse the Aristotelian and sophistic conceptions of what constitutes a science. Aristotle insists that any true scientific method must make manifest the true cause.

Does Aristotle's conception of a science, however, differ from the sophists' in this one respect only? If we accept Barnes' omission as valid (and Ross' non-natural interpretation of the omitted terms), it would seem that this is the case. However these omitted terms

represent yet a further, albeit a related point of differentiation between Aristotle's conception of what constitutes a science and the sophistic notion. For Aristotle insists that an apodeictic science comes into being not simply when the true causes are known, but when they are better known than, and prior to the conclusions. "We must not only know the primary premisses - some if not all of them - beforehand, but know them better than the conclusion: for the cause of an attribute's inherence in a subject always itself inheres in the subject more firmly than that attribute." ($72^{a}27-30$)[17] Aristotle insists then that not only must the formal conditions of understanding (i.e. the true causes) be present, but further that the material conditions (conviction covering the premisses) must actually have occurred before we may claim that an apodeictic science exists.

The point at issue between Aristotle and the sophists, then, is twofold. First, their method does not lay the basis for the revelation of the true causes while the apodeictic method does. Secondly, their method does not aim at understanding the causes in any case, while the apodeictic science is not considered to have come into existence until the scientist is himself more convinced of them than he is even of the conclusions. This latter element in the distinction is obliterated once we accept Barnes' omission and Ross' totally non-natural interpretation of the terms in question.

The distinction arises, again, in one of its forms, at Nicomachean Ethics, VII,ch.3. The context is Aristotle's discussion of ἀκρασία. The relevant passages read (in John Burnet's text):

"Ετι τὸ ἔχειν τὴν ἐπιστήμην ἄλλον τρόπον τῶν νῦν λεχθέντων ὑπάρχει τοῖς ἀνθρώποις· ἐν ᾧ γὰρ ἔχειν μὲν μὴ χρῆσθαι δὲ διαφέρουσαν ὁρῶμεν τὴν ἕξιν, ὥστε καὶ ἔχειν πως καὶ μὴ ἔχειν, οἷον τὸν καθεύδοντα καὶ μαινόμενον καὶ οἰνωμένον. ($1147^{a}10-14$)

δῆλον οὖν ὅτι ὁμοίως ἔχειν λεκτέον τοὺς ἀκρατεῖς τούτοις. τὸ δὲ λέγειν τοὺς λόγους τοὺς ἀπὸ τῆς ἐπιστήμης οὐδὲν σημεῖον· καὶ γὰρ οἱ ἐν τοῖς πάθεσι τούτοις ὄντες ἀποδείξεις καὶ ἔπη λέγουσιν Ἐμπεδοκλέους, καὶ οἱ πρῶτον μανθάνοντες συνείρουσι μὲν τοὺς λόγους, ἴσασι δ' οὔπω· δεῖ γὰρ συμφῦναι, τοῦτο δὲ χρόνου δεῖται· ὥστε καθάπερ τοὺς ὑποκρινομένους, οὕτως ὑποληπτέον λέγειν καὶ τοὺς ἀκρατευομένους. (1147[a]17f)

> And further the possession of knowledge in another sense than those just named is something that happens to men; for within the case of having knowledge but not using it we see a difference of state, admitting of the possibility of having knowledge in a sense and yet not having it, as in the instance of a man asleep, mad, or drunk. (1147[a]10-14)
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> It is plain, then, that incontinent people must be said to be in a similar condition to men asleep, mad, or drunk. The fact that men use the language that flows from knowledge proves nothing; for even men under the influence of these passions utter scientific proofs and verses of Empedocles, and those who have just begun to learn a science can connect up its arguments,[18] but do not yet know it; for it has to become part of themselves, and that takes time; so that we must suppose that the use of language by men in an incontinent state means no more than its utterance by actors on the stage. (1147[a]17f)[19]

Our interest in these passages is focused, of course, upon whatever insights they may provide into Aristotle's understanding of what it is to know (as in ἴσασι, line 22), as distinct from ἔχειν πως which is linked to μὴ ἔχειν (in line 13); and into his understanding of the processes involved in acquiring knowledge (as in the 'learners' referred to in line 21).

Burnet's note[20] on this passage reads, in part, as follows: "When we say a man has knowledge potentially we may mean either that he 'has' it but does not 'use' it, or, merely that he is capable of having it . . . but does not actually 'have' it at the time. This distinction is best brought out in Gen.An. 735[a]9 ἐγγυτέρω δὲ καὶ πορρωτέρω (τῆς ἐνεργείας) αὐτὸ αὑτοῦ ἐνδέχεται εἶναι δυνάμει, ὥσπερ ὁ καθεύδων γεωμέτρης ἐγρηγορότος πορρωτέρω, καὶ οὗτος τοῦ θεωροῦντος.

The case considered in this section is parallel to that of 'the sleeping geometer,' . . ."

Burnet rightly points out that this passage touches upon the ways in which we can know potentially. There is an interesting nuance in this passage however. Aristotle's concern here lies not only with the varieties of potential knowledge but perhaps even more with the fact that it is possible to possess potential knowledge and yet become actually ignorant (cf. Physics $255^{b}5$ ἀγνοία below). He is, after all, concerned to offer a possible explanation for the condition of ἀκρασία. In a certain sense, he says, one may both have, and not have, knowledge (1147^{a}13). The concluding lines of the passage quoted above (1147^{a} 22-24) describe the kind of knowing that is really only talk (cf. also 1147^{b}10-12). But it is talk. We are able, says Aristotle, to say the right things and yet become actually ignorant.

Physics $255^{a}30$-$255^{b}5$ reads as follows:

> But the fact that the term 'potentially' is used in more than one sense is the reason why it is not evident whence such motions as the upward motion of fire and the downward motion of earth are derived. One who is learning a science potentially knows it in a different sense from one who while already possessing the knowledge is not actually exercising it. Wherever we have something capable of acting and something capable of being correspondingly acted on, in the event of any such pair being in contact what is potential becomes at times actual: e.g. the learner becomes from one potential something another potential something: for one who possesses knowledge of a science but is not actually exercising it knows the science potentially in a sense, though not in the same sense as he knows it potentially before he learnt it. And when he is in this condition, if something does not prevent him, he actively exercises his knowledge: otherwise he would be in the contradictory state of not knowing.

Burnet is quite right in saying that the case considered in the Ethics passage is parallel to that of 'the sleeping geometer,' but it is only parallel, not identical.

Here in the Ethics passage Aristotle is anxious to display, perhaps rather more than in the Gen. An. passage cited, the sense in which that which is potentially something is also actually something. In this argument Aristotle maintains that while it is true that the ἀκρατής is potentially a knower he is, IN A SENSE, actually ignorant. It is in terms of potential knowledge but actual ignorance (Physics $255^{b}5$) that the whole dialectical passage has any meaning if, as Burnet rightly suggests, Aristotle is trying to show the Academy how it may, within its own doctrines (that is, holding to the essence of the Socratic paradox as cited at $1145^{b}23$f), explain ἀκρασία ; explain, that is, how man can act wrongly while seeming to have knowledge but not actually knowing.

Further, this case is only parallel to that of 'the sleeping geometer' because that which turns potential knowledge into actual ignorance differs with each of the passions cited - sleep, madness, drunkenness, etc. As we will shortly see this fact has important implications for our understanding of the case of the 'learners' in line $1147^{a}21$, whose impediment[21] is especially significant.

Paul Moraux, writing[22] of Aristotle's treatment of the stages of potential knowing, says: "Aristotle n'envisage pas le développement d'une faculté cognitive: cette faculté étant supposée prête à l'action, il analyse ses rapports avec son objet, selon qu'elle en est privée, qu'elle le possède ou qu'elle le contemple." Accurate as this comment may be, it is worth noting that texts such as the ones we have been examining would suggest that Aristotle holds that the potential knower at the second stage must undergo some form of further development before he can truly contemplate the objects his intellect possesses.

We shall consider below the nature of this development, and the impediment occasioned to the full exercise of knowledge if such development does not occur. Further, we will examine the possibility that Aristotle intends the apodeictic syllogism to play an important role in this development.

Before proceeding there is a problem to consider in John Burnet's text of E.N.1147[a]17f quoted earlier (p. 15 above). Burnet's text gives (a) μανθάνοντες (line 21) and συμφῦναι (line 22), while Bywater's Oxford text gives (b) μαθόντες and συμφυῆναι. It is of some interest here to consider which is the more probable reading.

The textual[23] evidence reported by Burnet and Bywater is not conclusive though neither offer any support from the manuscript tradition for Thurot's conjecture of μανθάνοντες for μαθόντες.

The choice must therefore be determined largely on the basis of the sense of the passage and this seems to me to favour Bywater's treatment.

Burnet, following Thurot, and W. D. Ross in his Oxford translation choose to construct the text so as to suggest that Aristotle is comparing the incontinent person to those who have just begun to learn a science but do not yet[24] know it for it must become part of themselves.

Bywater chooses to construct the text so that it has Aristotle comparing the ἀκρατής to students who have learned the science but do not yet know it, for it must have become part of themselves.

It seems that Aristotle would be more likely to draw his comparison with the latter class as it is clearly a more adequate reference for a comparison with the ἀκρατής. The incontinent person

is not simply a tyro. He already knows the evil of his action. That is the problem.

Burnet's note reads,[25] in part, as follows: ". . . This is another way in which Aristotle more than once describes merely potential knowledge. Cf. Physics 255^{a}33 . . . ; de An. 429^{b}8. . . . Thurot's conjecture μανθάνοντες for μαθόντες seems to me certain. We can hardly identify οἱ πρῶτον μαθόντες with οἱ μανθάνοντες πρὶν μαθεῖν." (De An. 429^{b}8)

Burnet seems not to have noticed that even on his own interpretation Aristotle is not here identifying the πρῶτον μαθόντες with οἱ μανθάνοντες πρὶν μαθεῖν . Burnet has already noted that the case being canvassed here is parallel to that of 'the sleeping geometer' - that is, to a geometer who has already learned the science but is taking a nap.

The Bywater reading seems the stronger. Further it fits quite well with the suggestion made earlier that Aristotle is here referring to a class of potential knowers who have indeed acquired their subject matter but must still be called ignorant. This class corresponds to the one noted in the Physics passage.[26] Such a person has already acquired a science, (ὁ ἔχων ἤδη 255^{a}34), but is not using it, (μὴ ἐνεργῶν 255^{a}34) possibly because he is impeded from doing so, (ἐάν τι μὴ κωλύῃ 255^{b}4).

We are now in a position to examine those elements in the Ethics passage which are specifically relevant to the earlier discussion concerning the proper Aristotelian definition of what constitutes an apodeictic science and his distinction between 'having knowledge' and 'knowing.'

Aristotle asserts here that "those who have just learned a

science" (οἱ πρῶτον μαθόντες, line 21) can be said to have knowledge in a sense' (ἔχειν πως, line 14) but 'do not yet know' (ἴσασι δ'οὔπω, line 21-22.cf. 1147^{a}13; 1147^{b}6; Physics 255^{b}5).

There can be little doubt that the μαθόντες here referred to are those who possess a science of a sort very closely resembling at least the model proposed in the Posterior Analytics. Aristotle's own words (τοὺς λόγους τοὺς ἀπο τῆς ἐπιστήμης line 18-19; ἀποδείξεις, line 20; συνείρουσι . . . τοὺς λόγους, line 21^{27}) seem if anything to stress the formal correctness of their science. But they are still ignorant. Why?

There is an impediment to their knowing; an impediment which is parallel, as Burnet has noted, to the sleep of 'the sleeping geometer.' Yet the impediment proves, in the case of the μαθόντες to be somewhat more complex than that of sleep.

The πρῶτον μαθόντες clearly do not belong to that class of knowers possessed simply of potentia prima, as the schoolmen call it, (even though Thurot's conjecture would, wrongly, imply this).

On the other hand, are we then to assume that οἱ πρῶτον μαθόντες can be classed amongst those who have attained possession of potentia secunda? Again we must answer, 'no.'

Perhaps the clearest statement of the criterion for the true possession of potentia secunda occurs at De Anima 429^{b}5f.

> Once the mind has become each set of its possible objects, as a man of science has, when this phrase is used of one who is actually a man of science (this happens when he is now able to exercise the power on his own initiative), its condition is still one of potentiality, but in a different sense from the potentiality which preceded the acquisition of knowledge by learning or discovery: the mind too is then able to think itself.

Potentia secunda may be said to have been achieved when the mind can, on its own initiative, proceed to the final actualization

of knowing. Yet the πρῶτον μαθόντες do not yet satisfy this criterion. There is some impediment barring their way to the stage where they can, on their own initiative, simply, make the next step to θεωρεῖν.[28] The Physics passage quoted above ($255^{a}30-^{b}5$) makes a similar specific reservation when describing the stage of potentia secunda. A man may be said validly to have attained potentia secunda when there are no longer any impediments to his capacity to θεωρεῖν at will ($255^{b}4$).

We must therefore conclude that οἱ πρῶτον μαθόντες are to be classed as those who have passed beyond potentia prima but who have not yet fully attained potentia secunda (at which later point they might properly be called actually men of science - De An. $429^{b}6-7$), since they are still subject to some sort of impediment.

What is this impediment? Aristotle provides the answer, and in doing so points to the conditions which, in terms of his scientific methodology, constitute the distinction between 'having knowledge' and 'knowing.' ἴσασι δ' οὔπω· δεῖ γὰρ συμφυῆναι, τοῦτο δὲ χρόνου δεῖται. "They do not yet know; for it must have become part of themselves, and that takes time." ($1147^{a}21-22$)

The impediment, then, is lack of time during which σύμφυσις might have occurred.

The word συμφυῆναι is not, perhaps, a very precise term, being used here in a somewhat extended sense (its most natural and frequent use being within biological contexts)[29], yet it is a strong word, and one which Aristotle defines fairly carefully at Meta Δ , $1014^{b}22f$. It is used to denote one of the basic means of natural growth or increase (the other being 'contact'). "Organic unity (σύμφυσις) differs from contact; for in the latter case there need not be anything

besides the contact, but in organic unities there is something identical in both parts, which makes them grow together instead of merely touching, and be one in respect of continuity and quantity, though not of quality." It is unnecessary here (perhaps impossible in any case), rigorously to apply Aristotle's dictionary definition to that which occurs between the mind and its objects. Yet the De Anima[30] seems to offer some grounds for our using this sort of language at least in an extended sense.

We must conclude that one who is in possession of apodeictic arguments, and further has the manifest facility to 'connect up these arguments' is nonetheless not ipso facto an ἐπιστήμων in the actual sense of the term until and unless he has undergone the further process of σύμφυσις.

But are we to infer therefore that the science is itself incomplete, or merely that the individual's possession of that science is somehow insufficient while the science itself, with regard both to form and content, is complete?

It is the contention here that this very question is improper in the Aristotelian context (though, of course, we must ask it) since the notion of an ἐπιστήμη existing independently of the ἐπιστήμονες who possess it is simply not operative in Aristotle's thought.[31]

Yet even despite this objection we discover that we must answer this question by saying that, in strict Aristotelian terms, the science is itself incomplete with regard both to form and to content, until the σύμφυσις is itself achieved. That is to say, in the process of σύμφυσις the mind turns its attention to matters either not embraced by the specific apodeictic syllogisms possessed by οἱ πρῶτον μαθόντες, or to matters embraced there, but not properly

elaborated,[32] and thus not fully embraced by the apodeictic system.

The answer to this critical[33] question must be sought through an examination of what Aristotle means by calling "lack of time" an impediment (E.N. $1147^{a}22$).

Aristotle has already told us, in the Nicomachean Ethics, how lack of time is an impediment, and further, he has specified the nature of those objects to which the mind relates in the process of σύνεσις.

At $1143^{b}6$f, Aristotle writes:

> This is why these states are thought to be natural endowments - why, while no one is thought to be a philosopher by nature, people are thought to have by nature judgment, understanding, and intuitive reason (νοῦν $1143^{b}7$). This is shown by the fact that we think our powers correspond to our time of life, and that a particular age brings with it intuitive reason and judgment; this implies that nature is the cause. Hence intuitive reason is both beginning and end; for demonstrations are from these and about these. (διὸ καὶ ἀρχὴ καὶ τέλος νοῦς· ἐκ τούτων γὰρ αἱ ἀποδείξεις καὶ περὶ τούτων. $1143^{b}9$-11.)[34] Therefore we ought to attend to the undemonstrated sayings and opinions of experienced and older people or of people of practical wisdom no less than to demonstrations; for because experience has given them an eye they see aright. (διὰ γὰρ τὸ ἔχειν ἐκ τῆς ἐμπειρίας ὄμμα ὁρῶσιν ὀρθῶς. $1143^{b}13$-14).

And again a few pages earlier, Aristotle writes[35] ($1142^{a}15$f):

> . . . but a young man has no experience, for it is length of time that gives experience; indeed one might ask this question too, why a boy may become a mathematician, but not a philosopher or a physicist. Is it because the objects of mathematics exist by abstraction, while the first principles of these other subjects come from experience, and because young men have no conviction about the latter but merely use the proper language, while the essence of mathematical objects is plain enough to them?

οἱ πρῶτον μαθόντες are impeded by lack of time, then, because time is required for experience to occur ($1142^{a}15$-16; $1143^{b}13$-14), and it is really, therefore, experience in which they are lacking. Further, lack of experience is an impediment by virtue of the fact that it is experience which provides the ἀρχαί of the various sciences.

Yet, to be more precise again, the impediment occasioned by lack of time during which experience might have occurred is really a deficiency of νοῦς. (1143^{b}5,9) For it is νοῦς which, in time and through experience, gives the eyes so that the ἀρχαί of the various sciences may be seen aright (1143^{b}13-14). Thus we should pay attention to men who have had the time and the experience and to their undemonstrated assertions and their views even though they are unsupported by proofs. (1143^{b}11-13)

We must note here that in introducing reference to the reflections on the ἀρχαί on the part of those who have surmounted the temporal impediment, Aristotle is in fact expanding both the form and the content of the sciences as properly to be possessed by those who are actually men of science. Lack of time is an impediment in that it prevents οἱ πρῶτον μαθόντες from συμφυήναι. νοῦς . . . must come together with the ἀρχαί so that they form a unity which resembles, somehow, the integrated growth of parts within a natural organism.

However, when Aristotle says (1142^{a}19) that the ἀρχαί are attained through experience does he mean that οἱ νέοι (or οἱ πρῶτον μαθόντες) have simply no idea of the ἀρχαί of their sciences at all? Does he mean that they have not been involved in any induction of these premisses?[36] Clearly, this is not the case. It is evident that οἱ νέοι, even though they lack time and experience for νοῦς to operate, nonetheless 'have' the ἀρχαί at least to the extent that they are able to 'use the proper language' (λέγουσιν 1142^{a}20; cf. λέγειν τοὺς λόγους τοὺς ἀπὸ τῆς ἐπιστήμης 1147^{a}18-19; ἀποδείξεις 1147^{a}20; συνείρουσι .... τοὺς λόγους 1147^{a}21).

But Aristotle makes it quite clear what he intends by the phrase τῶν δ' αἱ ἀρχαὶ ἐξ ἐμπειρίας when he glosses it with the

comment καὶ τὰ μὲν οὐ πιστεύουσιν οἱ νέοι ἀλλὰ λέγουσιν (1142[a]19-20). The young men have 'no conviction about'[37] the ἀρχαί because time and experience have not been granted them through which νοῦς could have gained insight into the ἀρχαί (1143[b]13-14).

Νοῦς, then, is the faculty which enables the novice learners first to isolate, and grasp the bare statement of the ἀρχαί. But νοῦς is also, for Aristotle, that faculty which, on the basis of experience and subject to time, so broadens the comprehension of the ἀρχαί that a better and more complete knowledge of them may be obtained and thus a firmer conviction concerning them.

We must, of course, enquire as to the nature of this 'experience' - what is its field of operation and how does it enable νοῦς to broaden and improve its comprehension of the ἀρχαί. We must further ask how the ἀποδείξεις themselves relate to this final movement of intuitive induction. The answers to these enquiries fall more naturally into later sections of this study, though something of the outline may be perceived in the pages which follow here.

Yet the general Aristotelian doctrine is simply that it is νοῦς that provides the ἀρχαί, and one is left with the strong impression that νοῦς is thus the prius (both in time and in the definition of knowing) of all apodeictic activity. The De Anima, for instance (III, 4-8), and the Posterior Analytics (II, 19) do not obviously depict νοῦς as the special prerogative of any particular age group.[38] Thus the suggestion that νοῦς only becomes operative in some significant way at a later stage in life needs some qualification. Such a qualification actually exists in the text at 1143[b]9-11 διὸ καὶ ἀρχὴ καὶ τέλος νοῦς· ἐκ τούτων γὰρ αἱ ἀποδείξεις καὶ περὶ τούτων.[39] Νοῦς, it would seem, does double duty. Initially it provides the ἀρχαί upon

which all demonstrations are built. Subsequently, with the passage of time and through experience, νοῦς is the faculty whereby we gain true conviction concerning the ἀρχαί which, initially, it isolated. νοῦς is, as well, the completion[40] of the scientific process (that is, of potentia secunda - it is not the ultimate actualization of knowing for that is θεωρεῖν).[41]

Of course, Aristotle does talk of two ways of acquiring the ἀρχαί. He talks of νοῦς and of ἐπαγωγή. (For the purposes of this study we may leave ἐθισμός to one side for it sustains the ἀρχαί of action, not of science. We will consider the role of dialectic in providing the ἀρχαί of the various sciences (Topics 101[a]25) in Chapter 5, below).

H. D. P. Lee analyses the roles of νοῦς and of ἐπαγωγή, and summarizes[42] the relationship between the two as follows:

> But though he thus speaks of two different ways of apprehending first principles, it is clear that Aristotle does not mean that they are absolutely distinct and unconnected. The meaning of An.Post.B19 is rather that νοῦς is the last phase in a development from sense through memory and experience (cf. also Met. A.1); νοῦς is not an isolated faculty, but a final act of insight whereby after the experience of particular instances (ἐπαγωγή) we finally see the general principle involved. And thus ἐπαγωγή, literally 'leads us on' to this final insight. νοῦς and ἐπαγωγή are in this way complimentary.

This comment, as far as it goes, is perfectly accurate. Aristotle does use the terms νοῦς and ἐπαγωγή with a fluidity that makes them, to all intents and purposes, interchangeable. But Lee does not ask, nor answer, the larger question. That is, when he asserts that νοῦς is not an isolated faculty, but a final act of insight he does not enquire into the sequence of processes which precede this 'final' act. Yet such a question seems inevitable if we accept his earlier[43] invitation to compare νοῦς with Plato's νόησις.

Lee writes:

> νοῦς then apprehends first principles, and the method of νοῦς is intuitive. This is evident from the general contrast between νοῦς and ἐπιστήμη. The function of ἐπιστήμη is reasoning, passing step by step from premiss to conclusion; and the natural antithesis of this type of thought movement is the intuitive. (Compare νόησις and διάνοια in Plato) . . .
>
> There is a parallel here both in terminology and thought between Plato and Aristotle. It is unlikely that the similarity of terminology is accidental; and the difference in meaning (between νόησις and νοῦς) is merely that between a faculty and the exercise of a faculty. There is also a clear parallel of function. Both Aristotle's νοῦς and Plato's νόησις have as their object the reaching of ἀρχαί ; and νόησις is contrasted with διάνοια , νοῦς with ἐπιστήμη the contrast in both cases being between a deductive thought movement and as intuitive. νοῦς and νόησις formulate the first principles from which ἐπιστήμη and διάνοια deduce the consequences.

Lee is manifestly right in calling our attention to the parallel between νοῦς and Platonic νόησις. Yet he fails to carry the parallel far enough and note the fact that for Plato νόησις occurs methodologically <u>after</u> διάνοια.[44] It is our experience in the deductive processes of διάνοια , in establishing the causes of things, which enables us to gain insight (in the final stage of the "line") into the conditions of the causes - into the ever more ultimate ἀρχαί until we encounter the ἀνυπόθετος ἀρχή. The condition of the attainment of νόησις for Plato is the painstaking process through διάνοια.

We can hardly fail to ask whether for Aristotle the same conditions are not requisite to the final act of insight - to νοῦς, (though, of course, there is for Aristotle, no ultimate single but only the indemonstrable ἀρχαί of the individual sciences).[45]

Is it not this painstaking process through διάνοια - the careful elaboration, in Aristotelian terms, of the ἀποδείξεις - which the πρῶτον μαθόντες have not had the time, yet, properly to undertake? They have the right arguments - but they have not yet so used those

arguments as to see their grounds with the full comprehension of νοῦς .

Aristotle seems to view the apodeictic movement as itself, on occasion, bracketed between two movements of intuitive induction,[46] of νοῦς . The first, initially to provide the ἀρχαί ; and the second, to bring about the σύμφυσις - that is, to complete the real content of the science through an examination, exposition, and defence of the ἀρχαί in their own right as definitions. We begin to see that the formal apodeictic syllogisms act, at times at least, to provide the tool whereby the "confused situation"[47] which is the subject genus may be comprehended no longer as "confused" but in its necessary being. It is not here being suggested that Aristotle conceives it to be the single function of the apodeictic syllogism to provide the medium whereby νοῦς may achieve final comprehensive insight into the ἀρχαί of a science. The function of the syllogism is quite simply to demonstrate the demonstrable.[48] Further, the defining relationship between νοῦς and ἀπόδειξις remains, for Aristotle, as he himself summarizes it in the final words of the Posterior Analytics: "And the originative source of science grasps the original basic premiss, while science as a whole is similarly related as originative source to the whole body of fact." We must come to understand the various conditions under which Aristotle sees demonstration of the demonstrable as appropriate. In this way we will avoid exhibiting ἀπαιδευσία .

