Beginning with Aristotle*

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Both the terms *physics* and *metaphysics* were introduced into the English language through the writing of Aristotle. If the works bearing these titles had not survived, it is doubtful whether either field of study would have the form and content that it has today. It would certainly be known by some other name. We might even construct a slightly flippant definition of metaphysics; it is the study of those topics discussed in Aristotle's *Metaphysics*. (It would be stretching the point to define physics in the same way, but certainly the topics in Aristotle's *Physics* are a valid part of modern physics.) This, if no other reason, makes the study of Aristotle useful and interesting. There is another, more subtle, value in studying the works of a thinker who is so remote from us in time as well as philosophical outlook. The study of physics is replete with abstract concepts such as space, time, force, field, causality, *etc.* which seem natural to us only because we have grown up with them. Try, for example, to define time. (We will return to this topic in a later chapter.) Well, time is what you measure with clocks. And what is a clock? A clock is an instrument that beats out equal intervals of time. Suddenly *time*, that cornerstone concept of physics, seems to be based on a circular definition. One way to escape such circular arguments is to step back away from your intellectual milieu and study how thinkers in other eras have addressed the same issue. We will have occasion to do this throughout this book. Let's start with Aristotle.

1 Introduction

Aristotle was born in 384 BC in a small town in northern Greece. He moved to Athens when he was still a teenager and became part of the intellectual circle that centered around Plato. He stayed in Athens until the death of Plato in 347 and then moved to Atarneus on the coast of Asia Minor.

Eventually (343) he was invited to the court of Philip II, King of Macedon, at Mieza to tutor his son, Alexander. This Alexander, or course, we know as Alexander the Great, perhaps the most powerful man in antiquity. It is fascinating to speculate what these two remarkable men might have had to say to one another. Unfortunately, no historical record of their interactions has survived.

In 335 Aristotle returned to Athens. The Academy that Plato had founded was still flourishing, but Aristotle preferred to set up his own school in the public Lyceum. There he taught and presumably composed most of the works that have come down to us. He left Athens in 322 and died a year later in Chalcis, on the island of Euboea, where his mother's family had estates. The Lyceum continued in Athens under the leadership of Theophrastus to whom Aristotle in his will bequeathed his school.

There is an ancient biography of Aristotle contained in *Lives of the Philosophers* by Diogenes Laertius. In it is a list of books attributed to Aristotle. There are some 550 books listed, which have been estimated to be equivalent to six thousand pages of modern text. The range of subjects is astonishing: art, rhetoric, biology, psychology, ethics, government, and physics are all represented, but this list does not begin to cover the range of his interests.

Only a fraction of these works have survived, some thirty in all. The most complete English edition of his works, the revised version of the "Oxford translation," [1] contains 2383 pages including some spurious texts. Nonetheless, these surviving works seem to cover all of Aristotle's main philosophical interests. To a modern reader these books often seem maddeningly obscure, pedantic, and full of embarrassing gaffes and fantasies. In the first category is the famous passage in which he argues that women are really inferior and incompletely developed men! His writing on biology is full of strange things. He for example remarks that the Lybian ostrich has eyelashes and cloven hooves![2] Despite all this, his work has an intellectual energy and range of interests that may be unprecedented in western civilization. Even in our century he has continued to challenge and stimulate some of the brightest scholars in philosophy.

We think of Aristotle as a philosopher; he would probably have called himself a scientist. The word "science" after all, comes from the Greek word for knowledge, and Aristotle's business was the acquisition of knowledge. He divided science into three categories: theoretical sciences, practical sciences,

[1] *The Complete works of Aristotle* ed. Jonathan Barnes, Princeton, 1984

[2] *Parts of Animals*

and productive sciences. The goal of productive sciences is to produce objects. These sciences include poetics and rhetoric, obviously, since their goal is produce poems and speeches. Practical sciences, such as ethics and politics, are concerned with the performance of actions. We will be primarily concerned with the theoretical sciences whose goal is the discovery of truths.