We must note, as a context to this study, the discussion amongst such scholars as von Fritz, Wieland, Hess, Happ and others. That discussion centres largely on two related questions: the types and practice of induction according to Aristotle; and the nature, function, and demonstrability of the ἀρχαί . Their concern with the status of the ἀρχαί and with the possible logical structure of

Aristotle's ἐπαγωγή constitute, of course, the field of our concern here.

In a sense, however, consideration of these issues lies beyond the immediate requirements of our present study. Here we are concerned with the possibility that Aristotle intends the apodeictic syllogism to discharge, as one of its functions, a certain service vis-a-vis the intellect. The ἀποδείξεις , it is here suggested, present the perceived situation in a science to the mind in such a way that it will be able to attain conviction concerning the ἀρχαί of that science. It is the role of ἀπόδειξις which is the focus of our attention in this study.

We must leave to some future study the question of what type of induction, if any, might make use of the ἀποδείξεις in the manner here suggested. So too we must postpone consideration of the question of the nature of the ἀρχαί themselves. This issue is certainly not irrelevant, but it is, perhaps, somewhat circumvented by the suggestion made in Chapter 5 concerning the operation in Aristotle's thought of the 'principle of essence' as distinct from the 'essences' themselves.

We might, however, call attention to an issue raised, for instance by von Fritz (p. 39: cf. Wieland (3), p. 55f; Hess, p. 50f). von Fritz reminds us that the ἀρχαί are the ἀρχαί of the individual sciences and function as such. We are encouraged to take seriously the claim here being pressed that the perception of the ἀρχαί can not be considered as entirely independent of the "analysis"[49] of the subject matter of the desired science.

Further, we might ask whether some contribution to the debate between Wieland and his critics on the nature of the ἀρχαί might be

found in the suggestion (Chapter 5, below) concerning the "principle of essence." Wieland is himself concerned with the essences as principles or points of view - as gesichtspunkte. Yet it will be argued below (p. 78f) that it is not the telos itself but the principle of finality which constitutes the true Aristotelian point of departure in method. There is, it would seem, something of a fresh perspective thrown on the question of the status of the ἀρχαί as considered by Wieland and his critics.

It is, however, as we noted above, the apodeictic syllogism and one of its possible functions which is our chief concern here. One might, in fact, remember that Aristotle chose to entitle his works dealing with the syllogism and the apodeictic syllogism τὰ ἀναλυτικά and it is in its analytic role - that of the resolution of ἀπορίαι of clarifying confused situations - that the apodeictic syllogism performs its defining function.

A disclaimer is called for concerning this 'analytic.' It is not suggested here that Aristotle entertains the possibility of the circular demonstration of the ἀρχαί as described in Prior An. 2,23. His rejection of that possibility is categorical at Post. An. 1,3 where he asserts that circular demonstration is far too limited in its applicability to be of any significant use, to say nothing of the general doctrinal principles such a procedure would violate within Aristotle's system.[50]

It should, finally, be emphasized that the operation of intuitive induction is nowhere[51] accepted by Aristotle as "proof." Ross is quite correct when he writes:[52]

> Here, then, under the heading of induction he clearly contemplates a mental process which is not proof, yet on which knowledge supervenes. . . . The induction here is not proof of the principle, but the psychological preparation upon

> which the knowledge of the principle supervenes. The knowledge of the principle is not produced by reasoning but achieved by direct insight. . . . This is in fact what modern logicians call intuitive induction. And it is far the most important of the types of induction which Aristotle considers.

Aristotle's almost casual comment at Post.An.74^{b}23-24 has provided the occasion for an examination of certain elements in Aristotle's thought which may alert us to the danger that the tendency to ignore (with Barnes) or to interpret non-naturally (as with Ross) certain of Aristotle's prime[53] conditions of ἀπόδειξις may be symptomatic of a partial view on our part of Aristotle's conception of apodeictic science. For the tendency[54] is really one of purifying Aristotle's logic (and consequently his scientific methodology) of any natural - i.e. physiological or psychological - elements, with the inevitable consequence that it is seen simply as a deductive form. It is a tendency so to purify Aristotle's logic as to render the ambiguity[55] between 'having knowledge' and 'knowing' null and void - to reduce knowledge to the simple possession of a "replica of the real." "The aim of science," writes Allan,[56] "is to produce a body of judgements which, in their connexion with each other, reflect the necessary connexions between substances and properties in the real world. 'The truth to be attained is a replica of the real' (H. H. Joachim)."

Aristotle seems to see the aim of his methodology, more ambitiously, perhaps, than Allan does, as that of creating conditions under which the "replica of the real" as it might be exhibited in a finite set of ἀποδείξεις may be recognised with conviction[57] as a true "replica of the real"; and it is this convinced recognition which constitutes the prime condition for the existence of an apodeictic science. His insistance upon the prior and better knowledge of the ἀρχαί seems to derive from his concern to effect this aim since it

is the priority and superiority which produces the specific conviction which thus defines scientific knowledge.[58]

At Post.An.75^{a}12f, just a few paragraphs after his reference to the naiveté of the sophists, Aristotle summarises his remarks by insisting that our recognition, the psychological state of the knower, is the ultimate determinant of the validity of the scientific knowledge. Not only must the premisses be necessary (else there will be no demonstration at all), but also the premisses must be recognised as necessary,[59] else the alleged demonstrator will still be in a state of ignorance (as were οἱ πρῶτον μαθόντες).

There is a further statement of this principle at Post.An.89^{a} 11-23 which passage offers further corroboration of the interpretation here offered of Aristotle's methodological intentions. At 89^{a}14, Aristotle refers to a process of passing through "the middle terms until the immediate premisses are reached." It would seem impossible that Aristotle is here thinking of a dialectical process (as at Topics 101^{a}36) since there is nothing in the context to permit such a reference to dialectic. Further, it seems highly improbable that he has the syllogism of induction (Prior Analytics 2,23) in mind since its operation, as he notes at Prior An. 2,23 and at Post.An. 1,3, is limited to convertible terms, and such a special class would not fit the general discussion here.

It seems unavoidable that the process to which Aristotle is referring here is a process of inductive inspection (cf. οὐδ' ἐπιστήμη ἀναποδεικτικός at 88^{b}36) which is conducted on the middles of an already established apodeictic chain of the science. This interpretation gains support from what Aristotle says next (89^{a}16-18): "The truth perhaps is that if a man grasp truths that cannot be other than they are, in the way in which he grasps the definitions through which demonstrations take place, he will have not opinion but knowledge."

CHAPTER III

THE AIM OF SCIENCE

"The details of Aristotle's theory are obscure, but its outline is clear: a demonstrative science is an axiomatised deductive system comprising a finite set of connected ἀποδείξεις or demonstrations."[1]

In the preceding chapter the completeness of such a definition of Aristotle's conception of a demonstrative science was critically examined, and it was argued that neither the form nor the content of an Aristotelian apodeictic science is achieved until the ἀρχαί of that science are comprehended, explored, and defended in their own right as definitions.

In this chapter the goals of Aristotelian science will be examined and an attempt will be made to articulate what it is that acts, in Aristotle's view, as the purpose, the ἐντελέχεια of apodeictic science.

At De Anima 417^{a}26-^{b}7, Aristotle says:

> . . . but there is a difference between their respective potentialities, the one (a) being a potential knower, because his kind or matter is such and such, the other (b), because he can in the absence of any external counteracting cause (ἂν μή τι κωλύσῃ τῶν ἔξωθεν - ^{a}28) realize his knowledge in actual knowing at will (ὁ δ' ὅτι βουληθῇ δυνατὸς θεωρεῖν- ^{a}27-28). This implies a third meaning of 'a knower' (c), one who is already realizing his knowledge - he is a knower in actuality and in the most proper sense is knowing, e.g. this A (ὁ δ' ἤδη θεωρῶν, ἐντελεχείᾳ ὢν καὶ κυρίως ἐπιστάμενος τόδε τὸ A - ^{a}28-29). Both the former are potential knowers, who realize their respective potentialities, the one (a) by change of quality, i.e. repeated transitions from one state to its opposite under instruction, the other (b) by the

> transition from the inactive possession of sense or grammar to their active exercise. The two kinds of transition are distinct.
>
> Also the expression 'to be acted upon' has more than one meaning; it may mean either (a) the extinction of one of two contraries by the other, or (b) the maintenance of what is potential by the agency of what is actual and already like what is acted upon, with such likeness as is compatible with one's being actual and the other potential (τὸ δὲ σωτηρία μᾶλλον ὑπὸ τοῦ ἐντελεχείᾳ ὄντος τοῦ δυνάμει ὄντος καὶ ὁμοίου οὕτως ὡς δύναμις ἔχει πρὸς ἐντελέχειαν 417^{b}3-5). For what possesses knowledge becomes an actual knower by a transition which is either not an alteration of it at all (being in reality a development into its true self or actuality εἰς αὐτὸ γὰρ ἡ ἐπίδοσις καὶ εἰς ἐντελέχειαν - 417^{b}6-7) or at least an alteration in a quite different sense from the usual meaning.

In this passage we see Aristotle making much the same use of ἐπιστήμη to exemplify the operation of potentiality and actuality as he did at Physics 255^{a}30f.[2]

We may note, first, that this passage is consistent in its teaching concerning the nature of the true possession of potentia secunda with the two passages (Physics 255^{a}30; E.N. 1147^{a}11f) examined in Chapter 2. Potentia secunda is not to be considered as secured until all the impediments to its attainment have been overcome (417^{a}27-28). We have already noted[3] the occurrence of virtually the same phrase (ἂν μή τι κωλύσῃ τῶν ἐξωθεν- ^{a}28) at Physics 255^{b}4, and its sense is made manifest, as has been argued, in the Nicomachean Ethics.[4] At Metaphysics 1048^{a}16, Aristotle advises us that we need only add this proviso when the potentiality (in this case, potentia secunda) has itself not yet been fully achieved.

We discern the correspondence of the passages even more clearly when we note (line 417^{b}6-7) that Aristotle describes the process of gradually attaining the fullness of potentia secunda as a process of ἐπίδοσις, a word strongly reminiscent of the "growth" concept represented in the Ethics (1147^{a}22) by the term συμφυῆναι.

The passage from the De Anima is, then, consistent with, and to that extent corroborates, our findings in Chapter 2. Yet the passage is useful not simply for that reason alone for it serves also to bring into somewhat sharper focus the question of what it is that constitutes for Aristotle the objective to be achieved in science. What is it that constitutes the ἐντελέχεια of ἐπιστήμη ?

"The aim of science is to produce a body of judgements which, in their connexion with each other, reflect the necessary connexions between substances and properties in the real world. 'The truth here to be attained is a replica of the real.' (H. H. Joachim)."[5]

ἐπιστήμη aims at, says Allan, is completed in, has for its ἐντελέχεια , "a body of judgements" or "a replica of the real." Yet Aristotle here repeatedly asserts that it is θεωρεῖν which is the ἐντελέχεια of the knowing agent ($417^{a}28,29$; $417^{b}5,^{b}19$), and reasserts the doctrine frequently elsewhere (e.g. De An. $412^{a}10,^{a}22$; Physics $255^{b}2$; Meta. $1087^{a}20$; $1048^{a}34$; $1050^{a}12$-14; E.N. $1146^{b}31$-35; E.E. $1216^{b}11$-15; De Gen.An. $735^{a}11$).[6]

The ἐντελέχεια of ἐπιστήμη is then, according to Allan and Joachim, a body of judgements, a replica of the real; while we have evidence that the ἐντελέχεια of the knowing agent himself is, rather, the activity called θεωρεῖν.

Some clarification is called for. It would seem that Allan and Joachim are quite right in their comments in so far as they are considering ἐπιστήμη in its personified sense, as an abstraction. Abstractly considered ἐπιστήμη can not aim at any activity. Medical science does not cure people; doctors do.

If man is constrained (as Aristotle's Organon clearly recog-

nises) to achieve his sciences through language then he must terminate his sciences, in so far as they are confined to language, in statements, - in bodies of judgements which replicate the reality studied. In this sense Allan's "body of judgements" or Joachim's "replica of the real" are fully justified. They are the concrete terms which correspond adequately to the notion of ἐπιστήμη considered abstractly (see pp. 45-46 below).

And yet it is certainly appropriate to call attention to the fact that we are concerned in this enquiry with the practical, concrete problems of Aristotle's scientific method. We must therefore attempt to reconcile, if possible, this sense of ἐπιστήμη abstractly considered with those statements where Aristotle treats ἐπιστήμη as a certain condition of the mind relating it, physiologically so to speak, to the objects of knowledge.[7]

There is one passage, at Metaphysics $1050^{a}10$f, which seems to afford some help in this regard. It appears to express Aristotle's view on how we are to understand the relationship between ἐπιστήμη abstractly considered (as culminating in bodies of judgements) and ἐπιστήμη considered from the agent's perspective.

> For animals do not see in order that they may have sight, but have sight in order that they may see. And similarly men have the art of building that they may build, and theoretical science that they may theorize; but they do not theorize that they may have theoretical science, except those who are learning by practice; and these do not theorize except in a limited sense, or else they have no need to theorize. (ἀλλ' οὐ θεωροῦσιν ἵνα θεωρητικὴν ἔχωσιν, εἰ μὴ οἱ μελετῶντες· οὗτοι δὲ οὐχὶ θεωροῦσιν ἀλλ' ἢ ὡδί [ἢ ὅτι οὐδὲν δέονται θεωρεῖν]. $1050^{a}12$-14.)

While Allan and Joachim[8] would seem to concentrate on the sense in which science must elaborate judgements we must be careful, I think, not to reduce the meaning of science as Aristotle understood

it simply to the production of these bodies of judgements on the analogy, for instance, of housebuilding ($1050^{a}30$).[9] Aristotle has here made it very clear that the actuality of the knower's potentiality resides not in any such produceable body, - rather it resides in the activity of the agent. Aristotle makes his meaning very clear at $1050^{a}23$-$^{b}2$. He concludes that statement by saying ($1050^{a}34$-36): ". . . but when there is no product apart from the actuality, the actuality is in the agents, e.g. the act of seeing is in the seeing subject, and that of theorizing in the theorizing subject."

But if we are to reconcile the two perspectives we must still work out the functional relationship between them. That is, we must ask what specific function is discharged by the bodies of judgements, the finite sets of ἀποδείξεις described in the Posterior Analytics.

Aristotle's comment at Meta. $1050^{a}12$-14, quoted above, provides us with a fairly clear indication of the proper way to see these arguments, these bodies of judgements, in relation to the final ἐντελέχεια of the agent. οἱ μεθεστῶντες, he says, do in fact theorize that they may have a theoretical science but they can not be regarded as engaged upon true theorizing.[10] It will be remembered that in Chapter 2,[11] we saw that οἱ μαθόντες and οἱ νέοι were required to gain the experience which would free them of their impediment and thus let them reach their ἐντελέχεια.

But there is a further issue raised as well. That is, what is it that constitutes the ultimate act of θεωρεῖν ? Is it perhaps the act simply of gazing at the replicas of the real which we have produced? Or, perhaps it is as Joachim puts it:[12]

> It is only in his speculative activities that man pursues an 'end' which is the proper 'end' of intelligence. In the pursuit of knowledge simply for the sake of understanding - in what Aristotle calls θεωρητικὴ ἐπιστήμη or φιλοσοφία - the intelligence moves freely towards the attainment, and in the vision and enjoyment, of the truth.

On this question too Aristotle offers some direct, if not entirely helpful, comment at De An. 417^{a}28-29 when he writes: "One who is already realizing his knowledge - he is a knower in actuality and in the most proper sense is knowing, e.g. this A."

The "knower in actuality" has a particular as the content of his knowing. This seems the inescapeable intent of this line. The same doctrine recurs explicitly at Meta 1087^{a}10f (and at Meta 1048^{a}35 if we accept θεωρῆσαι τόδε ἐνεργείᾳ).[13]

In his note on this doctrine,[14] Ross says that it is contrary to Aristotle's "usual view,which is that actual knowledge is of universals. The doctrine of the Posterior Analytics cannot be understood in any other sense, and the other works as well occasionally state the doctrine quite explicitly. De An. 417^{b}22 . . . Meta 1039^{b}27 . . . it is a genuine part of Aristotle's theory, though perhaps inconsistent with another part."

It is plain that there is a real problem, if not a simple inconsistency as Ross suggests, in this matter, and Aristotle himself, no less than his commentators, recognises the dimensions of the difficulty. We should note for instance his manifest admission of over-involvement at De An. 417^{b}28-29, and his own confirmation of the "greatest difficulty" at Meta 1087^{a}10.[15]

In the face of such admissions on Aristotle's part it would be most foolhardy to expect any simple resolution to this problem, which, in any case lies well outside the scope of the present study. The problem must, nonetheless, be at least examined since it seems to

have a direct bearing upon our understanding of what Aristotle comprehends under the term 'science', ἐπιστήμη, and on the scope of his scientific methodology as it is defined by that ultimate aim of science.

Aristotle tells us that the ἐνέργεια of ἐπιστήμης θεωρεῖν which is not a process of building or producing bodies of judgements, but is an activity residing in the agent, and relates, if De An. 417[a]28-29 is to be believed, to the particular, while we are everywhere repeatedly assured that ἐπιστήμη has for its proper object a universal. Are we to infer then from this that ἐπιστήμη has its proper object, "the universal," while θεωρία has a distinct object, the particular?[16] Or is it possible that both have the universal as object, but in different ways such that, by way of contrast, Aristotle refers to the object of θεωρεῖν as a particular.[17]

We have an interesting echo of this doctrine in that Aristotle tells us that knowledge of the 'more intelligible' renders us more 'sensitive' to things that are 'less intelligible' at De An. 429[a]29f.

> Observation of the sense-organs and their employment reveals a distinction between the impassibility of the sensitive and that of the intellective faculty. After strong stimulation of a sense we are less able to exercise it than before, as e.g. in the case of a loud sound we cannot hear easily immediately after, or in the case of a bright colour or a powerful odour we cannot see or smell, but in the case of mind, thought about an object that is highly intelligible renders it more and not less able afterwards to think objects that are less intelligible. The reason is that while the faculty of sensation is dependent upon the body, mind is separable from it.
>
> Once the mind has become each set of its possible objects, as a man of science has, when this phrase is used of one who is actually a man of science (this happens when he is now able to exercise the power on his own initiative), its condition is still one of potentiality, but in a different sense from the potentiality which preceded the acquisition by learning or discovery: the mind too is then able to think itself.

This passage is reminiscent of the doctrine at 417[a]28-29. The distinction between "less intelligible" and "more intelligible" seems to equate generally in Aristotle to the distinction between particular and universal. It may be that in the passage at 417[a]28-29 and in those passages which exhibit the same doctrine Aristotle is, almost by metonymy, referring to individual issues or ἀπορίαι not specifically covered by a man of science but which he is able to resolve by virtue of his greater "sensitivity." At any rate, we have in this text evidence of a psychological insight on Aristotle's part which coincides with his earlier assertions about the relationship which obtains between ἐπιστήμων and θεωρεῖν.[18]

Whatever the ultimate resolution of this immediate problem may be, certain facts emerge concerning the general nature of θεωρεῖν. First, we see that Aristotle does in fact affirm an aim or goal for the ἐπιστήμων in his works and it is not left implicit in his teaching. That goal is θεωρεῖν.

Further, θεωρεῖν is not a process of building bodies of judgements but is an activity residing in the agent.

Further again, we have strong ground for believing that whatever the precise object of θεωρεῖν may be, it involves something beyond looking at the replicas the mind has produced. It involves the attainment, as Joachim has said, of the truth.

We are now, perhaps, in a position to suggest that it is οἱ μελετῶντες who are charged with the task of building the bodies of judgements through which they come to the full possession of potentia secunda at which point, if they will it, they may proceed to θεωρεῖν.

However, in a comment applicable to the discussion here D. W. Hamlyn observes:[19] "There is a constant tendency for Aristotle to run

thinking and knowing together, as his invocation of an 'activity' sense of 'knowing' reveals. . . . Aristotle's confusions in this passage are evident enough, but they are endemic in his thought."[20]

It is manifestly true that Aristotle does "run thinking and knowing together." It is, further, true that this practice confuses us. What is perhaps not so clear is whether this is evidence of confused - i.e. sloppy or careless - thinking on Aristotle's part, or proceeds rather from a conscious doctrine which is, indeed, "endemic in his thought."

We have already examined, in Chapter 2, several instances where this tendency is manifested. We noted Aristotle's unwillingness (or inability) to elaborate logical criteria to define the apodeictic syllogism which took no account of the psychological condition of the knower.

The strength of this tendency may be seen on those few occasions when Aristotle comes to recognise some sense to the term knowing which is to be somehow distinguished from the active exercise of thought. For on these occasions Aristotle still does nothing to distinguish knowing from thinking. For example, Physics $247^{b}11$ reads: ". . . we do not claim an intelligent understanding until our thinking has come to a stand."[21] Aristotle sees the very etymological roots of the term as lying within the process of thought coming to rest. Again in the image of the "rout" in Post. An. 2,19 and of the "race-course" in E.N.1,4 the image is of a complete integration of the two.

De An. $407^{a}32$ has even more significance for our attempt to discover just how fundamental was this tendency and whether it must be ranked as confusion or doctrine.

"Further, thinking has more resemblance to coming to rest

or arrest than to a movement; the same may be said of inferring (τὸν αὐτὸν δὲ τρόπον καὶ ὁ συλλογισμός)."

The Oxford translation obscures somewhat the impact of this passage for the final word is not συλλογίζεσθαι but συλλογισμός. The syllogism, the expressed implication, is characterized itself in terms of the mind's thinking process and is not conceived of by Aristotle as something that can exist isolated from the thinking mind.

But if the tendency is real and fundamental it remains nonetheless confusion unless we can discern some element in Aristotle's teaching which will resolve the problem.

It seems clear that any account of knowledge must refer both to the distinctive object of knowledge and to the psychology of knowing. However we must attempt to see what balance Aristotle strikes between considerations drawn from these two aspects of knowledge in designing his scientific methodology. We must try to see how he integrates these two aspects.

On the one hand ἐπιστήμη is that rest-like moment in the process of thought upon which will ensue (if only the thinker will wish it)[22] the activity of θεωρεῖν.

On the other hand ἐπιστήμη has as its proper object that which cannot be other than it is. ἐπιστήμη is defined as the attainment of that cause which makes that which is incapable of being other than it is.[23]

It appears that Aristotle has two alternative ways of describing ἐπιστήμη which, while they may not be obviously contradictory, equally are not obviously identical. Do these two differing modes of describing ἐπιστήμη reflect a change in Aristotle's thought or represent merely alternate descriptions appropriate to

differing specific areas of discussion? After all, each statement is not a total definition.

Or are they differing modes at all? In a sense the problem has the appearance of being contrived. Of course, it may be pointed out, the moment in the process of thought which constitutes ἐπιστήμη is itself the attainment of that cause which renders what is incapable of being other than it is (be that cause "identical with the essential nature of the thing or distinct from it").[24]

But it is not quibbling to draw attention to the ways in which Aristotle characterizes ἐπιστήμη for there is a real area of confusion here and recognition of the source of that confusion carries with it implications for our understanding of the proper role of Aristotle's methodology, as depicted in the opening chapters of Post. An. I, within his scientific and philosophic practice.

Is Aristotle's methodology, as presented in the Posterior Analytics, designed as the vehicle of necessity on the assumption that the ultimate and defining act of science is the exposition of scientific truth in such a way that its necessity is fully manifested? Or, is Aristotle's methodology designed to serve some further objective as well?[25] That is, is the methodology designed so to enable the thinker to acquire the "replica of the real" that he is thus enabled to confront the "real" at will, whenever he pleases,[26] and enabled to recognise and comprehend the "real" itself as portrayed by, rather than contained within,[27] that "replica."

We are, then, searching for some element, implicit or explicit in Aristotle's teachings which will help us to understand how Aristotle integrates the two aspects of knowledge referred to earlier. Our search begins to yield results when we recognise that, for Aristotle,

ἐπιστήμη is everywhere a ἕξις and, more specifically, an ἀρετή. In the Categories, for instance, Aristotle affirms that, as a ἕξις, ἐπιστήμη may quite properly be predicated in two categories, that of quality and that of relation. The doctrine occurs quite generally in Aristotle's writings.[28] So firmly is the fact that ἐπιστήμη is a ἕξις a part of Aristotle's conventional apparatus that Bonitz comments:[29] "Itaque ἕξεως exempla imprimis ἐπιστῆμαι et ἀρεταί sunt."