The theoretical sciences are further subdivided into mathematical, natural, and theological sciences. Mathematical science included arithmetic and geometry. Although Euclid (whose dates are a bit uncertain) probably wrote the *Elements* around 300 BC shortly after Aristotle's death, Aristotle was familiar with the sort of reasoning that we associate with "Euclidean geometry." In this branch of mathematics one starts with what seem like unquestionable truths such as "parallel lines are everywhere equidistant," and then derives from them a series of theorems using purely deductive reasoning. Aristotle, who claimed to have invented the study of formal logic, was very much impressed with this, and he seems to have regarded geometry as a model for all the sciences. To the extent that one can discern a "scientific method" in his works, it is this: start with what seem like unquestionable truths supposedly based on a careful observation of the real world, and then reason deductively from premise to conclusion.

Theology, according to Aristotle, is the study of changeless things. We will have more to say about this when we discuss the *Metaphysics.* This leaves the natural sciences such as physics, astronomy, chemistry, meteorology, botany, zoology, and psychology. As I observed before, the bredth of interest is remarkable. He contributed to all these fields and in a sense, defined them for future study.

With that introduction in mind, let's take a closer look at Aristotle's physics.

2 Physics

The word "physics," comes from the Greek word *phusis.* This is usually translated as "nature," but not nature in the sense that we usually use the word. Aristotle might say that *phusis* is the internal activity that makes anything what it is. Our word for nature comes from Latin roots having to do with birth and growth, and these associations are present in the Greek word as well. It is in the "nature" of a human embryo to develop into a fetus, to be born, and eventually to become a mature human being. This is the internal activity that makes it what it is. One of Aristotle's most influential books is entitled simply *Phusis,* or as it is always translated, *Physics.* It

deals primarily with motion, and by extension, space, time, and causality, concepts that are still central to physics today. In a closely related book, *On the Heavens,* Aristotle applies his theory of motion to the stars and planets. Together they dominated physics and astronomy until the time of Galileo.

Aristotle begins his discussion of physics by identifying four kinds of motion:

> For what changes always changes either in thinghood, or in amount, or in quality, or in place···[3]

Physics is concerned with motion, but motion has a more general meaning than we usually give it. It can mean change of place, which we are accustomed to treating quantitatively, as well as changes in "thinghood," which could not possibly admit to any sort of quantitative reasoning. By treating all four kinds of motion on the same footing Aristotle makes quantitative reasoning impossible.

What other kinds of reasoning are there? In the *Posterior Analytics* Aristotle argues that scientific reasoning should have the form of a syllogism. (A familiar example of a syllogism is "All men are mortal, Socrates is a man, therefore Socrates is mortal.") The premises should be self-evident, and the conclusion should have some explanatory value. Presumably Aristotle was thinking about geometry. The basic axioms *seem* self-evident, and the reasoning probably could be cast in syllogistic form (although this is not how it is usually presented).

With the benefit of two thousand years of hindsight, however, we can see that Greek geometry is a dangerous model on which to base one's scientific method. Consider the axioms of Euclidean geometry. Is it true, for example, that parallel lines never meet? So long as "parallel lines" refers to something in the mathematical imagination, then the words "true" and "false" hardly have any meaning. I have simply used the property "never meet" as part of my definition of an abstract entity called "parallel lines." If, on the other hand, "parallel lines" refers to real physical lines (such as lines drawn on a surface or the paths of light beams in empty space), it is by no means clear that they never meet. Lines of longitude drawn on a sphere are parallel in some sense, but they meet at the poles. One consequence of Einstein's general theory of relativity is that the three dimensional space of the universe can, at least in principle, have this same property as the two dimensional surface of a sphere. We say colloquially that "space is curved." (Whether space on the scale of the universe is actually curved is still not entirely clear.

[3]Physics, Book III, Chapter 1

It is certainly true that it has this property in the vicinity of very massive objects.) When it is applied to the real physical world the "self-evident" nature of parallel lines becomes entangled with matters of definition, (What do you mean by a straight line? How do you define "parallel"?) as well as very subtle questions of fact (What is the structure of space?) that could not even have been asked before the development of differential geometry in the nineteenth century.