Further, of course, ἐπιστήμη is an ἀρετή.[30] It is because Aristotle holds that ἐπιστήμη is a ἕξις, an ἀρετή, that he is able to integrate the two aspects of knowledge into coherent epistemological and methodological doctrines. Once we perceive the significance of the concept of ἕξις in this regard it is possible to recognise at once that, for Aristotle, knowledge can never consist in a statement but must always be the possibility of a stating.[31]

It is in this context that we can most readily understand why Aristotle uses the term σωτηρία to describe the way the learner is "acted upon" in his gradual ἐπίδοσις from potentia prima to that point when, having fully secured potentia secunda, he can be called either an ἐπιστήμων in the true sense of the word or a θεωροῦν (since it is only an act of the will that separates these two). (De An. 417^{a}30-^{b}5 cf. 429^{b}5)

The same term (σώζεται) is used to describe the process involved in the acquisition of the grounds of the moral virtues at E.N. 1151^{a}15f. It is practice of virtue which, produced by habituation (ἐθιστή - 1151^{a}19), engenders the right principle so that the man becomes good. Aristotle's conception of the acquisition of intellectual virtue is parallel to his conception of the acquisition of the moral virtues. We become good by doing good actions. We learn

sciences by doing the actions appropriate to the sciences. The reference to the teaching of the principles of mathematics is suggestive ($1151^{a}16$-18). We have already seen examples of such people in our examination of οἱ πρῶτον μαθόντες in Chapter 2. But, while the two processes are parallel, there are very significant differences as will be seen.

However, once we recognise that ἐπιστήμη is, for Aristotle, a ἕξις we can perceive why it is that knowing and thinking are inseparable in his teaching.

If one starts with the assumption that knowing is characterized primarily by the ability "to produce a body of judgements which, in their connexion with each other, reflect the necessary connexions between substances and properties in the real world" then it is a very simple metonymy indeed to equate the judgements so constructed with knowledge itself - to see knowledge as a 'replica of the real.' The sophists do this (Post.An.$74^{b}23$). Once this equation is made it then becomes possible to separate the intellectual activity of the knower (which we call thinking) from the content of his mind (which we call, by metonymy, knowledge). The separation has already been made, effectively, in the uttering of the judgements. It is then easy to insist that thinking and knowing be kept distinct and separate so no "confusion" may occur.

The situation is radically transformed however if one starts, as does Aristotle, with the assumption that knowledge is a certain quality of the mind in virtue of which the possessor of that quality relates[32] to the real in a way that is marked by absolute fixedness[33] and certitude.[34] The difference in the two assumptions lies in the fact that the latter does not presume that the requisite certitude is a function of the form of the judgements uttered or of their relation

to the real, but leaves open the possibility[35] that the mind may be able to achieve certitude in some other way. There is no scope in this case for the transfer of epithets as there was under the former assumption, and consequently there is no possibility for the separation of thinking and knowing.

Language, in such a context, now plays a somewhat larger role than that of the medium for building bodies of judgements or replicas of the real. Rather, language is now conceived of as that human activity which, other things being equal, enables a human capacity (the capacity to know) to grow (ἐπίδοσις , συμφύναι , σωτηρία) to actuality.

To be sure it is the mark of the philosopher to demonstrate things,[36] and science is certainly the ἕξις ἀποδεικτική[37] but these characteristics belong in virtue of the fact that they proceed from someone whose undemonstrated statements deserve our attention.[38]

In returning, however, to the parallel noted above between the mode of acquisition of the moral virtues and the mode of acquisition of the intellectual virtues we must attempt to specify the differences between teaching and habituation.

The general Aristotelian doctrine concerning the acquisition of the moral virtues is summarized at the beginning of the Nicomachean Ethics Book 2.[39]

It is Aristotle's clear doctrine that the moral virtues are acquired through habituation. But the mode of acquisition of the intellectual virtues is not quite so clear. Aristotle says: ἡ μὲν διανοητικὴ τὸ πλεῖον ἐκ διδασκαλίας ἔχει καὶ τὴν γένεσιν καὶ τὴν αὔξησιν, διόπερ ἐμπειρίας δεῖται καὶ χρόνου[40] (E.N. 1103[a]15-17)

Certain things are clear. First, like the moral virtues, the

intellectual virtues are acquired not συγγενεῖς . Secondly, διδασκαλία plays the role vis-a-vis the acquisition of the intellectual virtues which corresponds to the role played by habituation in the moral virtues in that it induces a ἕξις not present at the beginning. Further, all virtues,[41] both the intellectual and the moral, are ἕξεις. That is all virtues are both qualities and relations[42] and thus exhibit a certain potentiality[43] vis-a-vis the ἔργον for the performance of which they render their possessors capable.

The intellectual virtues are acquired, and thus in their case, as distinct from those faculties which are συγγενεῖς, the act precedes the potency. We acquire the intellectual virtues, as we do the moral virtues, by first exercising them.[44] But this is clearly not to say that they are acquired by habituation. It is by διδασκαλία that they are acquired. What then does it mean, in the case of the intellectual virtues, that the act precedes the potency?

At E.N.1129^{a}11f, Aristotle points up the difference between the sciences and the other[45] states of character.

> For the same is not true of the sciences and the faculties as of states of character. A faculty or a science which is one and the same is held to relate to contrary objects, but a state of character which is one of two contraries does not produce the contrary results; e.g. as a result of health we do not do what is the opposite of healthy, but only what is healthy . . .

διδασκαλία is not a training to respond to the 'real' in a predetermined manner, as habituation trains us to respond to a challenge to e.g. health, in a "healthy" way, or to a moral challenge to justice in a "just" way.[46]

διδασκαλία trains the mind to cope, in words, with contraries as and when the contraries manifest themselves. The nub of the difference between an ἐπιστήμη and the other states (ἕξεων) lies

in the fact that an ἐπιστήμη, unlike the other states (ἕξεων) is μετὰ λόγου and hence (E.N.1129[a]13-14; Meta 1046[b]7-12; 1048[a]8-10) of contraries.

Since an ἐπιστήμη is of contraries, and since it is impossible for the same thing to act in contrary ways at the same time, it is required that some further element resolve the impasse. This resolution lies in the operation of ὄρεξις or προαίρεσις (Meta 1048[a]11; 1046[b] 21-22).

Now clearly the ἐπιστήμαι which Aristotle has in mind, at Meta 1046[b]3f are the productive, not the theoretical ἐπιστήμαι and we may assume that it is these too which are uppermost in his mind in Meta 9,5 and even at E.N.1129[a]6f cited above.

But the theoretical sciences, no less than the practical, are defined in terms of λόγος . Hence they, too, as Aristotle tells us at 1129[a]14, relate to contrary objects. We have already noted several passages[47] where desire is given the function of making possible the transition from potentia secunda to θεωρεῖν. Any science is of contraries. Man requires the operation of desire to motivate his choice to contemplate the truth which is in terms of one side of a set of contraries. Truth and error are to be distinguished.

But we must have some grounds upon which our desiderative choice may assert one set of contraries to the exclusion of another.[48]

At Rhetoric 1355[a]35ff, Aristotle has occasion to reassure us as we stand confronted by contrariety either in terms of practice or of theory.

> No other of the arts draws opposite conclusions: dialectic and rhetoric alone do this. Both these arts draw opposite conclusions impartially. Nevertheless, the underlying facts do not lend themselves equally well to the contrary views.

> No; things that are true and things that are better are, by their nature, practically always easier to prove and easier to believe in.

This is not simply a naive reliance on "the facts will out," but, as we shall see in Chapter 5 below, a direct appeal to the rigorous critical analysis of theories in the face of the phenomena which constitute the prime context of διδασκαλία.

διδασκαλία does not, as does habituation, address itself to the training of desire. The opening lines of the Metaphysics make it clear that no such training is needed since the appropriate desire is present "by nature." "All men by nature desire to know." ($980^{a}21$)

διδασκαλία does not constitute a training of the appetites for knowledge. Rather it is a provision of the context wherein those trained in language, i.e. those trained in handling contraries and in resolving the confusions that confront man (Post.An. $72^{a}35-^{b}4$), are invited critically to analyse the accounts of the teacher and thus provide the grounds for their desiderative choice to enable them to θεωρεῖν.

CHAPTER IV

Παιδεία [1]

In the introduction to his edition of the Nicomachean Ethics, Burnet calls attention to the role of the Analytics in providing "culture" and comments:[2] "With (Aristotle) the man of culture is above all things the arbiter of method. He is the judge of how much precision is fairly to be expected in any enquiry (E.N. $1094^{b}23$), and in the Metaphysics we are told that it shows want of culture not to know what can be demonstrated and what can not." (Meta. $1006^{a}6$)

At Metaphysics $1005^{b}1$f. Aristotle, commenting upon the pretensions of certain physicists, writes: "And the attempts of some who discuss the terms on which truth should be accepted (περὶ τῆς ἀληθείας ὅν τρόπον δεῖ ἀποδέχεσθαι , $1005^{b}3$), are due to a want of training in logic (δι' ἀπαιδευσίαν τῶν ἀναλυτικῶν τοῦτο δρῶσιν $1005^{b}3$-4); for they should know these things already when they come to a special study, and not be enquiring into them while they are pursuing it." ($1005^{b}2$-5) [3]

Burnet's brief treatment of the nature and importance of παιδεία is clearly correct. It suggests some important areas for further exploration. Specifically, we are led to attempt a more precise understanding of the role of the "arbiter of method." We might ask, for instance, how extensive the arbitration is to be. Also, in view of the fact that Aristotle clearly regards παιδεία as that training in logic provided by the Analytics (cf. Meta. $1005^{b}4$), we must ask which lessons or techniques taught by the Analytics act as the

grounds for the arbitration.

On this latter issue Burnet gives a good summary of Aristotle's expressed views. What the πεπαιδευμένος derives from his logical training is a knowledge of "what can be demonstrated and what can not." A little later[4] Burnet points out that the man of culture can also tell us that "every science must have a starting point."

This of course leaves considerable room for further enquiry. Is the πεπαιδευμένος simply aware of the general fact that he should not expect everything to be proven, and should not, therefore, be surprised when he finds certain propositions given without proof, especially the initial starting points of each science.

The rather vague and general admonitions which we meet in the opening pages of many of Aristotle's works would suggest that it is just this general sensitivity which is intended. Certainly Aristotle repeatedly makes it clear that he expects at least this general awareness before he can proceed.[5]

If the πεπαιδευμένος were to have any more advanced comprehension of the implications of these principles for the actual structure and methodological development of a science we would assume that he possesses something which Aristotle might call a "special" παιδεία, (E.N. $1094^{b}27-1095^{a}2$; De Part.An. $639^{a}10$f).

Yet we should ask whether Aristotle's comments on the πεπαιδευμένος suggest something rather more than simply a docile, acquiescent student. There are certain indications, which we will examine below, that Aristotle intends the man of general culture to be genuinely critical; that he should not simply suspend his methodological expectations,[6] but rather that he should be equipped with the appropriate methodological expectations and expect the

lecturer to conform to them.[7]

It is beyond question of course that Aristotle does expect that the man of general culture should, at the barest minimum, possess a general sensitivity to the limits of method. It is quite clear, moreover, that Aristotle's intention for παιδεία is not to instill a general "culture" as one might interpret the word on Isocrates' lips. Burnet is quite right when he says[8] that ". . . Aristotle means something far more definite than this." It would seem possible that on certain occasions at least he means something more definite even than a knowledge of the distinction between demonstrable and indemonstrable.

It will be noticed that Aristotle's remarks about παιδεία are very often addressed to "listeners" or to those "accepting the truth."[9]

This is not at all surprising. These texts arise in the opening sections of their respective courses of teaching and are cautionary preliminaries, on Aristotle's part, warning his students that they must accept the conventions of the didactic context. We shall examine more closely in Chapter 5 what these conventions might be. Aristotle's insistence on the "listener's" critical awareness of how the science should proceed would suggest that he regards it as important to the communication between teacher and student. The actual structure of the method would seem to provide a point of shared understanding. The Analytics teaches people to "listen" and to "learn" by providing them with the tools requisite to learning.[10]

If the πεπαιδευμένος is an arbiter of method deriving his skill from the Analytics we must ask whether he is expected to be competent to judge whether those propositions asserted as indemon-

strable are genuinely indemonstrable (not whether they are true, but whether they are demonstrable); and further whether the lecturer's demonstrables have been properly demonstrated,[11] (apart from the truth or falsity of what is asserted).[12]

The πεπαιδευμένος is critical. But there seem to be two types of this critical ability; ἕκαστος δὲ κρίνει καλῶς ἃ γινώσκει, καὶ τούτων ἐστὶν ἀγαθὸς κριτής. καθ' ἕκαστον μὲν ἄρα ὁ πεπαιδευμένος, ἁπλῶς δ' ὁ περὶ πάντα πεπαιδευμένος "Now each man judges well the things he knows, and of these he is a good judge. And so the man who has been educated in a subject is a good judge of that subject, and the man who has received an all-round education is a good judge in general." (E.N. $1094^{b}27$-$1095^{a}2$)

If we turn to the opening paragraphs of the De Partibus Animalium we see that the πεπαιδευμένος is not necessarily a student. A. L. Peck's translation is as follows:

> There are, as it seems, two ways in which a person may be competent in respect of any study or investigation, whether it be a noble one or a humble: he may have either what can rightly be called a scientific knowledge of the subject; or he may have what is roughly described as an educated person's competence, and therefore be able to judge correctly which parts of an exposition are satisfactory and which are not. That, in fact, is the sort of person we take the "man of general education" to be; his "education" consists in his ability to do this. In this case, however, we expect to find in the one individual the ability to judge of almost all subjects, whereas in the other case the ability is confined to some special science; for of course it is possible to possess this ability for a limited field only. Hence it is clear that in the investigation of Nature, or Natural Science, as in every other, there must first of all be certain defined rules by which the acceptability of the method of exposition may be tested, apart from whether the statements made represent the truth or not. I mean, for instance, should we take each single species severally by turn (such as Man, or Lion, or Ox, or whatever it may be), and define what we have to say about it, in and by itself; or should we first establish as our basis the attributes that are common to all of them because of some common character which they possess? (De Partibus Animalium $639^{a}1$-19)

Aristotle tells us that we can approach any subject as a scientist or as a πεπαιδευμένος . When he proceeds to examine the nature of the scientist's approach, however, he says that the scientist exercises the same critical capacity as the πεπαιδευμένος (τὸν αὐτὸν τρόπον τῷ εἰρημένῳ $639^{a}11$) except that he does so over a narrower field. ($639^{a}8$-12) The scientist seems in a very similar situation to the one who possesses special culture as described at E.N. $1094^{b}27$-$1095^{a}2$ quoted above.

Yet there seems a certain difficulty here. Aristotle has just described the πεπαιδευμένος as the man who can judge correctly which parts of an exposition are satisfactory and which are not. Now he wishes to describe the scientist as having the same capacity but over a limited area. We will examine shortly a text from the Eudemian Ethics which would depict the true philosopher as engaging on a careful critique of his own work. But here in the De Partibus Animalium, Aristotle suggests certain conditions which must exist if his description of the two approaches to science is accurate. Both the scientist and the man of general culture, the πεπαιδευμένος , must assure themselves that, from a methodological point of view they have expressed the subject of their enquiry in an appropriate manner, apart from considerations of truth. ($639^{a}14$) There must be certain ὅροι . We shall have occasion to consider this issue in the final chapter of this study.

Aristotle addresses himself to setting up these ὅροι at three points: $639^{a}15$-$639^{b}6$; $644^{a}23$-$644^{b}15$; $645^{a}36$-$645^{b}14$. In all these discussions the principle consideration is economy of presentation. At all costs one must avoid being ὑπάτοπον καὶ μακρόν.

($644^{a}35-^{b}1$) He concedes that it might be best if we were to deal with the attributes to be examined species by species but there would be so much repetition that this would be "unreasonable and long winded." It would be more reasonable, more economical, to consider the attributes as they belong in common. It will be recalled that in the Posterior Analytics ($98^{a}20f$) Aristotle envisages both methods of exposition as equally appropriate and shows no sign of either having the edge as regards the truth being expressed.

The interests of economical treatment and exposition are served by establishing the ὅροι appropriate to the subject genus in question. If it so happens, as in much of biological science, that the subject matter exhibits its properties in a somewhat regular fashion (many properties in common, others unique and highly specific), then we are able to adjudicate the appropriate groups by inspection of the "shape" of the attributes in the light of the principle of "excess and defect." (De Part.An.1,4)[13] The subject matter of ethics, for instance, is not quite so regular (E.N.1,3) in the way its properties belong.

Clearly the establishment of the ὅροι is the preliminary delimitation of the subject and is, therefore, the selection of the perspective from which it will be analysed and expounded. As such the job presumably falls to the man who can judge best the subject in hand, the man of special culture, the scientist. (E.N.$1094^{b}27-1095^{a}2$; De Part.An.$639^{a}10-15$)[14]

Thus we can understand Aristotle's meaning in describing the scientist himself as the one who enjoys the capacity to "judge correctly which parts of an exposition are satisfactory and which are

not," applied over a limited field. Not only must he constantly check his own work (E.E. $1216^{b}35$f - see below) but he must also examine which of a range of possible formulations of the subject are appropriate to his needs.

But the man of general culture is not here described as simply suspending his methodological expectations. It is his role τὸ δύνασθαι κρῖναι εὐστόχως τί καλῶς ἢ μὴ καλῶς ἀποδίδωσιν ὁ λέγων. ($639^{a}5$-6) His critique is an informed one in so far as method is concerned - leaving truth to one side. ($639^{a}14$-15)

There is a passage in the Eudemian Ethics, at $1216^{b}35$, which seems to reveal what arbitration is expected from the πίστιν δεδωκώς the man of general culture.

> Now in every enquiry there is a difference between philosophic and unphilosophic argument; therefore we should not think even in political philosophy that the sort of consideration which not only makes the nature of the thing evident but also its cause is superfluous; for such consideration is in every enquiry the truly philosophic method. But this needs much caution. For there are some who, through thinking it to be the mark of a philosopher to make no arbitrary statement but always to give a reason, often unawares give reasons foreign to the subject and idle - this they do sometimes from ignorance, sometimes because they are charlatans - by which reasons even men experienced and able to act are trapped by those who neither have nor are capable of having practical and constructive intelligence. And this happens to them from want of culture; for inability in regard to each matter to distinguish reasonings appropriate to the subject from those foreign to it is want of culture. And it is well to criticize separately the reason that gives the cause and the conclusion both because of what has just been said, viz. that one should attend not merely to what is inferred by argument, but often attend more to perceived facts - whereas now when men are unable to see a flaw in the argument they are compelled to believe what has been said - and because often that which seems to have been shown by the argument is true indeed, but not for the cause which the argument assigns; for one may prove truth by means of falsehood, as is clear from the Analytics.

In commenting on this passage,[15] Allan writes: "Now this fails to prepare the reader for the most singular feature of the method

which the author actually uses . . ." Allan then proceeds to describe that method as consisting in the presentation of "a mathematical pattern of deduction."

And yet it would seem possible that a reader, or a "listener," who was a πεπαιδευμένος in Aristotle's sense of the term, would have been so fully aware of the conventions as to be prepared in fact for the method which follows.[16] For what Aristotle describes in this passage is the critical application of the techniques inculcated by the Analytics. He is at pains to distinguish the apparent from the real philosophic method. The mock-philosopher will simply adduce arguments. The true philosopher adduces arguments as a critical analysis of his position. ($1217^{a}10$f) The true philosophic method is the one which not only makes evident the nature of the thing but also its cause. ($1216^{b}38$-39) The true philosopher institutes an examination both of his conclusion and of the grounds for these conclusions. ($1217^{a}10$-11) When people are unable to λύειν ($^{a}13$) they are compelled to believe whatever they hear. Above all they must be equipped to separate a specious from the appropriate cause. ($1217^{a}15$f)

There is compression in this passage, as everywhere in Aristotle's writings, and here Aristotle relies, perhaps too heavily, upon his reference to ἀπαιδευσίαν ($1217^{a}7$) to summon up the conventional apparatus recalled by that term.

On the one hand, παιδεία is here represented as that capacity which would enable men of general experience and proven effectiveness to evaluate or judge the ~~doctrines~~ methods ~~put forth~~ used by a true philosopher and to discriminate them from the sophistries of the charlatans. Yet the παιδεία is also represented here as providing the critical apparatus which the philosopher himself must use if he is to avoid self

deception and attain διάνοιαν ἀρχιτεκτονικὴν ἢ πρακτικήν (^{a}6-7).

Aristotle has not inserted a detailed exposition of what we are to expect from him in the study which follows since he has already laid the grounds for those expectations in the Analytics and he expects his listeners to be πεπαιδευμένοι . We should expect what we in fact get - a critical deduction of the facts and an exposition of the causes in a manner which enables us to perceive the indemonstrable grounds for the demonstrable.

In the texts so far examined in this chapter, the role of the Analytics in providing a παιδεία has been seen to have a predominantly critical character. It is suggested that the deductive procedures of the Analytics constitute means whereby the philosopher-scientiest-listeners may engage in a reduction to syllogistic form[17] of their own or others' views on a particular subject. The deductive procedures have not in these texts been presented as that structure whereby these views are confirmed or validated; rather as the structure through which inconsistencies in the accounts may be discovered and rooted out. The role of the syllogism seems not so much to be a constructive but rather a corrective one. It is seen not so much as a medium to insight as a barrier to deception. And yet such a representation of its role in Aristotle's thought is partial and therefore incorrect left as it is. For it does discharge a constructive role as a medium for insight.

At De Anima. 402^{b}21f, Aristotle tells us that ". . . the knowledge of the essential nature of a substance is largely promoted by an acquaintance with its properties." τὰ συμβεβηκότα συμβάλλεται μέγα μέρος πρὸς τὸ εἰδέναι τὸ τί ἐστιν.

Aristotle specifies that it is apodeictic[18] knowledge of the

accidents to which he is referring. ($402^{b}16$-21; $402^{b}25$)

Finally, he indicates how it is that the demonstration of the accidents largely promotes the knowledge of the essential nature of the substance. ($402^{b}22$-$403^{a}2$)

> For, when we are able to give an account conformable to experience of all or most of the properties of a substance, we shall be in the most favorable position to say something worth saying about the essential nature of the subject; in all demonstration a definition of the essence is required as a starting-point, so that definitions which do not enable us to discover the derived properties, or which fail to facilitate even a conjecture about them, must obviously, one and all, be dialectical and futile.

Before examining Aristotle's meaning in these last few lines it would be as well to note that earlier in the De Anima., Aristotle has made a couple of oblique references to the demonstrative syllogism as a means of hunting the essence.[19] At $402^{a}15$, he refers to demonstration, the single method appropriate to the study of derived properties, by way of exemplifying the kind of single method he would wish to achieve in the study of essence. Again at $402^{a}19$, ἀπόδειξις is canvassed (together with division) as one of the methods which, even if its utility to this end were manifest, would still be hedged with hesitations and doubts.

Aristotle's emphasis of considerable difficulty in attaining any such method must here be re-emphasized. There is no single method for securing the essence. What Aristotle does offer is a procedure, the truly philosophic procedure as it is called in the passage from the Eudemian Ethics just examined, which must be applied with the greatest care and which leaves wide scope for charlatanism against which we must be on our guard. Further, the method is in no way a proof of essence but it is capable of providing a very great help ($402^{b}21$), and it constitutes the grounds for enabling us to secure

the "most favorable position to say something worth saying about the essential nature of that subject" (402^b22-402^b25). This is all Aristotle ever claims for the method; and it is all that is being claimed for it, in this study, on Aristotle's behalf.

We must turn, however, to that passage where Aristotle explains how the demonstration of the accidents largely promotes knowledge of the essential nature of the substance.

ἐπειδὰν γὰρ ἔχωμεν ἀποδοῦναι κατὰ τὴν φαντασίαν περὶ τῶν συμβεβηκότων, ἢ πάντων ἢ τῶν πλείστων, τότε καὶ περὶ τῆς οὐσίας ἕξομεν λέγειν κάλλιστα· πάσης γὰρ ἀποδείξεως ἀρχὴ τὸ τί ἐστιν, ὥστε καθ' ὅσους τῶν ὁρισμῶν μὴ συμβαίνει τὰ συμβεβηκότα γνωρίζειν, ἀλλὰ μηδ' εἰκάσαι περὶ αὐτῶν εὐμαρές, δῆλον ὅτι διαλεκτικῶς εἴρηνται καὶ κενῶς ἅπαντες. (402^b22-403^a2)

The specific and immediate operation which renders us able to talk most meaningfully about essence is not the demonstrating itself so much as the use of the demonstration in a particular manner. The demonstration must permit us to ἀποδοῦναι κατὰ τὴν φαντασίαν.[20] The phrase indicates a process of offering an account[21] which manifestly conforms to the phenomena. The process, then, which enables us to see the essence is the process of examining to see how the ἀποδείξεις manifest their conformity to the phenomena. Aristotle indicates this procedure at De An. 402^b26-403^a2. Expressing positively, what Aristotle expresses negatively, we might say that since the starting point of any apodeixis which succeeds in enabling us to discover the derived properties and facilitates our understanding of them is itself the definition of essence we have, in that successful process of ἀποδοῦναι, a guarantee that our definition of essence

was right.

We might say this but we would most assuredly be wrong in doing so. For Aristotle chooses, very carefully, to express himself in the negative and what he says is not transformable. He does not suggest that there is any such guarantee. He expresses himself in the negative to avoid giving any false impression. All he claims is that what we achieve in considering the discoveries of the phenomena made possible by our demonstration of the accidents provides us with a comprehensive insight into the essence whose definition made that demonstration possible.[22] All we can hope for is a genuinely elenctic[23] situation but, as we shall see, this hope is capable of attainment and is for Aristotle at least, the sufficient key to methodological procedure.

For Aristotle the term παιδεία denotes varying degrees of familiarity with the principles governing the logic taught in the Analytics, and varying degrees of competence with the logical techniques to be learned there. Often the term may mean no more than a general sensitivity to the distinction between demonstrable and indemonstrable. On other occasions it seems to denote a critical competence based upon a mature command of the principles and techniques of the logic and deployed as a rigorous test of the methods used by any scientist.

The πεπαιδευμένος is the arbiter of method rather than content in a science since it is method which binds scientist and student in the search for the truth.

CHAPTER V

ἐπιστήμη

"Pour Aristote," says Roland-Gosselin,[1] "la définition est au centre même de la science. Elle doit exprimer les natures, et, principe de la démonstration, faire connaître leurs propriétés nécessaires."[2]

Augustin Mansion strikes the same note:[3] ". . . le souci de saisir ces essences et d'en établir la définition se manifeste tout au long de la carrière d'Aristote. De plus, dans la construction formelle du syllogisme servant à la déduction des propriétés, la définition doit figurer nécessairement dans les prémisses dont elle est ainsi un élément indispensable."

There can be little quarrel with these comments. Yet they signal a problem in our understanding of Aristotle's method, for, as Mansion himself goes on to point out, there seems to us to be an inconsistency between Aristotle's devotion to essence and his methodological concern with the establishing of properties.

Mansion treats this tension in Aristotle's thought as part of the evidence which must be examined in attempting to piece together a chronological account of the origin and development of the syllogism and of Aristotle's conception of science.

In the introduction to his paper he writes:[4]

> Si l'on met ensemble toutes ces données en essayant d'introduire une succession chronologique dans les témoignages qui paraissent se contredire, on pourra en tirer la conséquence que, si la critique du procédé de division n'a pas contribué à la découverte du syllogisme,

> elle a du moins eu pour résultat de faire substituer le syllogisme à la division comme moyen de prouver une définition. Mais, après cela, une critique plus poussée du syllogisme utilisé à cette même fin a abouti à un résultat encore plus important: non seulement elle a fait rejeter le procédé syllogistique comme susceptible d'établir une définition, mais elle a amené Aristote à exploiter dans un autre sens les virtualités contenues dans le syllogisme. En déplacant ainsi le centre d'intérêt de toute la construction scientifique, en lui assignant un objet répondant mieux aux possibilités du raisonnement syllogistique, il a modifié et élargi sa théorie de la science.

There is no reason in this study either to question or to raise objections to Mansion's treatment. It does, however, suggest a further issue which Mansion does not consider in his article and which we must consider. Mansion speaks of Aristotle's having been led to "exploiter dans un autre sens les virtualités contenues dans le syllogisme."

It will be suggested here that one of the "virtualités" of the syllogism which Aristotle develops is the way in which the apodeictic exposition of a science can, in certain circumstances, provide the grounds for an intuitive[5] recognition of the ἀρχαί . It will be argued that once Aristotle realized that a definition of essence could not be made to emerge from prior premisses, he turned to the demonstration of essential properties not only as a goal desirable in its own right but also in the realisation that, if carefully used, the apodeictic syllogism can enable the demonstrator to attain a fuller grasp of the ἀρχαί of the science.

It is significant, perhaps, to note that Aristotle himself does not appear conscious of any profound methodological tension between the need to define essences on the one hand and to demonstrate properties on the others. He blithely attributes to Socrates, the founder of definitional method, the search for syllogism. (Meta. $1078^{b}23$-24)

It is, of course, entirely true that in the Analytics Aristotle expends considerable energy in examining, and rejecting, the notion that essence may be demonstrated. It is also true that in the Analytics Aristotle casts definition of essence in the role of a means to an end, so to speak. Definition of essence is that which makes demonstration of the properties possible. These are, without question, the doctrines of the Analytics.

And yet there are texts[6] which would seem to suggest that for Aristotle the attainment of the definition of the essence is not to be understood solely as a step towards the demonstration of the properties.[7] At Meta. $1031^{b}6$-7, for instance, Aristotle comments: ". . . there is knowledge of each thing only when we know its essence." Again at Meta. $1064^{a}19$-20: "And since each of the sciences must somehow know the 'what' and use this as a principle, we must not fail to observe how the natural philosopher should define things and how he should state the formula of essence." Mansion comments[8] upon these texts: "C'est la doctrine des Analytiques mais ici la nécessité de connaître la définition est soulignée davantage que le rôle qui lui est dévolu dans la déduction (subséquente) des propriétés."

There is a certain real ambivalence in Aristotle's own manner of speaking of these issues. Aristotle does not seem to be aware of himself as caught in any inconsistency, or as forced to cite one or the other, demonstration of properties or definition of essence, as the ultimate goal of science.

We observe in the Nicomachean Ethics as elsewhere[9] the way in which Aristotle treats the relations between the ἀρχαί and the demonstration in terms of the way in which their structure is interdependent. Aristotle seems almost to infer that there must be ἀρχαί because syllogism is possible and to treat the ἀρχαί not as means but

as the defining ground. The same reciprocal relation is manifest for example at Post. An. 1,6, especially $74^{b}13$-15.

What is clear is that in the Analytics, Aristotle advances a deductive method. What is not clear is the context in which Aristotle intended that method to be used. There are grounds for suspecting that we will find, in tracing that context, the grounds for Aristotle's manifest lack of concern to separate out these two operations and his insistence upon the unity and finitude de la connaissance scientifique.[10]

One very significant element in the context of this whole issue is the notion of essence itself and the tentative attempts of Aristotle's predecessors to develop a method in science which makes full use of the concept of essence.

Roland-Gosselin holds a view similar in many respects to that advanced by Mansion. In his analysis of the alleged dilemma he raises an issue of paramount importance.

> . . . sur quoi fonder une synthèse nécessaire? Telle est la question, en définitive, à laquelle Aristote ne réussit pas à répondre. L'abstraction intellectuelle, l'intuition du νοῦς n'est certaine qu'en regard des idées simples et des principes. Dès qu'il s'agit de concepts plus déterminés et de les organiser suivant leur compréhension, - puisqu'il n'y a pas de recours possible à une progression synthétique purement rationelle - l'intelligence est en dépendance étroite des données de l'expérience, et, sans un principe qui sache discerner le nécessaire, elle restera prisonnière de l'empirisme. Ce principe Aristote ne l'a pas énoncé.[11]

It is, of course, true that Aristotle tells us repeatedly that definition is not demonstrable.[12] It is also true, however, that Aristotle tells us that certain knowledge of the definition is attainable through νοῦς ,[13] through l'abstraction intellectuelle.

Yet Roland-Gosselin is quite right in pointing out that νοῦς by itself is insufficient when faced with "concepts plus déterminées" and with the need to "les organizer suivant leur compréhension."

Aristotle himself seems to deny there is any "single and general method for solving the problem of essence."[14] Roland-Gosselin says: ". . . il n'y a pas de recours possible à une progression synthétique purement rationelle." Aristotle makes much the same point himself at De Part. An. $640^{a}6$-8.[15]

But Aristotle too regards νοῦς, by itself, as insufficient to the task and insists, as we have seen earlier,[16] that "l'intelligence est en dépendance étroite des données de l'expérience." (We shall examine shortly the way in which Aristotle sees διδασκαλία, as a prime condition for human learning. Further we will have reason to suggest that ἐπαγωγή and νοῦς rest upon the careful elaboration of the conditions for insight. As Aristotle reminds us:[17] ". . . it is an advantage to advance to that which is more intelligible. For learning proceeds for all in this way - through that which is less intelligible by nature to that which is more intelligible" ἡ γὰρ μάθησις οὕτω γίγνεται πᾶσι διὰ τῶν ἧττον γνωρίμων φύσει εἰς τὰ γνώριμα μᾶλλον·1029^{b}3-5.)

Roland-Gosselin indicates his dissatisfaction with this state of affairs in which experience is left as the basis of the theory (. . . "restera prisonière de l'empirisme") since Aristotle has not enunciated any principle "qui sache discerner le nécessaire."

Yet an appeal against this sentence is in order. It was suggested earlier that Aristotle's subscription to the theory of essence should be examined to see whether the particular perspective he adopts affects the use he sees for the syllogism. That same principle might be seen to acquit him, as well, of the charge here laid by Roland-Gosselin.

In writing[18] of Aristotle's commitment to the theory of essences D. J. Allan comments: "(Aristotle) fails to consider how far

the distinctions implied in the structure of language can be taken as a safe guide to the categories of thought, but this was excusable at a time when there was no comparative study of languages. As a contribution to the logic of science, the whole discussion misfires, because Aristotle's 'essences' are as otiose, and remote from the real requirements of science, whether physical or mathematical, as the Platonic forms which he intended them to replace. . . . The whole later progress of science is a commentary on this."[19]

Professor Allan's historical judgement need not be read, however, as a categorical rejection of the possible utility of the theory of essences within a science differently defined. That is, we must, I believe, examine the possible role of Aristotle's conception of essence within a science defined as Aristotle himself might define that science.

Ongle's Oxford translation of De Part. An. 642[a]13f reads as follows:

> It is plain then that there are two modes of causation, and that both of these must, so far as possible, be taken into account in explaining the works of Nature, or that at any rate an attempt must be made to include them both; and that those who fail in this tell us in reality nothing about Nature. For primary cause constitutes the Nature of an animal much more than does its matter. There are indeed passages in which even Empedocles hits upon this, and following the guidance of fact, finds himself constrained to speak of the ratio (ὁ λόγος) as constituting the essence and real nature of things. Such, for instance, is the case when he explains what is a bone. For he does not merely describe its material, and say it is this one element, or those two or three elements, or a compound of all the elements, but states the ratio (ὁ λόγος) of their combination. As with a bone, so manifestly is it with the flesh and all other similar parts.
>
> The reason why our predecessors failed in hitting upon this method of treatment was, that they were not in possession of the notion of essence, nor of any definition of substance. The first who came near it was Democritus, and he was far from adopting it as a necessary method in Natural Science, but was merely brought to it, spite of himself, by constraint of facts. In the time of Socrates a nearer

> approach was made to the method. But at this period men gave up inquiring into the works of Nature and philosophers diverted their attention to political science and to the virtues which benefit mankind.

Both Aristotle and Socrates[20] most explicitly talk of the notion of essence as having profound methodological significance.

Aristotle attributes to the notion the birth and development of method as he conceives of it ($642^{a}24$). Without this notion it is impossible to conceive of that range and complexity of αἰτίων which the scientist must be competent to discriminate in each subject area. ($642^{a}16$-17; $642^{a}21$-22) The single minded concentration on the essence as the key to the unity and intelligibility of the subject areas releases the mind from the materialist and mechanist perspective.

We must look for definitions, ($642^{a}19$-21; $642^{a}28$-29). Socrates further developed this method of definition. We are left with the clear impression (made explicit at Meta. $1078^{b}23$-25) that Aristotle perceives himself as a faithful heir to this tradition, not as one who has radically redirected it.

Our concern here is with the role of essence, and more particularly essence considered as finality, in Aristotle's methodological thought and practice. If Vlastos[22] is right in his interpretation then Plato provides us with a most helpful point of departure for our examination. Vlastos interprets Phaedo 100 C5-D2 as follows: ". . . what Socrates has failed to discover by his own labors or from those of others and is prepared to do without for the present is the teleological aitia itself."

It will be suggested that we can see in Aristotle echos of the kind of reflection described by Vlastos. It is through reflection of this kind that we come to see the development of Aristotle's own methodological use of the principle of essence.

Socrates' interest, diverted into ethics and politics,[23] did not extend to the development of an adequate method in Natural Science. Aristotle offers some revealing comments at E.E. $1216^{b}3$f (H. Rackham's Loeb translation) on the validity of Socrates' ethical method.

> Accordingly Socrates the senior thought that the End is to get to know virtue, and he pursued an inquiry into the nature of justice and courage and each of the divisions of virtue. And this was a reasonable procedure, since he thought that all virtues are forms of knowledge, so that knowing justice and being just must go together, for as soon as we have learnt geometry and architecture we are architects and geometricians; owing to which he used to inquire what virtue is, but not how and from what sources it is produced. But although this does happen in the case of the theoretical sciences, inasmuch as astronomy and natural science and geometry have no End except to get to know and to contemplate the nature of things that are the subjects of the sciences (although it is true that they may quite possibly be useful to us accidentally for many of our necessary requirements), yet the End of the productive sciences is something different from science and knowledge.

In the De Partibus Animalium ($640^{a}3$-4) the theoretical and constructive sciences are contrasted on the grounds that the theoretical sciences begin with what is while the constructive sciences begin with what will be.

Here in the Eudemian Ethics Socrates is depicted as recognising, methodologically, the significance of the τέλος in determining the perspective from which the scientist should proceed. (Socrates "thought that the τέλος is to get to know virtue" - $1216^{b}3$-4). Of course Socrates knows he is engaged in a practical[24] science, and that the goal is to be virtuous. However, because of his intellectualist view of the nature of the virtues he must equate this τέλος with knowledge of virtue. Thus it becomes "reasonable" ($1216^{b}6$)[25] for him to treat virtue now not as something to be attained but something about which we must know. In the language of the De Part. An. Socrates is forced to treat virtue as something which is, not as something which will be.

Socrates starts from the being of virtue and tries to sort out

its parts and types, ($1216^{b}4$-5). But a practical scientist should start with what will be, not with what is. One should, somehow, deploy a process of reasoning which concentrates upon how and from what sources the becoming of that form of behaviour called virtue occurs. ($1216^{b}19$f)

One might be led to assume that Socrates' method, while inappropriate to ethics, might have proved satisfactory, in Aristotle's view, had it been applied to the theoretical sciences. Aristotle points out ($1216^{b}8$-9) that it does in fact happen in the case of certain sciences that once we have learnt, e.g. geometry, we are geometers. But Socrates' method would have been no more successful, in Aristotle's judgement, in the theoretical sciences than it had been in ethics. It was necessary to isolate and make explicit the variety of roles played by final and efficient causation[26] in the theoretical and constructive sciences. (Meta.$991^{b}3$-9; $984^{a}16$-$^{b}24$; De Gen.et Corr.$335^{b}7$-17) It is true that in the theoretical sciences we are what we have learnt, but this is simply to reaffirm that in the theoretical sciences the final cause operates in a manner different from its operation in the constructive sciences.[27]

Aristotle's claim to have improved the Socratic method arises principally out of his insistence upon the integration of final, material, and efficient causation, the grounds for becoming, which had fallen outside the purview both of the method as Socrates developed it and the Platonic methodology predicated as it was[28] on separate forms.

Aristotle's own perspective, then, on the relations between his own method and that of Socrates seems to have this issue at its focus. It remains to be seen whether from this vantage point, the introduction of the syllogism could make any advancement in the method.

The difference in methodological perspective occasioned by differing ends[29] of the theoretical and the constructive sciences very greatly affects the ways in which the various kinds of necessity became

manifest, precisely because of the alteration in the role of final cause.

This becomes much more apparent when we see Aristotle address himself to the same issue in De Part. An. Book 1. In this work Aristotle's intent is to show how to design the method for a theoretical study, natural science, rather than for a constructive science such as ethics.

In the De Partibus Animalium, Aristotle complains that the failure to develop an adequate method prior to his own time was due, in the first instance, to the absence of the notion of essence and of the procedure of definition. ($642^{a}24-26$) In default of such a notion there was an insufficient grasp of the possible range of causation. ($642^{a}13-24$).

He further comments that during Socrates' time ($642^{a}28-31$) a methodological advance was made but since interests had shifted, this advance was not in Natural Science. We must carefully distinguish the types of definienda, and therefore [between] the various types of necessity manifested in each of the various kinds. ($642^{a}1-17$)

There is absolute necessity which belongs τοῖς ἀϊδίοις. ($639^{b}23-24$) There is hypothetical necessity which belongs τοῖς ἐν γενέσει πᾶσιν. ($639^{b}24-25$)

Further, there are more causes than one concerned in the formation of natural things. ($639^{b}11-12$) A theme which seems to run through this passage is the assertion that two modes of causation must be recognised by the scientist. There is final cause, cause "for the sake of which," and efficient cause, cause "to which the beginning of the motion is due." ($639^{b}11-13$) At $642^{a}1$ Aristotle again refers to two types of causation, final cause and necessity, which must be

recognised by science. This time, in speaking of Democritus and Empedocles, Aristotle depicts necessity more in their terms as resembling material cause (cf. $640^{b}1$-7, and Physics $194^{b}23$f) rather than efficient cause as at $639^{b}11$-13. αἴτιον clearly has several senses and Aristotle is not here confining himself to any one specific sense.

At $642^{a}13$, Aristotle yet again refers to two modes of causation requisite to any proper method in natural science and insists that unless the scientist describes both he is bound to fail. (cf. Meta. $1025^{b}31$; $1064^{a}23$; Physics $194^{a}6$; De An. $403^{b}1$) In fact we see that Aristotle is insisting primarily upon the integration of formal-final-efficient causation, into any method in natural science, and is not, at this particular point, taking any special pains to discriminate efficient and material causation. In fact it may well be that at this particular point in the context of this biological treatise Aristotle feels entitled to group material and efficient under one general heading (cf. De Gen.et Corr. $335^{b}24$-29) variously called ἀρχὴ τῆς κινήσεως ($639^{b}12$-13) or ἐξ ἀνάγκης ($642^{a}2$) (cf. $641^{b}21$f). Aristotle takes more care to render his meaning precise at De Gen.et Corr. 335^{b} 24-35, and, in a more general way, at Physics $255^{a}31$f.

The fact, however, that Aristotle here in the De Partibus Animalium repeatedly insists that there are two causes which must be integrated into any method in natural science - one of which, and the primary one, is the final cause - makes us seriously question such an assertion as that made by Düring[30] when he says that Aristotle "never makes a clear-cut distinction between οὗ ἕνεκα and ἐξ ἀνάγκης." It is certainly true, as Düring also says,[31] that "the supposed goal of Nature's work is constantly mixed up with the laws that govern the processes leading to that goal." This is due to Aristotle's explicitly

conscious attempt to design a method which will reveal the unity of goal and process in nature and is not due to any unwillingness to draw the appropriate distinctions.

It is Aristotle's very point in the first book of the De Partibus Animalium, and repeatedly elsewhere,[32] that the natural scientist must do a double accounting. Unless his method takes account of both of final cause and of those modes of necessity and causation which, also, are operative in natural things he will never achieve, in his study, the final synthesis - the recognition of the unity of goal and process in Nature[33] (cf. $642^{a}9$-17); for the "what," in the case of natural objects is not independent of matter (Meta. $1025^{b}31$f), and we must be able to perceive the operation of form on matter in the becoming of the subject (De Gen.et Corr. $335^{b}30$f).

The precise translation of De Part.An. $639^{b}30$-$640^{a}2$ has been disputed.[34] ἀλλ' ὁ τρόπος τῆς ἀποδείξεως καὶ τῆς ἀνάγκης ἕτερος ἐπί τε τῆς φυσικῆς καὶ τῶν θεωρητικῶν ἐπιστημῶν. Peck's Loeb translation gives: "Howbeit, the method of reasoning in Natural science and also the mode of Necessity itself is not the same as in the Theoretical sciences." Düring's somewhat amplified translation reads:[35] "Yet in physical science as well as in the theoretical sciences the method of demonstration and the mode of necessity are different . . . from the method of demonstration (reasoning) and the mode of necessity in the constructive sciences."

Perhaps this debate can have no definitive resolution. Düring's interpretation involves a certain amount of stylistic violence to provide sense. The traditional interpretation (Peck's) on the other hand needs at least some explanation to reconcile it with acceptable Aristotelian sense. In fact, Peck's note on his translation of the passage provides just such an explanation. "In the present

passage . . . Aristotle contrasts natural science with the 'theoretical' sciences. This is because he is considering Nature as a craftsman whose craft or science belongs to the . . . 'productive' sciences. Our study of Nature's science may be a 'theoretical' science, but Nature's science itself is 'productive."

As to the fundamental Aristotelian doctrine involved, then, Peck and Düring seem less far apart than one might have thought. Aristotle's general methodological advice to us in our study of "Nature's science" is clear,[36] especially in view of the methodological similarity between biologist and mathematician which he canvasses, somewhat rhetorically at $639^{b}7$ and confirms at $644^{a}23$f. In our study of "Nature's science" Aristotle's intention is that we should begin with what is, not with what will be. ($640^{a}3$-4)

The constructive sciences, aiming to bring about some future thing and beginning with that future thing as the determinate and limiting criterion, proceed to a deliberation[37] (E.N.$1112^{a}18$f) of the means within their power to effect that goal which, itself, lies within their power. Out of their deliberation (E.N.$1112^{b}23$-24) emerges the initial stages in the becoming of the object of their choice (E.N. $1113^{a}2$-5). They thus "bring back the moving principle to themselves" (E.N.$1113^{a}5$-7). The whole process of reasoning moves from the intention of the artizan or nature, through a process of analysis (E.N. $1112^{b}20$) which determines the shape appropriate to the goal, to the final seizure of the initial stages in its attainment. We may compare this account with Aristotle's account of natural and artificial production in Metaphysics Z, chs. 7-9, where the doctrines are confirmed.

Nature and the artizan thus contain within themselves the

synthesis, already inherent in the power of intention, of finality and form[38] (Physics 194[a]33-35).

Not only the processes of reasoning but also the modes of necessity manifest in the theoretical and the constructive sciences differ. In the constructive sciences it is man (or Nature, or Chance, or Necessity) who is cast in the role of cause (E.N.1112[a]31-33).

But the theoretical observer can discharge no such causative role, nor is the theoretical observer capable, by adopting the mode of reasoning or the kinds of necessity operative in Nature, to trace back[39] the links of necessity to eternity (640[a]6-8).

In the face of this problem Aristotle does not turn to empiricism, or to the processes of experimental verification of models, or to any process of stochastic computation in an attempt to mediate the possible to the natural fact. Düring is right when he says:[40] "It does not seem reasonable to characterize his method as empirical, for what we mean by empiricism was quite unknown to him, and so was the modern distinction between theoretical and empirical natural sciences." Again McKeon rightly tells us[41] what not to expect from Aristotle.

> The method of Aristotle is not based on the assumption either that the mind will discover truth if it is reoriented toward the source of truth or that it will find truth within itself if the distractions of sense are removed, and therefore the method is not constructed to reproduce the stages of thought as they are normal to the human mind[42] freed from the intrusion of error or of the characteristics of things as they exist and evolve apart from the intrusion of the mind.

Instead, Aristotle rejects any attempt artificially to relocate the scientist. He recognises that the natural scientist can not adopt the perspective either of nature or of the artizan in the hope that he might start, as they do, with what will be.

The natural scientist, says Aristotle ($640^{a}3$-4), must start with what is, not with what will be, and the mode of reasoning will, accordingly, differ from that used in the constructive reasoning of nature or the artizan. For his first and most critical task will be to establish what is. The artizan and nature already possess their starting point - in their intention. The natural scientist does not. He must first secure his starting point - that which is.

The theoretical scientist must realize that in his theoretical studies his aim is knowledge and contemplation and that the subjects with which he is concerned must be considered as outside his power. Nor, in any case, would the types of reasoning and of necessity operative in nature's or the artizan's constructive processes be of any use to the natural scientist since he could not, through them trace back the links of necessity to eternity (εἰς ἀίδιον $640^{a}6$-8). Such constructive necessity is temporal not 'eternal.'[43]

Aristotle insists that the natural scientist, like the mathematician in conducting his astronomical investigations ($639^{b}7$-10; cf. $640^{a}10$-19), must begin with what is. He must recognise that what is is what it was to be (τὸ τί ἦν εἶναι). That is to say, he must recognise that what is is the cause of the matter and processes of its becoming ($640^{a}18$-19). Such recognition is, of course, of paramount importance too in the constructive sciences. "Even in building the fact is that the particular stages of the process come about because the Form of the house is such and such, rather than that the house is such and such because the process of formation follows a particular course" ($640^{a}15$-18). Yet, while final cause plays a certain role in both the theoretical and the constructive processes of reasoning its role in each is not the same.

In the constructive process of reasoning final cause acts to mediate the doer to the means. Final cause is thus, in the contructive sciences, the ὑπόθεσις ($639^{b}24$ - it is the doer who asserts it). In the constructive sciences final cause does not necessitate in its own right, but only as ὑπόθεσις . That is, it necessitates if nature or man wills that it will be. Thus the necessity consequent upon the final cause in the constructive process of reasoning is only present when that final cause is itself willed by the original source of the construction. We might bear in mind here the penetrating analysis of Aristotle's teleology offered by Wieland and particularly his analysis of necessity (3, p. 264f).

In the theoretical sciences, on the other hand, because the subject of enquiry already exists - it is what it is - it is now in its own right a necessitating force which entails (in its own right - not now as ὑπόθεσις) the being of those further elements without which it could not be (De Part.An.$642^{a}8$). It is the final cause of its own essential properties. Now it is certain properties necessitated by the being of the subject which exist ἐξ ὑποθέσεως ($642^{a}9$). They are perceived by the theoretical scientist as contingent upon the already existing subject (which is thus their final cause) ($640^{a}33$-$^{b}1$).

The fact that there are different ways in which the scientist sees (and can trace necessity in terms of) final cause contributes to the methodological differences between constructive and theoretical sciences. In the constructive sciences final cause is only insofar as the constructing nature or man asserts it, and insofar as there is material available appropriate to the becoming of that final cause.

In the theoretical sciences the final cause already is and we perceive the grounds of the necessitated matter to be the final cause.

In the constructive sciences, because man asserts it, he knows what the final cause will be and therefore he can use this knowledge directly as the principle of selection of the means to that end, the making of the matter (Physics $194^{b}7$-8).

In the theoretical sciences the final cause can not be used in this manner. We can not deduce the properties from the final cause of the subject (though this would be best and it describes the condition for which we are striving - De Part.An.$640^{a}33$-35).[44] Rather it is the principle of finality (not the final cause itself, for this he can not yet know) to which the natural scientist must hold in his researches and which links the 'what' and the 'why.' This principle he has in the finality aspect of the notion of essence.[45] A thing is only insofar as it was to be. ἡ φύσις ἕνεκά του ποιεῖ πάντα ($641^{b}12$). Once this is accepted as the grounds for explanation and understanding, the scientist is then free to proceed, through the apodeictic syllogism, to reveal the causes of the parts using their own definitions as middle terms for he realizes that the what (the essence of the subject) and the 'whys' are indissolubly one by virtue of the fact that the subject is what it was to be. In doing this he creates the conditions for his understanding of why the parts are for the sake of the whole. He has hunted the knowledge of essence.[46]

While the existent subject necessitates matter and conditions of particular natures in order that it may be, yet, in turn, the causes proper to those conditions and matter serve to inform our understanding of the form of the subject and the way in which the subject is formed,

is actualized ($642^{a}9$-13). Aristotle is most insistent that the nature of the matter can not be ignored by the natural scientist since it is not any matter that can become any thing ($641^{b}26$).

> Again, matter is a relative term: to each form their corresponds a special matter. How far then must the physicist know the form or essence (sc. of the "special" matter[47])? Up to a point, perhaps, as the doctor must know sinew or the smith bronze (i.e. until he understands the purpose of each): and the physicist is concerned only with things whose forms are separable indeed, but do not exist apart from matter. Man is begotten by man and by the sun as well. (Physics $194^{b}9$f)

The point of the final comment is to show us the limit up to which we should study the form of the matter of any subject - that is we should study it up to the point at which we have established the proximate matter of the subject which, as we know (Meta. $1045^{b}18$) is one with the form of the subject.

Time and again[48] Aristotle tells us that the natural scientist can not neglect the matter - not, indeed, all matter or qua matter, but that matter which is seen to be proximate to the subject concerned. There must be undertaken a process of elimination. Not all of the matter is in the definition of the subject, but only that in the matter which is proximate. "If then matter is one thing, form another, the compound of these a third, and both the matter and the form and the compound are substance, even the matter is in a sense called part of a thing, while in a sense it is not but only the elements of which the formula of the form consists" (Meta. $1035^{a}1$f).

There is a very real difference between a μόριον and a στοιχεῖον or element in the definition (Meta. $1041^{b}2$f). The element is the cause of the part's inherence ($1041^{b}25$f), and it should not be called an element as if it were itself part of the matter, but rather as its principle ($1041^{b}27$f). It is this that must be isolated,

through our demonstration of the inherence of each of the parts, in our search for the essence of the subject.[49]

It is because Socrates neglected the matter that Aristotle censures him.[50] It is because Democritus included an account of the matter and its formative processes that Aristotle praises him.[51]

Clearly, Aristotle insists upon the closest examination of the matter in the conduct of natural science. But how does Aristotle propose that this is to be performed? By use of the syllogism in its dialectical and apodeictic forms. Ideally, we should be able to assert simply that because the essence, e.g. of man, is what it is, therefore a man has such and such parts since there cannot be a man without them (De Part.An. $640^{a}33$-35). This is the ultimate goal of science - so to comprehend the essence that one is able[52] without doubt to demonstrate the demonstrable properties. This is the 'best' way but it is rarely the possible way, and in the vast majority of cases we must resort to another form of the statement. "If we may not say this, then the nearest to it must do, viz. that there can not be a man at all otherwise than with them, or, that it is well that a man should have them" ($640^{a}35$-$^{b}1$). We then proceed to a demonstration of the existence of these properties. In performing this demonstration we not only prove the existence of the properties, but also, since the demonstration proceeds through their definitions as middle terms, we reveal to ourselves the elements or principles in virtue of which they inhere in the subject and which constitute the elements in the defineable form. We perform, that is, the process of elimination upon which Aristotle insists.[53] We place ourselves in a position where we can come to comprehend those elements in the matter "of which the formula of the form consists" (Meta. $1035^{a}1$f). Our final task then

is to "follow . . . through . . . the . . . middle terms until the immediate premisses are reached" (Post.An.$89^{a}13$-14).[54]

It is in rendering precise the way in which the parts inhere in the subject that we come to be in the best position to say something worth saying about the formula of the form (De An.$402^{b}22$-25).

The natural scientist, unlike the housebuilder, does not commence his researches with a foreknowledge of what it is that constitutes the purpose, the explicit final cause, of his subject. The natural scientist has only mute nature before him; nature which rarely declares what the ends of its generated things are, though it everywhere declares that they have ends (De Part.An.$641^{b}12$). The natural scientist is unable therefore to start his enquiry with the declared final cause of the subject of his enquiry.

And so he must undertake, first, to examine the parts, for the natural scientist is aware of the principle everywhere manifest in nature ἡ φύσις ἕνεκά του ποιεῖ πάντα ($641^{b}12$). He is aware that the principle of τέλος is, above all, a principle of economy, of unity between form and function. He is aware that this principle operates in nature to determine that what a thing is is the actualization of a goal. He is aware that is, that formal, efficient, and above all final cause are one;[55] and that once he is able truly to comprehend the form of his subject its finality will be immediately obvious. He is able to come to a comprehension of the form of his subject because the being of the subject is the final cause of its essential properties. Thus he must undertake to comprehend why the parts belong (demonstrate them through their own definitions as middle terms) if he is to comprehend the form of the subject and its

finality.

The unity of form and finality of a subject can be analysed if we undertake to examine the hypothetically necessitated processes of material and efficient causation, which examination we saw earlier[56] to be, in Aristotle's view, his chief contribution to the advance of Socrates' definitional method.

Aristotle himself assures us that this question is legitimate and its analysis possible providing that we ask it in the right way (Meta. $1041^{a}14$f).

"Now why a thing is itself is a meaningless inquiry" (1041^{a} 14-15). In answer to the question why a man is a man the only appropriate response is "because he is a man" (Meta. $1041^{a}15$-20).

> But we can inquire why man is an animal of such and such a nature. This, then, is plain, that we are not inquiring why he who is a man is a man. We are inquiring, then, why something is predicable of something. ($1041^{a}20$-23)

> Plainly we are seeking the cause. And this is the essence (to speak abstractly). . . . The object of the inquiry is most easily overlooked where one term is not expressly predicated of another (e.g. when we inquire 'what man is') because we do not distinguish and do not say definitely that certain elements make up a certain whole. . . . Since we must have the existence of the thing as something given, clearly the question is why the matter is some definite thing; e.g. why are these materials a house? Because that which was the essence of a house is present. . . . Therefore what we seek is the cause, i.e. the form by reason of which the matter is some definite thing, and this is the substance of the thing. (Meta. $1041^{a}27$-$1041^{b}9$)

Post.An.2, chs. 1 & 2 again assure us of the propriety of the question "what is God?" or "what is man?" ($89^{b}34$-35). When we ask whether a thing without qualification is "we are really asking whether . . . the thing has a middle" ($89^{b}37$-38). Aristotle is showing us, as he did in the Metaphysics passage cited above, that the ability to to answer the question "is centaur" or "is God?" ($89^{b}32$-33) is itself

contingent upon whether the question can be properly asked (Meta.1041 $^{a}14$). "Why is man an animal of such and such a nature?"[57]

Once we recognise that asking "is man?" is the same as asking "why is man" ($89^{b}37$-$90^{a}1$) we must further recognise that this question is, as expressed, meaningless (Meta.$1041^{a}14$). Our knowledge of the being of anything, man, moon, centaur, or God included, is wholly contingent[58] upon (Post.An.$93^{a}20$) our knowledge that it is something and whether in fact we know what that something is,[59] its form, its essence, its cause. Aristotle is telling us in the beginning of the Post.An.Book Two, as we have seen him tell us elsewhere, that we come to the knowledge of the essence of a thing through our analysis of the causes of its properties in terms of their constituting the becoming or being of the subject. In asking the question "is man" we must avoid the meaningless question "why is man" in favour of a formulation which can be managed. The answer will be found in establishing e.g. what can be predicated of man, and then hunting the causes of those predicates through apodeixis, and seeing in that cause an element in the answer to the question "why is man as he is?" "For the cause through which a thing is - not is this or that, i.e. has this or that attribute, but without qualification is - and the cause through which it is - not is without qualification, but is this or that as having some essential attribute or some accident - are both alike the 'middle'" ($90^{a}9$-11).[60]

Clearly, Aristotle insists upon the closest examination of the "matter" in the conduct of natural science. But there were some, says Aristotle,[61] "who thought the 'matter' was adequate by itself to account for coming-to-be, since 'the movement originates from the matter. . . . To say that 'matter generates owing to its movement'

would be, no doubt, more scientific than (what adherents of the Forms say). For what 'alters' and transfigures plays a greater part in bringing things into being; and we are everywhere accustomed, in the products of nature and art alike, to look upon that which can initiate movement as the producing cause. Nevertheless this theory is not right either."

It might be thought[62] that the type of necessity here being discussed - that by which we come to see the form of the subject in the causal definitions of its demonstrated parts under the principle of "what is is what it was to be" - is really nothing other than the mechanism flowing from the material cause as it was understood by the φυσικοί who preceded Aristotle. Aristotle is careful to forestall this judgement.[63]

The ancients assumed that the factor of necessity was present in all the works of nature in a similar sense ($639^{b}21$). Thus they saw nature simply as a source of movement and their 'method' was simply to trace any object or event to any cause seen to be capable of occasioning that object or event. Matter is potentiality. But potentiality must be harnessed[64] and this is achieved through the efficient causation of form. The forces of matter can only be harnessed to constitute becoming when form is operative. Matter must be moved (De Gen.et Corr.$335^{b}30$f). Its function can only be comprehended when the notion of essence, operating in some appropriate method such as Aristotle's, enables us to perceive that potentiality as harnessed by the unifying and actualizing constraints of form. It is only within these constraints that we can perceive what kind of matter - matter of a particular form - it is that makes possible the

becoming of the subject.

Thus when Aristotle determines that the natural scientist should, like the mathematician in his astronomical enquiries (De Part. An. 639^{b}7-10; 640^{a}10-19) begin with the parts and go on to state their causes he is insisting that the processes of the earlier philosophers be inverted.[65] We must first study the animal as it actually is (640^{a}12). We must "take the phenomena that are observed in each group, and then go on to state their causes" (640^{a}14-15). We must not, that is, do as the earlier philosophers did, see the matter as motive cause; but rather we must see the matter as subject to cause, as itself caused by having its being within a whole. ἔστι σὼν πρός τι ἡ ὕλη· ἄλλῳ γὰρ εἴδει ἄλλη ὕλη. (Physics 194^{b}8-9)

As was noted earlier,[66] the natural scientist in his theoretical studies can not use final cause in the same manner in which the constructive scientist uses it. "In the products of art, we make the material with a view to the function" (Physics 194^{b}7-8). As Aristotle says in the De.Part.An., the constructive sciences must start with what will be, the matter which, "must be or become to serve a further purpose" (De Part. 640^{a}3-5). "Whereas in the products of nature the matter is there all along" (Physics 194^{b}8). In the constructive sciences we start by making the matter to subserve the known final cause. In the theoretical sciences we must start with the matter already present, but not just as matter for such is not comprehensible (De An. 403^{b}9-10). The matter can only be comprehended when seen in terms of the causes of the parts necessarily belonging to the whole, as demonstrated properties of the whole. Once the essence of the part is revealed in demonstration (for this is the middle term) then we are able to perceive, comprehend, the form and finality of the

subject, the minor term; for we are now in a position to comprehend why the parts are "for the sake" of the whole, and thus to comprehend the nature of the whole in its finality.

The structure and sequence of the elements of the Aristotelian method are most easily seen when we examine the model which Aristotle advances as that which the natural scientist must follow, that of the mathematician in his astronomical enquiries. He clearly presents this method as involving two processes.[67] πρῶτον τὰ περὶ τὰ ζῷα θεωρήσαντα καὶ τὰ μέρη τὰ περὶ ἕκαστον (639^{b}8-9) constitutes the first stage. ἔπειθ' οὕτω λέγειν τὸ διὰ τί καὶ τὰς αἰτίας (639^{b}10) constitutes the second phase (cf. 640^{a}14-15). The examination of the phenomena is one process. The telling of the causes is the second. We see confirmation that Aristotle intends this as a two stage process at Posterior Analytics 78^{b}39 and 79^{a}2-6. These passages occur in the context of Aristotle's discussion of the relations between the syllogism of the fact and the syllogism of the reasoned fact (Post. An.1,13).[68] When we have two sciences one of which is subordinate to the other the one gives the syllogism of the fact and the superior the syllogism of the reasoned fact (78^{b}34f). Such is the relation of astronomical observation to the mathematical astronomy (78^{b}39). "It is the business of the empirical observers to know the fact, of the mathematicians to know the reasoned fact[69]; for the latter are in possession of the demonstrations giving the causes, and are often ignorant of the fact" (79^{a}2-4). The latter must rely upon the former (76^{b}11), for the latter must assume the existence and meaning of the subjects and the meaning of the attributes (76^{b}5-7).

The initial examination of the phenomena is conducted using the syllogism of fact as its instrument of analysis. At Prior An.1,30,

Aristotle maps out the procedure. Where apodeictic syllogisms are possible they are made. Where only dialectical are possible they are used. "But in each science the principles which are peculiar are the most numerous. Consequently it is the business of experience to give the principles which belong to each subject" (46^a17-18). One wonders whether one type of this experience is that attained by the observer in his syllogistic analysis[70] of the phenomena described in the preceding sentences (46^a3-17). (cf. 46^a24-27; see below, pages 88-89)

It is the making of the syllogism, the reduction to syllogistic form, which itself constitutes the analysis. Robinson is quite right to insist, against Cornford, that it is the deduction which constitutes the analysis in the Greek tradition of mathematics. We start with what is and demonstrate what follows from it. This "was followed by a synthesis, and the latter constituted in the first place a check on the analysis, to make sure that there had been no error; but, secondly, provided that there had been no error, it constituted the actual proof or solution for the sake of which the analysis was undertaken" (in mathematics). The synthesis consists in going through the same steps as the analysis in the reverse order. "For this method to work," notes Robinson, "the implications must be reciprocal. . . . In other words, the propositions concerned must be convertible."

This describes precisely what Aristotle means by analysis and it is the function which the syllogism, and more particularly the apodeictic syllogism, discharges in his method.

For Aristotle, of course, recognises the problem of the non-reciprocity of most implications (Post.An. 78^a7f).

But Aristotle's method accommodates the fact that his method is used over fields where convertibility is virtually never possible

and it does so in two ways.

Aristotle insists that the synthesis is not a demonstration (see page 90f below).

Secondly, he discharges the two functions of the synthesis cited by Robinson by placing the whole operation within the context of διδασκαλία . The scientist, acting qua teacher provides the grounds for the synthesis by "telling the causes." This does not constitute a proof. Yet the scientist's findings must be subjected to the test. This is provided in forcing the students themselves critically to assess the synthesis provided by the scientist-teacher by themselves undertaking precisely the same kind of analysis of the subject in the most rigorous possible confrontation with the phenomena.

The synthesis made by the teacher, and ultimately by the students on completion of their own analysis, is a process of following up the middle terms until the immediate premisses are reached. It does not constitute a proof but it does provide the experience necessary for νοῦς to perceive the full nature of the indemonstrable. The analytic criticism engaged in by the students acts as a check and a further vehicle for the students too to gain the requisite experience for νοῦς to achieve its goal.

Of course we are speaking in the broadest possible terms. The actual conduct of any science will depend on the type of subject matter as we saw in Chapter 4.

Aristotle goes on to show ($46^{a}19$-27) how this analysis provides the foundation upon which the mathematician can proceed to establish the syllogisms of reasoned fact. "I mean for example that the astronomical experience supplies the principles of astronomical science: for once the phenomena were adequately apprehended, the

demonstrations of astronomy were discovered. Similarly with any other art or science."

Discovering the demonstrations provides the opportunity for attaining the synthetic grasp of the indemonstrable definition of the whole. For the culmination occurs when, providing the "historical survey" ($46^{a}24$) has been complete and we have thus been "able to discover the proof and demonstrate every thing which admitted of proof" ($46^{a}24$-27), "we make that clear whose nature does not admit of proof" ($46^{a}27$).[71]

In building these theories the mathematicians may well be unfamiliar with certain facts or details ($79^{a}4$-6; cf. Meta.$982^{a}9$).[72] But they must rely upon the accuracy of their observational foundation. Yet that is not all, for they know too that they must, as teachers[73] "tell the causes" and that their students will perform the final test by rigorously testing the "causes" they are told through their own apodeixeis of the phenomena.[74]

Aristotle makes it clear that his method is neither easy nor sure. His concern in De An. $402^{a}10$-22 is real, yet his comment as to the insufficiency of Plato's scheme ($402^{a}21$-22) is categorical. For he has his method and he proceeds to execute it (De An.$402^{b}9$-16) and $402^{b}16$f).

In the notion of essence, itself operating in Aristotle's thought as a principle of economy, we find the principle enunciated "qui sache discerner le nécessaire."[75] Its implementation is methodologically possible through the demonstration of the parts. The syllogism, and more especially the apodeictic syllogism, has rendered possible the integration of final-efficient, and material elements into the method of definition. Thus Aristotle avoided adopting a

a method which precluded any accommodation of the fact of becoming. In the De Partibus Animalium, Aristotle claims to have provided the notion of essence with an appropriate vehicle for its deployment in philosophical enquiry.[76] Nor is his claim limited to the field of natural science alone for he makes the same claim for ethics[77] and for First Philosophy.[78]

There are, of course, three (at least) major objections to be raised against this interpretation. The method as here described seems manifestly cyclical and to involve a petitio pricipii. Secondly, on the evidence of the Posterior Analytics (1,6; 1,31) it is not possible to demonstrate unless the demonstrator has prior and better knowledge of the essence. Yet this interpretation seems simply to ignore that principle, placing better knowledge of the essence at the end rather than at the beginning of demonstration. Finally, of course, there remains the central "problem of demonstration"; where do we find, in Aristotle's extant works, any demonstrations?

Each of these objections must be examined in turn but some general comment is appropriate first. It must be recognised that the reflexive structure of this method wherein the demonstrated knowledge of the parts informs our understanding of the essence of the whole does not constitute circular demonstration for it is not, in any sense of the word, a demonstration at all.

It is suggested here that demonstration of the parts can inform our knowledge of the essence of the subject. This procedure, whereby we gain further insight into the essence by examining the demonstration of the parts, must not be regarded as circular demonstration.

The proof of the parts is, of course, an ἀπόδειξις. We start with the definition of our subject (De Part.An.$640^{a}36$), and proceed to prove on the basis of a necessity which governs the existence of the

properties. (Post.An.91^{a}1-2) When, however, we turn back to examine the grounds of the proof, and try in this way to deepen our comprehension of the subject essence we are, once again, involved in definition, and definition does not touch existence. (Post.An.2,7)

Now we are examining the way in which the causes of the proven properties determine the character of the subject and, therefore, its finality. The necessity involved on this occasion does not relate to the being of the subject, nor to the being of its defining properties. Rather it is the necessity one recognises when one recognises the integrity of a subject. There is no mediation involved here nor is one possible.

There is no proof of essence. We either see it or we do not, but we can prepare the ground for the recognition and thus become "best qualified to speak about essence." (De An.402^{b}24-25)

It is clear, too, that this method would be inconceivable without the complete integration of the notions of thinking and knowing. The necessity which we can see when we move from the demonstrated properties to the form of the subject is manifest only to the mind which is actively thinking. Roland-Gosselin is quite right when he observes[79] "L'intelligence est en dépendance étroite des données de l'expérience." It is only our experience attained according to this method which can act as the ground upon which we could "fonder une synthèse nécessaire" since any proposition (however extended[80] that proposition) which would result would be an immediate one corresponding to the question 'why is a man man?' (cf. Post.An.2,9)

Once the methodological significance to Aristotle of the notion of essence is appreciated it becomes possible to see the origin of certain of the more manifest shortcomings of his scientific works. "Even in his most advanced works in biology," says Düring,[81] Aristotle's "reasoning is based on a priori principles and book-

knowledge more than on observation." It is to this that During attributes many of the gross errors that Aristotle makes in his scientific treatises.

Aristotle has been repeatedly upbraided, with justification, for having established his principles without a sufficiently comprehensive observation of the facts. Yet it must be emphasized that this shortcoming is due not to a failure in the structure of the method but to Aristotle's own failure to apply the method with sufficient rigor. His own methodology requires the most rigorous critical observation of the facts, both on the part of the researching scientist and on the part of his students. It is this critical adjudication of the syllogistic analysis in the light of the phenomena which leads to full comprehension of the principles of the science.[82] Aristotle recognises that the success of a science depends upon how exacting has been this examination of the facts.[83]

During says,[84] "fortunately he did not always apply his own rules," implying that Aristotle's successes are largely despite his method rather than because of it. Yet the reverse is the case. The obvious failures Aristotle has in science are due to his own incapacity (laziness, or even more, the haphazard state of data gathering, and lack of sophisticated tools) to fulfil the requirements[85] of his method.[86]

But Aristotle must be shown to meet the objections raised above. The first objection, that concerning the circularity of the method, he meets principally at three places: at Post.An.II,6 (where the problem is raised); at Meta.Z,12 (where it is further analysed); and at H,6 where the resolution is offered.

At Post.An.II,6, Aristotle offers a concise formal analysis

of the method as it operates in the sciences generally ($92^{a}6$-19).

He offers first a syllogistic formulation (1st fig. Barbara) of the method.

The definable form of a thing is the set of peculiar attributes of the thing's essential nature.

The set of peculiar attributes of this thing's essential nature are xyz (and only xyz).

The defineable form of this thing is xyz (and only xyz).

Aristotle brings three objections against this as demonstration.

First, it is a petitio principii in that the middle term is one with the minor term.

The second objection is in many ways the more interesting. We can not assume the principle on which we reason as the principle from which we reason in any particular syllogism (cf. Post.An.1,7; 1,9). The principle enunciated in the major premiss is, of course, the principle of essence itself - viz. "a thing is what it was to be," or, alternatively stated, ἡ φύσις ἕνεκά του ποιεῖ πάντα (De Part.An. $641^{b}12$).

The principle is not commensurate with the subject of the enquiry. We have tried to use a universal principle as genus and this simply will not work since there is no universal over and above the defineable form of this thing (e.g. man, or animal) (cf. $74^{a}7$-8).

This form of reasoning, Aristotle concludes, does not constitute a demonstration of essence. Such reasoning does not conform to the natural manner of definition and its consequents (cf. Meta.$1045^{a}7$f).

We can not, says Aristotle, include what syllogistic inference is in our syllogising, nor can we include a statement of what definition is in proving a definition. The principle of what constitutes a

definition can however be used, says Aristotle, "when someone doubts whether the conclusion proved is the defineable form." We "defend it as conforming to the definition of defineable form which we assumed" (Post.An.92^{a}16-18). The situation depicted in these lines characterizes precisely the situation which obtains in the method presented here as Aristotle's method in philosophy and science. We have before us a demonstration and we are asked (or ask ourselves), "does the property as demonstrated belong to the essence of the subject?" and we answer "yes, since it conforms to the principle that a thing is that which it was to be." (Note the direct speech in Greek text reflecting the immediacy of the perception involved and perhaps, too, the didactic context of such an exchange.)

Aristotle adds a final decisive rejection of the possibility that the essence can be deductively proven. Deduction proves the properties, but can offer no proof that "the predicates shall constitute a genuine unity and not merely belong to a single subject as do musical and grammatical when predicated of the same man." Aristotle is insistent that the knowledge of the essence must be knowledge of the unity of the synthesis and not merely of the discrete belonging of the parts. But there is no unifying formula (Meta.1045^{b}16-17). There is only the unity to be recognised or not depending upon whether or not they come to know the proximate matter and recognise that proximate matter and form are one (Meta.1045^{a}23-25 and 1045^{b}17-18).

To be sure, if the method is taken as wholly demonstrative it is manifestly cyclical. But the method as a whole is not demonstrative. It contains within it a key element of demonstration, but this is operative only in the context of a conscious, active, thinking person who reflects and asks himself immediate questions to which he

can give immediate answers under the principle of essence. As demonstration it is cyclical. As reflective consciousness it is the synthetic act of perceptive thinking, asserting mind. The principle "qui sache discerner le nécessaire" is not a principle of deductive method but of the recognition of unity. Deduction by itself can not suffice, and induction by itself "proves not what the essential nature of a thing is but that it has or has not some attribute." "Presumably one cannot prove essential nature by an appeal to sense perception or by pointing with the finger" (Post.An.$92^{a}38$-$92^{b}3$). It is only by the reciprocal functioning of the two, generating the experience necessary, that one can come to "defend" the synthesis.

At Meta.Z,12,$1037^{b}8$-9, Aristotle explicitly offers a supplement[87] to his discussion of this issue in the Analytics. The problem is raised by directing our attention to the question of how we come to know the unity of the formula of essence which consists in many parts. "I mean this problem: - wherein can consist the unity of that the formula of which we call a definition, as for instance, in the case of man, 'two-footed animal'; for let this be the formula of man. Why then, is this one, and not many, viz. 'animal' and 'two-footed?' (Meta.1037^{b}10-14).

Clearly the principle of unity is not because these elements "are present in one thing; for on this principle a unity can be made out of all the attributes of a thing. But surely all the attributes in the definition must be one; for the definition is a single formula and a formula of substance, so that it must be a formula of some one thing" (1037^{b}23-26).

Aristotle recognises that the unity of the synthesis must have some grounds[88] in our comprehension. There must be a principle which

enables this unity to become manifest to us as a necessary unity.

The definition provided through division involves us in superfluous repetition and, again, does not give grounds for the comprehension of unity (Meta.1037^{b}27f; cf. Post.An.92^{a}27f).

Aristotle has here shown that the problem has two aspects (cf. 1044^{a}3f). First, there is the clear need for a principle upon which to ground our comprehension of the unity of the synthesis which is the definition, (and this must be a ground not only of our comprehension of its unity but of its being a unity (Meta.1037^{b}27).) Secondly, the principle must be such that it encompasses the necessity of the inherence of the attributes and not their mere predicability (1037^{b}23-26).

At Meta.H,6, Aristotle indicates how these two requirements are to be fulfilled. He confirms first (1045^{a}8-10) that there is a cause of unity "in the case of all things which have several parts and in which the whole is not, as it were, a mere heap, but the totality is something besides the parts." He then explains how the necessity of the inherence of the attributes is to be seen. He does this by giving examples: "for as regards material things contact[89] is the cause in some cases, and in others viscidity or some other such quality." His examples are precisely those of efficient and material causes by which he explains the belonging of parts; that is to say the kinds of middle terms used in the demonstration of demonstrables.

It is in these causes, says Aristotle, that we must satisfy the requirement that our definition be composed of necessarily inhering elements and not merely predicable elements (1037^{b}23-26; cf. Post.An. 1,6).

As to the grounds for our perception of the unity of the synthesis as a whole he goes on to show that the problem is one of

perspective. If we act from the perspective provided by the nature of essence we experience no problem at all.

Plato's rigorous adherence to separate forms contains no solution (Meta. $1045^{a}12$f).[90]

The problem resolves itself if "as we say, one element is matter and another is form, and one is potentially and the other actually" (Meta. $1045^{a}23$-24).

Quite simply if we adopt, as Aristotle has repeatedly told us to do, a perspective made possible by the principle of economy which is the notion of essence there is no problem. We will recognise that in demonstrating the parts we see the causes of the parts - we come to understand the principles of the matter, and "there is no other reason why the potential sphere becomes actually a sphere, but this was the essence of either" (Meta. $1045^{a}31$-33). People advance many causes for unity "participation," "communion," "composition," "connexion" ($1045^{b}7$-16). They are floundering. All such explanations resolve to one. They are seeking a unifying formula (hence a mediation of some difference, between potency and complete reality) (Meta. $1045^{b}16$-17). "But, as has been said, the proximate matter and the form are one and the same thing, the one potentially, and the other actually" (Meta. $1045^{b}17$-19).

The method provides for the analysis of an immediate unity. It does not pretend to mediate that unity unless we are to call the intellectual act of perception a mediation.

"To be sure, there are paths which lead up <u>to</u> principles, but principles can never be derived <u>from</u> them in the strict sense. They are 'evident' in the sense that once they are discovered nothing equally plausible can be discovered which contradicts them."[91]

Wieland's thesis that the principles are "evident" corresponds to the theme here being proposed. Of course Wieland would not accept that the principles are themselves "evident" to the intuitive intellect as is suggested in this study.[92]

Wieland suggests that the principles are "points of view," "concepts of reflection" (Wieland (1), p. 136), and that Aristotle's search for principles is a search into "presuppositions" (p. 132-133). The findings of this study would lead us to describe the principles in terms rather more remote from such a "Kantian" (p. 136) view. The role of the syllogism as grounds for insight into the principles (under the methodological perspective offered by the principle of essence) seems to offer a far closer relation between Aristotle the scientist and Aristotle the philosopher than Wieland proposes (p. 136).

At Meta.1006^{a}11f, Aristotle shows how the problem of begging the question may be avoided in dealing with the immediate ἀρχαί. (His subject is an axiom but the answer is appropriate to the ἀρχαί of the sciences.)

> We can, however, demonstrate negatively (ἐλεγκτικῶς) even that this view (sc. that there is a prior principle to that of non-contradiction - Meta.1005^{b}35f) is impossible if our opponent will only say something; . . . Now negative (ἐλεγκτικῶς) demonstration I distinguish from demonstration proper, because in a demonstration one might be thought to be begging the question, but if another person is responsible for the assumption we shall have negative proof (ἐλεγκτικῶς), not demonstration. The starting point for all such argument is not the demand that our opponent shall say that something either is or is not (for this one might perhaps take to be a begging of the question), but that he shall say something which is significant both for himself and for another; for this is necessary, if he really is to say anything. For, if he means nothing, such a man will not be capable of reasoning, either with himself or with another. But if any one grants this, demonstration will be possible; for we shall already have something definite. The person responsible for the proof, however, is not he who demonstrates but he who listens.

The petitio principii is avoided by appealing to the possibility of significant utterance, to the elenctic invitation of the interloqutor (either oneself or another ($1006^{a}23$-24)) to perceive the necessity (Post.An.$76^{b}23$f) of the ἀρχαί . It is however, the interloqutor who is responsible for the proof ($1006^{a}25$-26).

The absolute context for the method as a whole is conversation - the possibility and exercise of significant statement brought to its fulfilment in that conversational argument[93] which is didactic, viz. ἀπόδειξις. Aristotle remains true to that most profound of Socratic insights into the mode of human communion, ὁ ἔλεγχος .

In Chapter 4 above, it was proposed that Aristotle casts the Analytics, the theory of the syllogism and the apodeictic syllogism, in the role of a παιδεία , a training in the critical techniques to be used by the scientist-philosopher in his researches (in his conversations with himself) as by the listener, the student in his critical assessment of what is being taught.

That is to say, the scientist can not regard his task as complete when he has discovered the causes. He must subject this to the test by telling the causes ἐπισθ' οὕτω λέγειν τὸ διὰ τί καὶ τὰς αἰτίας De Part.An.$639^{b}10$. This he may do using whatever device, including demonstration, is appropriate to the subject matter, and to the circumstances. But it is the causes which he must tell. "The science which investigates causes is also the more communicable, for the people who teach are those who tell the causes of each thing" (Meta.$982^{a}28$-30; $982^{a}12$-14). "Again," says Aristotle, "every science is thought to be capable of being taught, and its object of being learned" (E.N.$1139^{b}25$-26). Teaching is the required test, in

Aristotle's view, of the validity of the claim of the science (cf. Meta.981^{b}7f) to be a science. Aristotle's works are strewn with references to the testing of a science by the scientist proceeding to ἀποδοῦναι the science and allow it to be subjected to rigorous criticism[94] in the face of the observed facts.

"Intellectual virtue in the main owes both its birth and its growth to teaching." ἡ μὲν διανοητικὴ τὸ πλεῖον ἐκ διδασκαλίας ἔχει καὶ τὴν γένεσιν καὶ τὴν αὔξησιν (E.N.1103^{a}15-16).[95] Further, it is as teacher that Aristotle is best known to us, since what remains to us of his work is, by and large, his lecture notes.[96]

It is simply because this didactic context is so all[97] pervasive - is the assumption upon which Aristotle proceeds (cf. Post.An.1,1,71^{a}1f) - that Aristotle does not trouble to distinguish between research and teaching but subsumes them both under the phrase λέγειν τὸ διὰ τί καὶ τὰς αἰτίας . The two activities, research and teaching,[98] are in no way to be separated, for the research is not completed until the causes are told and subjected to the most rigorous criticism by the students using the same analytic tools (the syllogism in its dialectical and, finally, apodeictic form) that the researcher used in his own conversation with himself.

Yet there is a circumstantial and temporal separation of research and teaching for they each have different requirements which determine their actual modes of procedure.[99] There is a temporal separation because the researching scientist must have completed his research. He must be an actual knower before[100] he can undertake to guide the potential knower to actuality. He must, that is, have

already completed the dialectical and apodeictic syllogistic element of his researches by the time he comes to tell the causes.

In any case the apodeictic syllogism is often, though not always, unsuited to the task of telling causes since generally learning proceeds from what is less well known in nature to what is better known in nature;[101] whereas, as the Analytics makes clear, the apodeictic syllogism proceeds in diametrically the opposite direction:[102] and yet Aristotle tells us [103] that we learn "sometimes through induction and sometimes by syllogism." Clearly, the syllogism is an instrument in the didactic context, but not the instrument of communication. It is the instrument of critical analysis, for when he talks of learning through the syllogism it is of the discovery for oneself of a truth that he speaks (cf. Post.An.71^{a}16f, where the student is led on to make a syllogistic 'discovery' for himself).[104]

Aristotle will not be a party to any teaching method which gives the students the "facts already won."[105] He praises his own work for not doing this and condemns previous teachers for having committed this sin.[106]

Ernst Kapp has set right "one source of confusion which has hindered the general understanding of Aristotle's logic from later antiquity up to our time."[107]

> The problem set by the definition of the syllogism may be understood in two entirely different ways. Either we must start with given combinations of premisses and look for the possible inferences, or we must start with a conclusion and look for the possible premisses. The first seems the natural thing to do, and so it has been overlooked again and again that Aristotle understood his task in the second sense. His syllogistic is essentially a system of possible combinations of premisses leading to given conclusions, not a study of the possible inferences from given propositions.[108]

But there is also a circumstantial separation between research

and "telling the causes" to students. As was seen in Chapter 4 above, the question of how one should proceed to publish one's findings is, for Aristotle, contingent upon purely practical conditions of communication such as economy of presentation, the mode in which the subject matter manifests itself, and so forth.

But this issue is also contingent upon the qualification of the audience being addressed. "Moreover, before some audiences not even the possession of the exactest knowledge will make it easy for what we say to produce conviction. For argument based on knowledge implies instruction, and there are people whom one cannot instruct" (Rhetoric $1355^{a}24f$).

Aristotle is not referring here only to the congenitally stupid or unintelligent but to those who, however intelligent, have not received the training requisite to the didactic situation. His meaning comes clear a little later at $1356^{b}35$ where he shows that those who have not had the training in syllogistic provided by dialectic[109] are unable to "take in at a glance a complicated argument, or follow a long claim of reasoning" ($1357^{a}3-4$). We could even form the syllogisms for them and they would still not understand for they are simply not trained ($1357^{a}9f$).

The scientist must, then, when he comes to teach, tailor his recounting of the causes to accommodate the technical qualifications of his audience.[110] But when he comes to tell the causes to an audience whose only interest is truth he must be confident that he can rely upon an audience which has the proper technical expertise to judge the truth of his statements so that he may be left free to structure his statement of the causes in the most illuminating way possible given the practical confines of economy and the manner in

which the subject matter exhibits its form. He must be left free to lead the students on. He must be able, that is, to rely upon an audience of πεπαιδευμένοι (De Part.An.639^{a}5). He must be able to rely upon an audience whose critical powers have been derived from their training in the theory and practice of the syllogism and apodeictic syllogism presented in the Analytics.

It is of course well recognised that Aristotle stands within the tradition of the pedagogic moot as it evolved prior to and in the Academy.[111] The didactic situation as Aristotle designed it is a further evolution of that tradition for it is required that the students who listen to the scientist-teacher telling the causes must themselves subject his teachings to a rigorous criticism by undertaking by themselves to prove the demonstrable and to come to understand that which does not admit of proof.

Barnes is manifestly correct in seeing διδασκαλία as the proper context within which to come to our understanding of Aristotle's intentions for ἀπόδειξις . But he has clearly misread that intention when he suggests[112] that the theory of demonstrative science "offers a formal model of how teachers should impart knowledge" and is thus "concerned exclusively with the teaching of facts already won." Teachers do not, according to Aristotle, tell the "facts;" they tell the "causes." The syllogism is, in its apodeictic form, admirably suited to the telling of the facts (Post.An.90^{b}30-91^{a}2). But therein lies its liability for Aristotle (cf. Rhetoric 1418^{a}9-12 and E.N. 1147^{a}18f). The student must be led to see the causes. Aristotle is all too fully aware of the snares of the syllogism.[113] It is a potent weapon and could easily lead to the development of science away from the causes. He insists upon concentrating on the causes and confining the syllogism

to its proper analytic role.

And yet there remains the problem that Aristotle insists in the Posterior Analytics that a true demonstration is not possible without the prior and better knowledge of the ἀρχαί.

Yet the problem ceases to exist when the apodeixis is viewed, as it must be, within the didactic context. Aristotle is laying down the goal to be achieved. Scientific knowledge, when it finally is attained, proceeds in this fashion. This is the best way (cf. De Part. An. 640^{a}33f). It is because this way of knowing is the actuality of our knowing that we practice its form even though we have to take a less than perfect form to start with (cf. De Part.An. 690^{a}35f).

It should hardly surprise us to see Aristotle, in the Posterior Analytics, treating scientific knowledge first in its actuality, as it will be, and subsequently proceeding to an analysis of its parts and how they are to be brought about, for this is the pattern of procedure we saw him advocate for any such constructive science.[114] The full comprehension of the ἀρχαί constitutes the full possession of potentia secunda of knowing. It is only when we have analysed, through demonstration, that we come to possess the key, the ἀρχή, of demonstrative science and are finally able to proceed to the exercise of that knowledge qua true knowers whenever we wish. We are now able to solve any aporia which may confront us in that subject area. Scientific knowledge is being able to demonstrate the demonstrables; it is a ἕξις ; it is not the possession of demonstration of all the demonstrables.[115]

In a sense, Ross[116] was correct in advocating a non-natural interpretation to the terms 'better known' and 'prior.' Insofar as they are better known and prior in the actuality of scientific knowledge

but not its first potential being there is a 'natural' problem to be faced.

And yet, if we look closely at what Aristotle says about the nature of this "better" knowledge of the ἀρχαί which must be possessed if there is to be any true demonstration we see that even in the opening chapters of the Posterior Analytics he describes it in a way that renders it fully consistent with the exercise of the method as here presented. At Post.An.1,2,72^{a}37-72^{b}4, Aristotle writes:

> Moreover, if a man sets out to acquire[117] the scientific knowledge that comes through demonstration, he must not only have a better knowledge of the basic truths and a firmer conviction of them than of the connexion which is being demonstrated: more than this, nothing must be more certain or better known to him than these basic truths in their character as contradicting the fundamental premisses which lead to the opposed and erroneous conclusion (τῶν ἀντικειμένων τὰς ἀρχὰς ἐξ ὧν ἔσται συλλογισμὸς ὁ τῆς ἐναντίας ἀπάτης). For indeed the conviction of pure science must be unshakeable.

This condition can not be fulfilled unless and until one has followed out the process requisite to this condition. The "character" whereby we are to secure this better knowledge of the ἀρχαί is the dialectical examination of the conclusion entailed by taking the contrary to the ἀρχαί as premisses. Aristotle here, as at Topics 101^{a}34f,[118] grounds the character of our better knowledge of the ἀρχαί in a preliminary dialectical exercise. Such a knowledge of the ἀρχαί, dialectically attained, constitutes a sufficient (if not the 'best') "better" knowledge from which we may proceed to make true demonstrations and come, in the end, to transform the dialectically attained knowledge of the ἀρχαί with which we started into a full comprehension in terms of the unity of the whole.

Such a dialectical procedure (described more fully at Topics 153^{a}23-^{b}24) does not constitute demonstration of the essence. Aristotle makes that very clear in the very same chapter[119] (Post.An.

II,6,92^{a}20-27) in which he rejected the validity as demonstration of the proof of definition through the parts. It is not demonstration. But that fact does nothing to reduce its immense importance in the establishment of scientific knowledge.

We might properly conclude this study with a tentative and admittedly sketchy map of the place which, on the thesis here advanced, Aristotle gives to the apodeictic syllogism as described in Post.An. Book 1.

The method is the same in all cases, in philosophy, in any art or study Prior.An.46^{a}3.

1. What confronts the scientist as he first determines to embark upon a subject of enquiry is a confused whole to be analysed (Physics 184^{a}21f).
2. His first task will be to establish that he has taken his subject in a properly analyseable form. To ask 'is God?' or 'is man?' is to ask 'why is God?' or 'why is man?'. But such questions are meaningless. We must ask 'is God something?' before we can go on to ask 'why God is something?' and through that enquiry to arrive at the knowledge "God is." In doing this the philosopher is establishing the "defined rules" of the subject area (De Part An.639^{a}13).
3. Once he has properly framed the question (perhaps by establishing its category - cf. De An.402^{a}23) we then proceed (Prior An.1,30) "to look for the attributes and the subjects of both our terms and supply ourselves with as many of these as possible" (46^{a}4-6). Division will be a great help in achieving this and will ensure that nothing is omitted (Post. An.96^{b}25-26, 35-36, Prior An.1,31).

4. We then proceed to syllogise, or, as Aristotle puts it ($46^{a}6$-7) "consider them by means of the three terms, refuting statements in one way confirming them in another." Where demonstration is possible right away it is made. Where it is not thus possible we turn to dialectic ($46^{a}7$-10; cf. Topics $101^{a}34$f; $153^{a}23$-$^{b}24$, Post An. $72^{a}37$-$72^{b}4$). This constitutes our "analysis," the reducing of the material presented in stages 1-3 above to arguments in the moods of the three figures ($47^{a}2$-5). However since it is possible to hunt the essence through the 1st figure only (Post.An. $79^{a}24$-25) we must know how to reduce or "analyse" (Prior An. $51^{a}22$, $^{b}4$). Our analysis will be completed with the reduction to 1st figure form of the material gathered in stages 1-3.[120]

5. We then undertake to test the analysis we have created and trace back the chain of middles ($89^{a}12$-14). In so doing we realize that we will be coming to perceive the proximate matter of the subject in hand, which will be seen as one with the nature of the subject of our enquiry. The experience gained in these procedures will enable us eventually, with time, to see the unity of the synthesis and hence attain the true ἕξις of scientific knowledge. However, this synthesis must, itself constitute not simply a review but a critical test. We recognise that this experience, and our whole understanding, must be subjected to the test of the phenomena. We must subject it to this test, therefore, by "telling the causes" and engaging in a further reanalysis of those causes (E.E. $1216^{b}35$f).

The effective occasion for such a recounting of the causes is the didactic context. We must therefore, in this context, be careful not to use the apodeictic form in recounting the causes because: (a) learning proceeds in the opposite direction to that of ἀπόδειξις ; and (b) we would lead the students away from the causes, rather than towards the causes. The students are not only learners. They discharge an indispensible function within the process in so far as it is they who provide the true synthetic verification or falsefication of the science.

6. The truth is complex, and we must rely upon the capacity of those who listen (a) to understand what is said, and (b) to subject what is said to the most rigorous test in terms of the phenomena. Therefore we must secure adequate critics by training them in the method so that they may themselves use it against us. Therefore we insist that they learn and practice the lessons of the Analytics.

The apodeictic syllogism appears in none of Aristotle's works because it is we who are to use it in critically assessing the "causes" recounted to us by Aristotle in his treatises, as he has used it in coming to understand the subjects of his various studies. It is we who are to use it as a tool within a process which is designed so that we too may come, in time and with experience, to attain that intuitive grasp of the essences - which insight constitutes the ἕξις (called ἐπιστήμη) which will enable us to θεωρεῖν at will.

FOOTNOTES

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INTRODUCTORY SYNOPSIS

1. 1. Allan (1), p. 126.

CHAPTER I - THE PROBLEM

3. 1. Barnes, p. 123.

3. 2. Barnes, p. 137 (and notes).

3. 3. Barnes, pp. 125-137 (and notes), and 138f.

4. 4. Barnes, pp. 125-126.

4. 5. Barnes, pp. 126-127.

4. 6. Barnes, pp. 127-137.

4. 7. Barnes, p. 138.

4. 8. Barnes, p. 137f.

4. 9. Barnes, p. 138.

5. 10. The term 'scientist' and 'philosopher' can generally be used interchangeably in the Aristotelian context. See A. Mansion (1).

5. 11. See below, Chapter 5, esp. p. 99f and note 102 on p. 101.

5. 12. See below, Chapter 4.

CHAPTER II - THE QUESTION

6. 1. Allan (1), p. 126.

6. 2. As to the grounds for such an assumption on Aristotle's part we need look no farther than the Academy. The broad outlines, at least, of such a common view of the nature of ἐπιστήμη are available in the Republic itself. (cf. H. D. P. Lee, p. 124 ". . . there is a close general similarity between Aristotle's view of

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the logical procedure of science and Plato's dialectic.") Cf. also e.g. von Fritz, p. 39.

On the question of the chronological sequence of Aristotle's own writings and the place of the Posterior Analytics, it will be sufficient for the purposes of this study, to adopt the view expressed by Msgr. Mansion (1), pp. 5-6: "Il en résulte que les traités, - tels que nous les possédons -, rendent en gros la pensée d'Aristote, au terme de son évolution . . ."

This seems a somewhat more balanced view than that expressed by Düring (1), p. 7, in that it does not discount the possible role of evolution in our understanding of Aristotle's thought, but does place it within a context.

7. 3. Barnes, p. 123.

7. 4. Barnes, p. 124.

7. 5. Barnes, p. 124, note 4; Post.An.$71^{b}19$f. All references are to the Ross edition.

7. 6. Barnes also omits any reference to the term πρώτων (line 21), but this is perhaps understandable in that Barnes is listing the characteristics appropriate to the differentiation of any apodeixis from other varieties of syllogism, and not merely those relating to the initial or ultimate apodeixeis.

8. 7. Translation that of The Works of Aristotle, translated under the editorship of W. D. Ross. Unless otherwise indicated all translations of Aristotle's works quoted in this study will be taken from this Oxford translation.

8. 8. cf. Ross (1), pp. 509-510.

8. 9. Ross (1), p. 53. Cf. Wieland (1), pp. 129-130.

9. 10. For Ross' comments on προγινώσκομενα ($71^{b}31$cf $72^{a}28$) see (1), pp. 54-55.

9. 11. Even though he must begin all his searching, of course, with "things known to us." cf. e.g. E.N.$1095^{b}3$-4; Meta.$1029^{b}3$. The student who has not yet attained the stage where he is more convinced in his own right of the premisses must reconcile himself to accepting the cogency of his teacher's assertions. cf. $71^{a}7$, $76^{b}27$; S.E.$165^{b}3$, and further, E.N.$1143^{b}11$f. cf. Topics 141^{b} 25f, esp. $142^{a}10$.

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9. 12. We shall deal with Aristotle's meaning in lines $72^{b}1$-3 below in Chapter 5. (See pp. 104-106).

10. 13. Aristotle is quite explicit on this ($71^{b}31$-33).

10. 14. Wieland (3), pp. 69-85. Cf. Meta.$1029^{b}3$-12; Topics $141^{b}15$f. See also McKeon's comment (p. 27): "When it is a question, therefore, of demonstration or scientific proof, as it is in the Posterior Analytics, the distinction is between proof and principles, and the cogency and validity of the proof is shown to depend on first principles which are prior and better known than the conclusions or the demonstrations ($72^{b}25$-30; $100^{b}8$-10), and the superior demonstration is shown to be that which proceeds from better known and prior premisses ($86^{b}27$-30; $87^{a}25$-30)."

McKeon's statement could, I think, be stronger. The cogency and validity of the apodeictic syllogism (as distinct from the syllogism generally) is shown to depend upon our better and prior knowledge of the principles which are themselves, of course, prior and better known in nature than are the conclusions or the demonstrations.

12. 15. Ross (1), p. 528.

12. 16. cf. S.E.$170^{a}12$f.

14. 17. Ross (1), p. 511 emends the text to give a meaning different to Mure's in the translation quoted. Yet Ross' interpretation offers similar support. Aristotle insists that there is an order to the "belonging" which must be taken into account in tracing the order of our knowing.

15. 18. The translation quoted is that of the Oxford translation except for the words "connect up its arguments" for which the Oxford translation gives "string together its phrases" in rendering συνείρουσι μὲν τοὺς λόγους (line 21). The translation here offered seems more appropriate in the light of Aristotle's use of the term (συνειρομένην) at Meta.$986^{a}7$ where the sense is clearly more of close, even rigorous, connexion, rather than of casual succession as is implied by "string together." I would suggest that the activity Aristotle has in mind here is something resembling that of producing a "finite set of connected ἀποδείξεις to which Barnes refers (p. 123).

15. 19. It should be noted that this passage occurs within a dialectical context, and that Aristotle's own treatment of ἀκρασία ($1147^{a}24$f) has a more strictly psychological character, and does not in fact turn upon epistemological considerations such as those cited here. The

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epistemology, however, is genuinely Aristotelian, as we shall see. The fact that the problem of ἀκρασία is not to be resolved in epistemological but psychological terms does not vitiate the epistemological principles themselves (see below). Burnet notes (his editorial comment on 1146^{b}31f, p. 299) that the epistemological considerations are derived from the theory of potential knowledge first worked out by Plato in the Theaetetus. Aristotle is showing the Academy how ἀκρασία may be explained in terms of ἐπιστήμη even though he does not so explain it himself. It is ἀκρασία, however, that Aristotle feels is not adequately explained in terms of these epistemological doctrines; he does not reject the epistemological doctrines in their own right.

15. 20. Burnet, p. 300.

17. 21. On the operation of impediments to the actualization of potentials, see Physics 255^{a}30-33 and Ross (6), p. 695.

On the question of "how ignorance is dissolved and the incontinent man regains his knowledge," Aristotle tells us that "it is the same as in the case of the man drunk or asleep," and is not peculiar to ἀκρασία (1147^{b}6f). Burnet feels (p. 304, note 12) that Aristotle is here referring us to a discussion such as that in the De Somno concerning how the sleeping man wakes up. But Aristotle is not referring to the physiological processes of 'waking up'; rather he is referring us to discussions of the physiological processes of how a sleeping (or drunk, or ἀκρατής) man πάλιν γίνεται ἐπιστήμων, and the locus of his reference would therefore seem more likely to be a passage such as De An. II,5(417^{a}10f and ^{a}21f) or Physics 247^{b}1f where this question is properly put in its 'general context' (οὐκ ἴδιος τούτου τοῦ πάθους 1147^{b}8); that 'general context' being the movement from potential to actual - the related problems such as sleep, drunkenness, madness, and the impediment to be surmounted when a science has first been learned (247^{b}16-17) are noted as special cases.

At first glance it might seem strange to rank lack of χρόνου with impediments like sleep, drunkenness, madness, etc. Aristotle's use of 'sleep' as an example of an impediment standing between a potential state and its final actualization might seem to suggest that it is his view that the simple act of waking up immediately and per se transforms the potential into the actual. But as the Physics makes clear (255^{a}30f) Aristotle has no such simple view of the processes

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involved. The simple act of waking up merely resolves the impediment - it does not impart the κίνησις which brings the full potentiality into being nor transform the potentiality into actuality. Thus the ἐνέργεια of the upward movement of fire is not caused by the removal of an impediment to movement. And 'the sleeping geometer' may become an actual ἐπιστήμων when he wakes up (he certainly will not unless he wakes up!), but he may also move to the other state, that of ἕξις (Physics $255^{b}5$). So too οἱ πρῶτον μαθόντες may, with the passage of time so secure potentia secunda that they will be able to θεωρεῖν at will (unless they have time they will not achieve this), but this will only happen, as we shall see, if experience occurs and is operative, and there is something actual, a teacher, to actualize the potentiality of the student.

17. 22. Moraux, p. 80.

18. 23. There are several codices, apparently, which offer (with Burnet) συμφῦναι, but συμφυῆναι is the reading of cod. Laurentianus LXXX.11 (of which Bywater comments (preface): "optimum esse codicem . . ") (cf. Bywater, p. 135). Neither Bywater nor Burnet offer any support from the m.s. tradition for Thurot's conjecture of μανθάνοντες for μαθόντες .

18. 24. The οὔπω is ambiguous - it may either mean "not yet" or "not" as a reinforced negative. Aristotle's practice seems to give no help. See Bonitz Ind.Aristotelicus $541^{a}12$-13 for a selection offering both uses. "Not yet" is perfectly acceptable in either (a) or (b), whereas "not" could only easily be accepted in (b).

19. 25. Burnet, p. 301.

19. 26. Physics $255^{a}30$-$255^{b}5$ quoted above (p. 16) in translation. This is perhaps to labour a point in an attempt to emphasize a key aspect of Aristotle's methodology. The movement from possession of the arguments relating to the facts of a science to being a scientist requires some attention.

20. 27. See above, note 18.

21. 28. We will note in Chapter 3 below, q.v., the role of θεωρεῖν as ultimate actualization. Further we will note that Aristotle is most careful, when referring to those who have attained potentia secunda, to specify that no impediments remain, and that all that is now required is a simple exercise of the will to occasion θεωρεῖν . We may note, in this regard, the caution

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exhibited in the phrase ὡς ὁ ἐπιστήμων λέγεται ὁ κατ' ἐνέργειαν (De An.429^{b}6-7), and the insertion of the criterion itself in this passage.

21. 29. See Bonitz, Ind. Arist., p. 719^{b}20f.

22. 30. De An.429^{b}5f and, generally, De An.III, 4-8.

22. 31. When Aristotle speaks, as he often does, of αἱ ἐπιστῆμαι he is referring to capacities of ἐπιστήμονες, not to bodies of knowledge separable from knowers.

23. 32. That is, the special ἀρχαί of the individual sciences.

23. 33. "Critical" in terms of this study, since it raises again the adequacy of Barnes' treatment (corroborated by Ross) of the defining conditions for the Aristotelian apodeictic syllogism.

23. 34. On the bracketing of this line by Bywater, see note 39 below.

23. 35. cf. E.N.1095^{a}2f.

24. 36. But see Post.An.81^{b}2f.

25. 37. This comment is strongly reminiscent, to say the least, of Aristotle's comments in the initial chapters of the Posterior Analytics I concerning the requirement that the demonstration must be performed by one who has a better and prior knowledge of the ἀρχαί, and that "the man who sets out to acquire the scientific knowledge that comes through demonstration must . . . have a better knowledge of the basic truths and a firmer conviction of them than of the connexion which is being demonstrated" (72^{a}37f). Clearly οἱ νέοι and οἱ πρῶτον μαθόντες are not in such a position though time, experience, and νοῦς will provide the conditions for their attaining this position.

25. 38. But cf. Problemata 955^{b}22 Διὰ τί πρεσβύτεροι μὲν γινόμενοι μᾶλλον νοῦν ἔχομεν . . .

25. 39. Burnet brackets this line in his text (as does Bywater, and Ross in his translation) saying (p. 281): "These words break the argument here, nor do they come in very well after αὕτη δ' ἐστὶ νοῦς above, where Rassow and Bywater would place them. . . ." But Burnet does not doubt the genuineness of the text nor offer any alternative to the relocation proposed by Bywater and Rassow. Indeed, while the expression is admittedly abrupt the line seems not so much to 'break the argument' as to gloss the argument. Aristotle is dealing,

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albeit tersely, with the very issue we are at present considering - viz. the apparent restriction of the operation of νοῦς to one particular age group, while his general theory seems to cast the operation of νοῦς as the prius of all apodeictic arguments. These words simply affirm the obvious; that νοῦς is the beginning and end of apodeictic activity, and that demonstrations proceed 'from these' ἀρχαί (acquired by νοῦς operating in the initial phase), and are 'about these' ἀρχαί (cf. 1094^{b}20; 1095^{a}3f) both in the sense that the ἀρχαί stipulate the subject matter (as definitions) of the demonstrative sciences; and also in the sense, as the context here shows, that experience in the demonstrations themselves enables νοῦς to acquire a fuller comprehension of the ἀρχαί (cf. De An.402^{a}16f; Post.An.89^{a}14 -)

26. 40. cf. E.N.1141^{a}17f (ὥσπερ - κεφαλὴν ἔχουσα, ^{a}19) is again cast in a finalizing and completing role - after the occurrence of some formal ἀποδείξεις

26. 41. See Chapter 3 below; cf., e.g., E.N.1146^{b}31f; Physics 255^{b}2; Meta.1048^{a}34.

26. 42. Lee, p. 122.

26. 43. Lee, p. 120. von Fritz, p. 39 elaborates the issue.

27. 44. When we have finally attained true knowledge and turn to its integration (return into the "cave" either in action or in comprehension) we already possess the ἀρχή (or ἀρχαί, in Aristotle's terms) in the fullest possible sense. νόησις may now be said to be to come prior to διάνοια (or νοῦς to ἀπόδειξις) in the order of time as well (cf. E.N.1095^{a}32f). Also see Republic VI, 510^{b}, 511^{b}; Phaedo 101^{d}; Meno 86^{e} on the deductive processes through which Socrates is constrained to move prior to the final insight.

27. 45. It is in view of this that Aristotle uses the term ἀρχαί where Plato uses the term ὑποθέσις (in Plato's case to designate premisses which are adopted as unproven but proveable by deduction from the ultimate single ἀρχή).

We might well ask at this point how they are to be recognised as ἀρχαί if it requires some subsequent act of νοῦς, occurring after the ἀποδείξεις have been elaborated, to fully comprehend their nature. This issue will form a main theme of the remaining chapters of this study.

We might anticipate that discussion here, however, in the interests of orientation. It will be suggested

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(in Chapter 5) that dialectic proceeds, on the basis of a careful "historical" catalogue of all the pertinent facts available relating to subject genus, to limit the range of the ἀρχαί to those which may be intuited by νοῦς as the definition of the subject genus. At this point this is viewed not so much as a definition but as an act of immediate predication. The finite set of connected ἀποδείξεις are then elaborated and the "science" expands by drawing on the already prepared 'historia' of the subject. Once this is completed νοῦς is then able to make its final intuitive induction of the initial ἀρχαί, this time perceived and understood and defended in their definitional character. At this point the science is finally completed both in form and in content. Potentia secunda has been secured. "Discovery," however, is still possible even after this final stage of complete and comprehensive knowledge of the ἀρχαί since we may well be presented with ἀπορίαι within the area of the science which will require resolution, and discovery is precisely the resolution of ἀπορίαι (E.N.1146^{b}7-8). Scientific knowledge is the ability, ἕξις, to demonstrate; it is not the possession of the demonstrations themselves per se. θεωρεῖν, the actualization of scientific knowledge, would seem possibly to be best described as continuing "discovery" (or rediscovery) of individual ἀπορίαι within any area of science.

28. 46. See Chapter 5 below Cf. von Fritz, (e.g. p.54)

28. 47. The allusion here is to the somewhat perplexing passage at Physics 184^{a}21f which would seem to reflect this kind of methodological intention on Aristotle's part. cf. Wieland (1), p. 131.

28. 48. cf. Post.An.71^{b}28-29.

29. 49. See Chapter 5, note 120. The further question of the cyclical reasoning which seems implicit in any methodology such as that here suggested will be examined in Chapter 5 as will be the question of whether the final activity of νοῦς constitutes proof in any sense of that word.

30. 50. Cherniss, p. 66f.

30. 51. cf. Post. An.1,3, especially 72^{b}18f. cf. also E.N.1151 ^{a}15-19.

To say that knowledge of the immediate ἀρχαί is ἀναπόδεικτον (72^{b}20) is not quite to say that it is "independent of demonstration" (G. R. G. Mure's Oxford translation), but rather that it is non-demonstrative.

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We may, at this stage in the discussion, at least entertain the possibility that Aristotle perceives the proper relationship between the ἄμεσα and the ἀποδείξεις as parallel to the relationship that obtains between the first principles of morality and the virtues. Just as the virtues "save the first principles" (E.N.1151 ^{a}15-19) so too the arguments "save the first principles" of the sciences. If, further, we see this against the backdrop of the Aristotelian doctrine concerning the acquisition of the virtues (the difference between the moral and intellectual virtues in this regard will be examined in Chapter 3) then we begin to perceive a further relationship between ἀποδείξεις and the ἄμεσα paralleling the dictum that 'one becomes good by doing good actions.' But it remains unalterably true that "neither in that case is it the argument that teaches the first principles." (οὔτε δὴ ἐκεῖ ὁ λόγος διδασκαλικὸς τῶν ἀρχῶν. E.N. 1151 ^{a}17-18)

For a recurrence of the term σωτηρία in this context see De An.417^{b}3f.

30. 52. Ross (1), p. 49.

31. 53. It would seem significant that, in the Nicomachean Ethics when Aristotle is defining ἐπιστήμη and refers us to the Posterior Analytics for the defining conditions, he singles out for special mention that very condition which Barnes ignores and Ross would treat in a non-natural way (E.N.1139^{b}31-35).

31. 54. cf. Kapp, pp. 79-80. It would seem possible that Kapp might be in danger of tending too much in the other direction (though in very much the right direction) if he excludes from Aristotle's intention any function for syllogistic reasoning from principles to conclusions. It seems not to be a case of one role operating to the exclusion of the other, but rather of a real reciprocity between the two roles.

31. 55. cf. also S.E.165^{b}30. See Plato Euthydemos 277^{a}, where we note the use of ἀποστοματίζῃ corresponding to ἀποστοματιζόμενα in S.E.165^{b}32.

31. 56. Allan (1), p. 147.

31 57. This convinced recognition is, as has been argued, contingent upon the operation of induction and is, in essence, a kind of verification. This is a process, however, which is conceived of by Aristotle as an operation of the soul - as a psychological process rather than as a logical process of proof (cf. Kapp, pp. 78-82). It would not be extreme, then, to say

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that Aristotle requires his science to be self-verifying - to contain its own verification - before it may be genuinely admitted as a science.

32. 58. See, inter alia Post.An. 72^{b} 1f.

32. 59. Ross (1), p. 530 seems clearly to offer the correct interpretation of this passage.

CHAPTER III - THE AIM OF SCIENCE

33. 1. Barnes, p. 123.

34. 2. Chapter 2 above, p. 16f; on this occasion he uses ἐπιστήμη to exemplify the nature of the operation in sense perception.

34. 3. See Chapter 2 above, p. 16; cf. also p. 17, note 21.

34. 4. See Chapter 2 above, p. 21f.

35. 5. Allan (1), p. 147.

35. 6. We must, of course, ask whether the object of the θεωρεῖν is in fact a 'replica of the real.' We find (see this chapter, below) that Aristotle's answer, while somewhat ambiguous on this point, would seem to suggest that the object of the θεωρεῖν is not a 'replica of the real' but rather the "individual," the "particular" real thing, seen as an ἀπορία to be resolved.

36. 7. cf. this chapter, below, pp. 43-46.

36. 8. Joachim (p. xiv) seems fully aware of the area of distinction being drawn here, but seems to see no inconsistency in continuing to look upon "truth" as something which can be produced, a 'replica of the real.'

37. 9. But cf. E.E. 1216^{b} 11-15.

37. 10. This much of the text seems reliable but any attempt at reconstruction of the last part of the sentence (see Ross (4), pp. 262-263) would be conjecture.

37. 11. See Chapter 2, p. 23f. We shall see in Chapters 4 and 5 below, how it is that Aristotle conceives of the bodies of judgements as means to an end rather than the end itself.

37. 12. Joachim, p. xiv.

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38. 13. As does Ross in his Oxford translation, though he appears later to have had second thoughts. Ross (4), p. 251. (But, again, see his note on $1087^{a}13$, Ross (4), p. 466.) cf. also Wieland (1), p. 132.

38. 14. Ross (4), p. 466.

38. 15. cf. Meta.$999^{a}24$ for a similar acknowledgement of intense difficulty in this and immediately related matters.

39. 16. cf. Allan (1), p. 160 where the implications are drawn from this; but cf. De An.$417^{a}29$.

39. 17. We have, for example, instances of Aristotle's use of the term τὸ καθ' ἕκαστον to refer, manifestly, to universals of diminished generality. cf. e.g. De Part. An.$642^{b}5$ (cf., possibly, Post.An.$71^{a}9$; $71^{a}17$f; $79^{a}5$f.)

40. 18. We might be tempted to conclude that Aristotle sees in this psychological fact the peculiar virtue of the knowledge of universals - namely, that it renders us more capable of finally knowing the particulars, the substances, the real things. (cf. Meta.$1087^{a}15$f). Yet this temptation must be resisted and J. Owens (1) is a great help in strengthening our resolve. Aristotle's denial of this possibility is categorical at Meta. $1036^{a}6$-8 and again at Meta.$1040^{a}1$-7 (as elsewhere).

As we shall see in Chapter 5, Aristotle makes it a clear part of his method to isolate those parts of the formula of a thing which belong qua matter and which qua form so that the knowledge of the individual through its form is quite possible. cf. Prior An.$67^{b}1$-5. As Owens puts it; ((2), p. 163) "The universal, upon which scientific knowledge is based, is therefore for Aristotle something that is identical with each of the singulars in turn" (Meta. 26, $1023^{b}30$-32).

40. 19. Hamlyn, p. 103 - the locus of his discussion is his note on De An.$417^{b}16$.

41. 20. LeBlond makes a parallel observation (p. 273f) and attempts to distinguish (what he accuses Aristotle of failing to distinguish) between concept and definition. (See also his shock at the inadequate basis of Aristotle's apodeictic science on p. 274.) It is a very real question, I think, whether we should attempt to distinguish knowing and thinking, or definition and concept, in Aristotle's thought. The unity of his method depends, in large measure, upon seeing the synthesis of these, not in trying to separate them.

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41.	21.	See Ross (6), p. 676; cf. Categories 9^a3f; Problemata 956^b40.
42.	22.	By this stage the only requisite condition is that of desire, De An.417^b27; cf. Meta.1048^a16.
42.	23.	e.g. Post.An.74^b5f; E.N.1139^b20f.
43.	24.	Post An.93^a5.
43.	25.	As will be shown, the position here being advanced does not entirely contradict such emphatic assertions as e.g. Allan's ((1), p. 147): "It must be emphasized again that this is not a principle of scientific research, but an ideal (perhaps a visionary one) of the presentation of scientific truth, obtained by other means, in such fashion as to make its full necessity appear." Certainly the role of ἀπόδειξις is the presentation of scientific truth, but, it is argued here, that "presentation" takes place principally within the context of a search for the truth (though it acts, too, as the model for the resolution of ἀπορίαι encountered after the "truth" has been secured, and as the model for the man who has attained philosophic wisdom, E.N.VI,7).
43.	26.	e.g. De Anima 429^b7; 417^a27; E.N.10,7; Meta.1048^a16.
43.	27.	For a revealing exposition of this important distinction on Aristotle's part see On Memory and Recollection 450^b20-451^a2.
44.	28.	Categories 6^b2; 8^b25; 11^a20; Physics 246^b3f; 247^b1f; E.N.1139^b31; Post An.$99^b18,25,32$. Generically, says Aristotle, knowledge is a relation, while specifically, sciences are qualities. cf. Meta.Δ, ch.15.
44.	29.	Bonitz, Ind. Arist. 261^a13-14.
44.	30.	e.g. E.N.6,2.
44.	31.	ἐπαγωγή is the source and sustenance of intellectual virtue (E.N.1103^a15-16) because, it will be suggested, it is a training in the way to use those statements appropriate to each science so that the "soul may tell the truth by way of affirmation or denial" (E.N.1139^b15).
45.	32.	Categories 6^b2; 8^b25; 11^a20; Physics 246^b3f; 247^b1f.
45.	33.	cf. e.g. Categories 8^b25f.

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45.	34.	e.g. Post An.72^{a}25f; 72^{b}1-4.
46.	35.	Post An.72^{b}18f.
46.	36.	e.g. E.E.1217^{a}1f.
46.	37.	E.N.1139^{b}31-32.
46.	38.	e.g. E.N.1143^{b}6f; 1142^{a}15f; E.E.1217^{a}1f.
46.	39.	E.N.II,1,1103^{a}14f.
46.	40.	Note again the reference to time and experience. See Chapter 2 above.
47.	41.	E.N.II,5 and 6, especially 1106^{a}15f.
47.	42.	E.N.1106^{a}16f; 1106^{a}22-24; cf. Categories 8^{b}25-35; 6^{b}5f; 6^{b}32-36; 11^{a}20.
47.	43.	E.N.1,12, especially 1101^{b}12-21; cf. 1,13,1103^{a}8-10.
47.	44.	Burnet calls attention to this point of similarity between the moral and intellectual virtues in his commentary on E.N.1103^{a}32, see his edn. p. 77; cf. Meta.IX,5.
47.	45.	The text reads: οὐδὲ γὰρ τὸν αὐτὸν ἔχομεν τρόπον ἐπί τε τῶν ἐπιστημῶν καὶ δυνάμεων καὶ ἐπὶ τῶν ἕξεων. Aristotle is not, of course, denying his long standing principle that an ἐπιστήμη is a ἕξις. Rather he is pointing out that in one important respect an ἐπιστήμη behaves in a different manner from the other 'states of character.' His meaning is made clear in the context.
47.	46.	cf. E.N.1129^{a}3f. Note Aristotle's comments at Meta. 994^{b}32f.
48.	47.	cf. e.g. De An.417^{a}26f; 429^{b}5.
48.	48.	cf. E.N.1139^{b}15.

CHAPTER IV - παιδεία

50	1.	On this theme see Fortin. His study lays the groundwork for seeing a technical use for the term παιδεία in Aristotle, but does not make precise the lines that tie it to the Analytics nor to its role within the growth of science. cf. also Schramm, M., ch. 4, Die Bedeutung Der Teleologie, especially pp. 150-153.
50	2.	Burnet, p. xxxii.

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50.	3.	On Jaeger's bracketing of these lines in the Oxford text see Ross (3), pp. 262-263. See also Meta.995^{a}12f where the same theme appears.
50.	4.	Burnet, p. xxxiv.
51.	5.	As, for instance, at Meta.994^{b}32f; E.N.1094^{b}23f.
51.	6.	The burden of the passage at 994^{b}32f seems to be to the effect that we should suspend our methodological expectations and yet the concluding lines suggest rather that we should equip ourselves with the right expectations. διὸ δεῖ παιδεύεσθαι πῶς ἕκαστα ἀποδεικτέον, ὡς ἄτοπον ἅμα ζητεῖν ἐπιστήμην καὶ τρόπον ἐπιστήμης· ἔστι δ' οὐδὲ θάτερον ῥᾴδιον λαβεῖν. (995^{a}12-14)
52.	7.	cf. E.E.1216^{b}35f examined below.
52.	8.	Burnet, p. xxxii.
52.	9.	Meta.1005^{b}3; Meta.994^{b}32; E.N.1094^{b}22.
52.	10.	It is in this sense that the Posterior Analytics is about "πάντα διδασκαλία καὶ πᾶσα μάθησις διανοητική" (Post.An.71^{a}1).
53.	11.	Except, presumably, where we are dealing with an hypothesis (Post.An.76^{b}27-31). But even here the student's judgement determines the status of the procedure - cf. 76^{b}29-31.
53.	12.	cf. De Part.An.639^{a}14-15.
55.	13.	Perhaps the principle of "excess and defect" is no more a logical principle than the principle of the "middle term" in logic or of the "mean" in moral growth. They all constitute recurrences of a fundamental metaphysical principle which lies right at the heart of Aristotle's philosophical perspective. (cf. Meta.1005^{b}5-8; and Meta. Γ, 4) All three principles require great discrimination in their application.
55.	14.	Presumably he acts on the basis of the information supplied in a thorough "historia." cf. Chapter 5, below, pp.106f.
56.	15.	Allan (2), p. 307.
57.	16.	See below, Chapter 5, p. 90 and note 77.
58.	17.	cf. Prior.An.1,30.

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58. 18. Hicks, p. 190f, does not regard Aristotle's use of the term here as strict and, accordingly, interprets this passage differently. The considerations which compel Hicks to take this path are themselves critically examined, and their sting removed, in Chapter 5 below.

59. 19. Barnes (p. 145, note 103) acknowledges that the passage at De An.402^{a}11-22 is "less clear" on his interpretation. He shows no awareness of the present passage (402^{b}16f) at all.

60. 20. Ross (5), p. 167 offers the proper interpretation as with Bonitz, Ind.Arist.811^{a}58, of κατὰ τὴν φαντασίαν as κατὰ τοῦτο δ' φαίνεται ἡμῖν With this idea cf. Topics 163^{b}9; cf. Wieland (1), p. 135.

60. 21. See also Hicks, p. 193.

61. 22. See De An.413^{a}13f where Aristotle shows how the causal definition of the parts of the soul reveals the nature of soul.

61. 23. cf. Meta.1006^{a}11f - see Chapter 5 below, especially p. 98f.

CHAPTER V - διδασκαλία

62. 1. Roland-Gosselin, p. 236.

62. 2. Aristotle interprets Socrates' definitional method as a "seeking to syllogise" Meta.1078^{b}23-27. "But it was natural that Socrates should seek the essence. For he was seeking to syllogize, and the essence is the starting point of syllogisms." See note 52 of this chapter below.

62. 3. Mansion (2), p. 79.

62. 4. Mansion (2), pp. 58-59.

63. 5. One must recognize the debate between Wieland (1,3) and his critics, notably Tugendhat. See Chapter 5 below, pp. 97-98. Wieland tries to discount passages in which apprehension of the principles is ascribed to intuition.

64. 6. Mansion (2), p. 63.

64. 7. For a comment on this sort of approach to the question, see McKeon, pp. 37-38.

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64. 8. Mansion (2), p. 63.

64. 9. cf. E.N.1139^{b}28f.

65. 10. See M. Grene, especially pp. 80-96.

65. 11. Roland-Gosselin, p. 674.

65. 12. e.g. Post An.90^{a}6-92^{a}5; 92^{b}4-38; Prior An.2,23; Post An.1,3; Meta.1025^{b}14; 1064^{a}9; De An.402^{a}10f.

65. 13. cf. e.g. Post An.72^{b}18f.

66. 14. De An.402^{a}16-17. Of course the "question of essence" is not met by the method proposed at Post An.II,13, 96^{a}20f, nor does Aristotle make any such claim for that method as providing a synthetic grasp of the essence in its necessity. It is, rather, a method "for tracing the elements predicated as constituting the defineable form" (96^{a}22-23). The role which this particular technique plays within the overall economy of Aristotelian method may be seen from the opening words of the succeeding chapter (Post An.II,14): "In order to formulate the connexions we wish to prove we have to select our analyses and our divisions." The technique proposed in Chapter 13 is a technique designed to prepare the way for the syllogistic operation by clarifying the nominal definitions of the subject area involved, and as such it corresponds to the advice given in Prior An.1,30. It is worth noting for instance that Aristotle makes the same claim for the value of division as preventing any omission at Post An.96^{b}35 as he made at Prior An.46^{a}24-25.

66. 15. Aristotle there notes that the process of reasoning used, e.g. by the carpenter or anyone involved in the constructive sciences or arts, can not be used, "to track back the series of necessary antecedents to a starting point, of which you can say that, existing itself from eternity, it has determined their existence as its consequent" (Oxford translation).

66. 16. See Chapter 2, above. cf. E.N.1143^{b}13-14; also De Gen. et Corr.316^{a}5, and Post An.81^{b}5. See M. B. Evans, pp. 484-485.

66. 17. e.g. Meta.1029^{a}33-^{b}12.

66. 18. Allan (1), p. 112. But cf. Wieland (2), p. 152.

67. 19. cf. Vlastos, pp. 291-296. For a similar view to Allan's, see Vlastos, pp. 322-323.

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68.	20.	e.g. Phaedo $100^{c}9$f. cf. Vlastos, p. 291f, especially p. 296.
68.	21.	cf. Phaedo $100^{c}9$ and 97^{c}f. cf. Wieland (2), p. 152f.
68.	22.	Valstos, p. 297, note 15; p. 302 and note 35. Further we must, of course, heed Vlastos' warning not to confuse the Greek aitia with what we might call cause. We are not dealing here with science or with causes as they might be recognised today.
69.	23.	cf. Meta.$987^{b}1$-4; Meta.$1078^{b}17$-19,23. This is not to say that proper scientific method is inapplicable to such studies. Aristotle claims that his developed method is applicable to all sciences. cf. De Part.An. $639^{a}1$f. Also see Post An.1,1,71^{a}f, Prior An.1,30, $46^{a}3$-4; $46^{a}10$-18. At Eudemian Ethics $1216^{b}35$ Aristotle again confirms this principle with reference to ethical studies.
69.	24.	There is also a further subdivision; see Physics 194^{a} 36-$194^{b}7$. However this latter subdivision itself disappears once Ethics is treated, methodologically, as a practical science.
69.	25.	Indeed, given the Socratic epistemological and ethical doctrines as depicted in the early dialogues it would seem not only "reasonable" but inescapable that he should construct his method in this way.
70.	26.	McKeon, passim.
70.	27.	cf. E.E.$1216^{b}11$-15.
70.	28.	De Gen.et Corr.$335^{b}7$-17.
70.	29.	Plato himself points to the fact that the practical and productive sciences originate in man's power. Politicus 258^{D-E}.
72.	30.	Düring (2), p. 215.
72.	31.	Düring, idem.
73.	32.	cf. Meta.$1025^{b}31$; $1064^{a}23$; Physics $194^{a}6$; De An.$403^{b}1$; in fact we might cite all those many passages where Aristotle invokes the "snub nose" image as the paradigm of method for the natural scientist, e.g. De An.$429^{b}14$, 19; $431^{b}13$; Physics $186^{b}22$, $194^{a}13$; Meta.$1030^{b}17$,29, 31; $1035^{a}5$-6; S.E.$173^{b}10$.
73.	33.	Aristotle insists that there is nothing to prevent something being both for a purpose and by necessity.

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De Gen.An.788^{b}9-20; 789^{b}2-5; On Respiration 471^{b}30-472^{a}25; cf. De Part.An.642^{a}31-32. In fact showing how that which is for a cause comes-to-be by necessity is the core of his method in natural science, and with suitable modifications, in other areas of study.

73. 34. Düring (2), p. 215f. Schramm, p. 167f; but cf. Kullmann, p. 140, note 1.

73. 35. Düring (2), p. 216.

74. 36. See J. Owens (3), pp. 213-214, where there appears to be something of a misconstruction of Aristotle's intentions on this issue. Aristotle does not model his scientific method on the processes operative in the constructive sciences, but rather as the texts here examined make clear, he develops his method in the theoretical sciences out of a contrast with the procedure of the constructive sciences on certain crucial issues, notably the role of final cause. cf. Wieland (2), p. 154.

74. 37. This is not to say that ethics, as a constructive science, is simply a deliberative process. Clearly it contains within it, as a means, a theoretical study (conducted as a theoretical method - cf. E.E.1216^{b}32f, especially 35f) of the things that are always or for the most part. Aristotle permits the integration of theoretical studies into the constructive at E.E. 1216^{b}15ff. Ethics combines what Aristotle separates at e.g. Physics 194^{b}1f.

75. 38. For texts bearing on the identity of form and finality see Bonitz, Ind.Arist., p. 753^{b}28-32. On the synthesis of these two in the producer see Owens (3), pp. 206-207.

75. 39. Schramm, p. 171, however, casts this translation in some doubt.

75. 40. Düring (2), p. 218.

75. 41. McKeon, p. 43.

75. 42. cf. Meta.1045^{a}20f.

76. 43. Note Aristotle's problem with τὸ τίνων ὄντων ἀνάγκη τοῦτ' εἶναι at Post An.94^{a}21-22f. See Ross' (1) comments (pp. 639-640). The distinction between 'atemporal' and 'eternal' in Aristotle's thought is beyond the scope of our concerns here. See note 39 above.

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78. 44. We can compare Aristotle's contrast between the 'best' and the alternative modes possible with Socrates' similar contrast at Phaedo 99^{c}f. See Sayre, p. 4, note 3, where he reviews the issues.

78. 45. cf. Physics $198^{a}21$f; $198^{a}31$f; De An.$403^{a}24$-$^{b}29$. That it is the principle, rather than the explicitly formulated final cause, to which the natural scientist must hold, see Post An.2,6 and this chapter below, p. 93f.

78. 46. cf. Post An.$79^{a}24$-25; $79^{a}18$-21. cf. also $88^{a}5$; $79^{a}30$; $78^{a}5$f; $84^{b}25$-26. Barnes' attempt to take the "sting" out of these passages (p. 143f) is somewhat hard to accept. Barnes explains these passages on the grounds that Aristotle is using a brachylogy. Yet Aristotle goes on to explain that the universal and affirmative features of the first figure fit it to disclose the essence of a thing. This can hardly be regarded as a brachylogy, especially in view of $79^{a}30$-31.

79. 47. See Hope, p. 27.

79. 48. e.g. De An.$429^{a}14,19$; $431^{b}13$; Physics $186^{b}22$; Meta. $1025^{b}31$; $1030^{b}17,29,31$; $1035^{a}5$-6,26; $1064^{a}23,25$; S.E. $173^{b}10$.

80. 49. cf. Post An.$72^{a}27$-30. It must be remembered that the De Partibus Animalium is concerned with the causes of the parts of animals. cf. $639^{b}10$; $640^{a}15$; $646^{a}7$f; De Gen.An.$782^{a}21$f. See Peck's introduction to the Loeb edn., p. 8.

80. 50. e.g. E.E.$1216^{b}3$f.

80. 51. e.g. De Gen.et Corr.$315^{a}35$f.

80. 52. Scientific knowledge is, for Aristotle, the ability to solve problems, to resolve ἀπορίαι - it is not so much the solution to those problems. Scientific knowledge, the capacity to demonstrate, is coterminus with the full comprehension of the subject essence as the grounds for that possibility. Socrates' search for definitions was truly a search for the ability to syllogise, not for the sake of syllogising but for the possibility that this creates for the knowledge of essence. "For there was as yet none of the dialectical power which enables people even without the knowledge of essence to speculate about contraries and inquire whether the same science deals with contraries" (Meta.$1078^{b}23$-27).

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80. 53. See above, pp. 79-80.

81. 54. The structure must, as far as possible, be reduced to the 1st figure to facilitate this process. (See note 46 of this chapter above.) It must be remembered that Aristotle nowhere presents his method as a universally applicable technique or device guaranteeing easy resolution. Rather it is a universally applicable πρᾶξις.

81. 55. For a selection of texts, cf. Bonitz, Ind.Arist., p. $753^{b}28$-32. cf. Wieland (2), p. 151f, especially p. 152.

82. 56. See above, pp. 70-71, 77f.

83. 57. Ross (1), pp. 611-612 does not make the point that at Meta.$1041^{a}15$ Aristotle insists that for a substance to be it must be something and in comprehending what it is we comprehend that it is. We may note Aristotle's insistence at Meta.$1006^{a}18$-21 that something significant be said.

83. 58. For some illuminating reflections on the possible linguistic basis for this, see J. Lyons. On the strictly copulative nature of εἶναι in Aristotle, cf. De Interpretatione $16^{b}19$-25, especially 22-25. We see this expressed, in the teachings of Meta.$1041^{a}15$f, and the first two chapters of Post An.2, as reasoned doctrine.

83. 59. cf. Post An.$93^{a}20$-29. As long as we are aware simply of the existence of something accidentally (having inferred its existence by association), we are still in a "wholly negative state as regards awareness of its essential nature" ($93^{a}25$-26). We must undertake to change this to the positive state by establishing the causes of the properties, for as soon as we apprehend an element in the thing's (e.g. man's or thunder's) essential nature we reduce our difficulties ($93^{a}27$-28). We demonstrate the eclipse of the moon through the eclipse's defining cause and in so doing we realise that the moon is such as can be so eclipsed ($90^{a}12$-14). Once the cause is secured we are enabled (Post An.2,9) to go about the comprehension of the moon's own nature in "some other" way ($93^{b}21$f). The "some other way" is the task of the scientist to work out once he has constructed the ὅρους of the special science. See Chapter 4 above, p. 54f. We must determine how the subject matter may best be handled. cf. De Caelo $293^{b}21$f; $297^{b}28$f.

Page	Note	
83.	60.	Aristotle does not minimize the difficulty of this task. cf. Post An.$93^{b}32$f.
83.	61.	De Gen.et Corr.$335^{b}16$; generally see $335^{a}24$-$336^{a}14$.
84.	62.	Aristotle is careful to meet this judgement again at Meta.$984^{a}16$f.
84.	63.	De Gen.et Corr.$335^{b}30$-$336^{a}14$; cf. Physics $255^{a}31$f.
84.	64.	Yet the mechanist forces of nature are not always entirely contained by the operation of form. See Aristotle's treatment of the περίττωμα in the De Partibus Animalium and at De Gen.An.$788^{a}8$.
85.	65.	De Part.An.$640^{a}10$f.
85.	66.	See this chapter above, p. 75f.
86.	67.	For a similar separation of processes, see Physics $194^{b}1$f where, again, the one deals with the form and the other with matter though not, of course, the matter per se ($194^{b}8$-9f).
86.	68.	See Barnes' comments (p. 145) and an alternative view expressed by M. Evans, p. 481f.
86.	69.	cf. e.g. De Caelo $293^{a}23$-30; $197^{a}2$-6; Meta.$1073^{b}32$-38.
87.	70.	See R. Robinson, pp. 464-465 and passim. The nature of Greek ἀνάλυσις is much debated. In this work we are concerned with the term only in its Aristotelian sense, and particularly in τὰ ἀναλυτικά. See further below, note 120.
89.	71.	Ross (1), p. 396 interprets the line $46^{a}27$ in a different sense in his summary translation, but offers no comment on it in his notes.
89.	72.	Is Aristotle acknowledging the possibility of his own failure to check detail, a feature of his biological writings for which he has been so often censured?
89.	73.	cf. Bonitz, Index Arist.$809^{a}40$f for a selection of texts testifying to the purification of theories which occurs when the scientist, acting qua teacher, undertakes to ἀποδεδόναι
89.	74.	At Post An.$76^{b}27$f we perceive the procedure of the teacher. He advances a cause - a hypothesis which he can prove but does not. The student accepts this

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without asking the teacher for a proof, and proceeds to test it by himself, applying the rules of the Analytics for he has the πιστεις it has provided. The student must have grounds, in the exposition of the teacher for accepting it, and it must not fly in the face of observed fact to which the student must continually refer. If the student has no opinion or a contrary opinion it is an illegitimate postulate and must be abandoned ($76^{b}30$-32). We begin to perceive some of the rules operative in the pedagogic moot as Aristotle would have it conducted. See Ryle. The theories must not confute the phenomena De Caelo 303^{a} 3-24; Meta. $1039^{a}3$-14.

89. 75. Roland-Gosselin, p. 674.

90. 76. cf. Düring (2), pp. 217-218.

90. 77. If we look once again at the Eudemian Ethics ($1216^{b}3$f) where Aristotle comments on Socrates' procedure in comparison with his own we see that these considerations of the foundations of method lead Aristotle to adopt a different point of departure and a more elaborate method of procedure in his own ethical studies than does Socrates.

Aristotle recognises, in common with the generality of men (E.E.1,1; cf. $1216^{a}27$-$^{b}2$; E.N.1,4), that there is a goal to human behaviour called happiness which is something lying within man's power (E.N.$1096^{b}34$-35). Clearly he does not, at this point, know what happiness is (e.g. E.N.$1095^{a}20$f). But then the architect has no very clear picture of what constitutes shelter when he starts. What the architect realises he must do is to start with a survey of what are the properties and conditions without which shelter could not be. Once these are established he must then turn to examine how these conditions and properties may best be brought into being to serve the goal of shelter. Through this analysis he will come to a comprehension of the things within his power which are the means to the becoming of the shelter. These means, thus reached in analysis, when they are undertaken by the builder will in their concerted functioning constitute the form of an object - a house - appropriate to the final cause, shelter.

In ethics then Aristotle recognises that he is faced with a somewhat similar problem and must pattern his reasoning processes accordingly. He is faced with a vaguely defined goal to be attained, happiness (E.N.

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$1095^{a}14$-30). In the face of this problem Aristotle comments (E.N. $1095^{a}30$f; (cf. Physics $184^{a}10$-21; De An. $413^{a}11$-16)

> "Let us not fail to notice, however, that there is a difference between arguments from and those to the first principles. For Plato, too, was right in raising this question and asking, as he used to do, 'are we on the way from or to the first principles?' There is a difference, as there is in a race-course between the course from the judges to the turning point and the way back. For, while we must begin with what is known, things are objects of knowledge in two senses - some to us, some without qualification. Presumably, then, we must begin with things known to us. Hence any one who is to listen intelligently to lectures about what is noble and just and, generally, about the subjects of political science must have been brought up in good habits. For the fact is the starting point, and if this is sufficiently plain to him, he will not, at the start, need the reason as well. . . ."

Aristotle realizes that he must first move away from first principles, away from the "judges," by clearly establishing what is known to man, viz. the properties and conditions without which happiness, whatever it is, could never come to be. This process narrows, in the case of ethics, to virtue as the condition of happiness (E.N. 1,7,$1098^{a}16$-18). "Human good turns out to be activity of the soul in accordance with virtue, and if there are more than one virtue, in accordance with the best and the most complete. Let this serve as an outline of the good."

This definition of the good in terms of the prime condition without which it could not come to be is all that is required at this point in the procedure. The final synthetic definition must await the conclusion of the process as Aristotle has just warned us (E.N. $1095^{b}2$f).

Having established virtue as the prime condition for the being of happiness he must round the "turning point" by examining virtue. So too, it will be remembered, did Socrates examine virtue (E.E. $1216^{b}3$f). But Aristotle does this in a somewhat different manner. Aristotle does not, like Socrates, examine virtue as though it were an end in itself. Rather he undertakes

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to define it in terms of how it is produced and in what materials and in what manner it is exhibited (E.N.II,1 - III,5) because in this way Aristotle returns to the "judges" by manifesting the fitness of virtue to its actualizing final cause, viz. happiness, and in so doing he comes to an awareness of what happiness is. In this method we see Aristotle's intention, like that of the architect, realised in so far as he designs the medium, whereby the form and finality of human behaviour are unified and further, in adopting this procedure he reveals to the observing mind that same unity so that people are properly convinced. "And about all these matters the endeavour must be made to seek to convince by means of rational arguments, using observed facts as evidence and examples" (E.E.1216^{b}26f).

90. 78. At 995^{b}20f Aristotle asks whether Metaphysics must study substance only, or the attributes of substance too. At 997^{a}25-34, he asks the same question in an expanded form. He answers (1003^{b}32-1005^{a}18) that we must study the attributes that inhere generally.

91. 79. Roland-Gosselin, p. 674.

91. 80. See LeBlond, p. 272. (See also Meta.1034^{b}20f.) It is significant to note that Aristotle contrasts definitional unity with the unity of the Iliad (e.g. Η, 1045^{a}13) indicating possibly that his own conception of definition is not that of a brief formula, but a rather more comprehensive and extended exposition - in fact the kind of exposition which we find in his own works when each is taken as a whole (with obvious exceptions, of course).

91. 81. Düring (2), p. 218.

92. 82. cf. E.N.1098^{a}33f. "But each set of principles we must try to investigate in the natural way (ἢ πεφύκασιν), and we must take pains to state them definitely, since they have a great influence on what follows" (1098^{b}4-7).

92. 83. cf. De Gen.An.760^{b}27-33: "Such appears to be the truth about the generation of bees, judging from theory and from what are believed to be the facts about them; the facts, however, have not yet been sufficiently grasped; if ever they are, then credit must be given rather to observation than to theories, and to theories only if what they affirm agrees with the observed facts."

92. 84. During (2), p. 218.

92. 85. cf. De Gen.et Corr.316^{a}5-14.

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92.	86.	For an alternative view in this context, cf. Evans, p. 485.
95.	87.	This is the only instance I have been able to find where Aristotle offers to expand upon an issue in the Analytics. Of course there are many references to the Analytics in his other works (Bonitz, Index Arist. p. $102^{a}30$f), and its doctrines are cited, but the importance of Post An.2,6 to Aristotle's thinking is, I would suggest, seen as of some significance in his offering to expand upon it here and in Meta.8,6.
95.	88.	cf. De An.$413^{a}13$-16.
96.	89.	cf. Woodbridge, pp. 13-14.
97.	90.	It might be asked whether Plato required that definitions have demonstrative cogency. We may compare the language of the Parmenides with that of the Theaetetus and cite the internal and relative nature of the γένους εἶδος versus the εἶδος simpliciter of the Republic and Sophist.
97.	91.	Wieland (1), p. 135.
98.	92.	However no attempt has been made here to examine the structure of such an intuitive faculty. This falls beyond the immediate scope of this study. See above, pp. 28-32.
99.	93.	S.E.$165^{a}38$-$^{b}11$. See Barnes, p. 137f.
100.	94.	cf. e.g. Meta.$1073^{b}36$; E.E.$1236^{a}26$; De Gen.et Corr. $325^{a}26$; De Caelo $306^{a}7$; $309^{a}26$; Post An.$89^{a}5$; De Gen. An.$760^{b}33$. Note especially De An.$402^{b}23$; E.E.$1216^{b}35$; E.N.$1179^{a}16$-22.
100.	95.	cf. Protr. frag. 22 (Ross); and Meta.$980^{a}21$f.
100.	96.	cf. Barnes, 145 - I find it difficult to see the difference, in this context, between "progress-reports" and "text-books." To whom would these "progress reports" be addressed?
100.	97.	See Kapp, pp. 86-87.
100.	98.	cf. F. M. Cornford, who attempts to disentangle two programmes in Plato's presentation of dialectic, "one of education and the other of research" (p. 37). Plato clearly considers the two elements as integrated and Aristotle certainly does, starting as he does with the conception of ἐπιστήμη as a ἕξις . As Conford says (p. 173): "Not that they could ever be separated: the researcher is always learning; and in

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communicating his results he is teaching; while the student who follows those results is exercising the same faculties in rediscovering them."

The integration, for Aristotle at least, is more complete than this comment would imply, for "in communicating his results" the researcher is not only teaching, but also providing himself with the conditions for testing, appraising, and more completely comprehending his own findings through the rigorous criticism raised by his students.

100. 99. cf. Meta. $993^{a}2$-10.

100. 100. De An. $417^{b}2$-7; Physics $255^{a}30$-$255^{b}2$; De Gen.An. $742^{a}26$; Meta. $1029^{a}33$-$^{b}12$.

101. 101. Physics $184^{a}10$-21; De An. $413^{a}11$-16; E.N. $1095^{b}3$; Prior An. $68^{b}35$-37; Topics $105^{a}16$-19; See also Aristotle's preference for example over enthymeme (corresponding to induction and syllogism) at Rhetoric $1356^{b}22$-24; $1368^{a}29$-33; $1394^{a}9$-16.

101. 102. Barnes seems nowhere to take this principle into account when he suggests that "a series of demonstrations is appropriate to the setting out of knowledge securely achieved" (p. 145). This is certainly true. It is this fact which admirably suits it to the analytic role in which Aristotle casts it. Barnes completely reverses the roles and completely vitiates any practical utility when he suggests that it can act as a medium for the communication of "knowledge securely achieved", and when he says (p. 138) that the apodeictic syllogism is "concerned exclusively with the teaching of facts already won."

101. 103. E.N. $1139^{b}27$-28; cf. Post An. $81^{a}40$.

101. 104. cf. E.N. $1146^{b}7$ where Aristotle characterizes discovery as follows: ἡ γὰρ λύσις τῆς ἀπορίας εὕρεσίς ἐστιν.

101. 105. Barnes, p. 138.

101. 106. S.E. $186^{b}26$.

101. 107. Kapp, p. 70.

101. 108. Kapp, p. 71.

102. 109. Topics $101^{a}27$ and 28-30.

102. 110. Plato wrote his dialogues for general consumption and retained his lectures for the initiated. So too tradi-

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tion leads us to believe we have in the extant Aristotelian corpus the lectures to the initiated while his popular writings have been lost. We have good evidence of the "tailoring" referred to here.

103. 111. See Ryle; also see Fortin.

103. 112. Barnes, p. 138.

103. 113. He had good reason to be aware if for no other reason than the restrictions that had been placed on the use of various such techniques - see Ryle, p. 42.

104. 114. See this chapter, note 77 above.

104. 115. Post An. $79^{a}4$-6; Meta. $982^{a}9$-10.

104. 116. See Chapter 2 above, p. 8f.

105. 117. Note that there is no suggestion here of the use of the apodeictic syllogism to convince someone else. It is the one performing the ἀπόδειξις who is to achieve the knowledge.

105. 118. On this passage see Solmsen, p. 54, note 3.

105. 119. See this chapter above, p. 92f.

107. 120. cf. Post An. $79^{a}18$-21, 24-25; $88^{a}5$; $79^{a}30$; $78^{a}13$; 84^{b} 25-26.

No attempt has been made in this study to raise, let alone to resolve, the controversy concerning the nature of analysis in Greek methodological theory and practice. Rather, a tactic has been borrowed from Ross (1), p. 400. That is, we have simply accepted the apparently unobjectionable description given by Ross of Aristotle's use of the term to imply "that the student has before him an argument expressed with no regard to logical form, which he then proceeds to 'break up' into its propositons and those into their terms. . . . There is a second use of ἀναλύειν (probably derived from that found here) in which it stands for the reduction of a syllogism in one figure to another figure." Such a description neither broaches, nor, I think, prejudices the larger issues one must face in a study of analysis itself. In this study a methodological use has been suggested for analysis which, it must be admitted, does seem to correspond rather more with one side of the controversy on analysis,but no attempt has here been made to work out the possibilities or the probabilities in this regard. We have tried to trace the methodological use of the syllogism (and more

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particularly the demonstrative syllogism) and in tracing this use there appeared a correspondence with the way in which Ross describes Aristotle's use of the term analysis and with the way Robinson treats the method of analysis generally.

Proclus says: μέθοδοι δὲ ὅμως παραδίδονται, κυριώτη μὲν ἡ διὰ τῆς ἀναλύσεως ἐπ' ἀρχὴν ὁμολογουμένην ἀνάγουσα τὸ ζητούμενον.... (ed. Friedlein, p. 211)
"Nevertheless there are certain methods that have been handed down, the best being the method of analysis, which traces the desired result back to an acknowledged principle" (Morrow, p. 165).

Without wishing to prejudice the issue in any way, I would tentatively suggest that the heuristic function described in this study as falling within Aristotle's intention for the apodeictic syllogism could be seen to accord with Proclus' description. Of course they could not be properly reconciled unless we were to bear in mind the transferrence in application from mathematical objects to objects of natural philosophy and the like. But this is, as noted, a subject for further investigation.

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