At any rate, Aristotle's *Physics* does not have the orderly structure of self-evident postulates followed by syllogistic deductions. The structure has rather been called "aporetic" from the Greek word "*Aporia*" meaning "puzzle" or "difficulty."[4] Aristotle repeatedly presents a contradiction or, as it is often translated, an "impasse," and then reasons around it. The most important of these contradictions came from the philosopher Zeno of Elea, (490?-430 B.C.), who devised four famous paradoxes, all purporting to prove that there is no such thing as motion. The *Physics* is in part an extended answer to these paradoxes.

Zeno argues, for example, that an arrow shot into the air does not, in fact, move. If you look at the arrow "now," it is "here." True, the arrow may be somewhere else at a later time, but the moment of perception is now, and now the arrow is stationary. Today, of course, we resolve this paradox by resorting to the notions of continuity that are the basis of differential calculus. Aristotle resolves the difficulty by inventing an non-quantatative (or at least non-algebraic) formulation of continuity. He argues that time must be infinitely subdividable; between the present instant and any subsequent instant there must be an infinite number of "nows." This definition of continuity was rediscovered in the nineteenth century by the German mathematician Richard Dedekind. That Aristotle could have invented this without any exposure to what we would call mathematical analysis is very impresive.

Unfortunately, there are many things in the *Physics* that seem either strange or factually wrong. He claims, for example, that there can be no such thing as an empty void, that an isolated point cannot move, that all motion (in the sense of change-of-place) is either in a straight line or a circle with circular motion restricted to the heavenly bodies and straight line motion restricted to earthly things. He claims that an object tossed in the air becomes stationary before changing direction and that a projectile, such as a javelin, moves after it leaves the thrower's hand only because it is

[4] *cf.* Jonathan Barnes's essay "Life and Work," in *The Cambridge Companion to Aristotle*, *ed.* J. Barnes, Cambridge University Press 1995

pushed along by the air.

I should mention in connection with these claims that Aristotle's reputation has had a curious history in the intellectual history of western civilization. Sometime after the fall of the Roman empire his works were rediscovered by scholars and theologians associated with the Roman Catholic Church, translated into Latin, and studied intently for centuries. His work was regarded by some as second only to the Holy Scriptures in authority regarding higher truths. In the renaissance, however, particularly starting with the sixteenth century, he fell from grace with the intellectuals. It became, and still is, fashionable to ridicule him for being authoritarian, pedantic, obscure, and wrong! Bertrand Russell is probably writing for most experts of our time in the following quote from his monumental *History of Western Philosophy*:[5]

> His doctrine on this point (the theory of substances and universals), as on many others, is a common-sense prejudice pedantically expressed.

and again,

> Aristotle's metaphysics, roughly speaking, may be described as Plato diluted by common sense. He is difficult because Plato and common sense do not mix easily.

I cannot be so glib. Aristotle so vastly excells the philosophers of his own time and, even by Russell's admission, the next two thousand years that he deserves to be taken seriously. Let us rather try to understand what attitudes or missteps may have resulted in these strange conclusions. It seems to me that there are at least three.

- Motion should be treated quantatatively and algebraically. This is seen especially clearly in the argument that a point cannot move. In Book VI, Chapter 2, Aristotle discusses what we would call speed or velocity. In modern notation, $v = \Delta x/\Delta t$, where Δx is the distance traveled by the point in some very short interval of time Δt. He cannot say this, however, because *Physics* lacks the concept of space as we understand it mathematically. We would say that the particle moves from x_1 to x_2 in time $\Delta t = t_2 - t_1$, so that $\Delta x = x_2 - x_1$. The idea of assigning a variable to describe position is foreign to Aristotle's way of thinking. As a consequence the reasoning in this section is very

[5]Bertrand Russell, *A History of Western Philosophy*, Simon and Schuster, Inc., 1959

labored and obscure. When he comes around to the motion of a point in Chapter 10 of the same book, he says in effect that $v = \Delta x/\Delta t$, but Δx is the size of the point. That is zero of course, so $v = 0$ as well. Put this way the error is immediately obvious, but without a quantatative notion of space it is extremely obscure.

- Despite his remarks about the logical structure of scientific arguments in the *Posterior Analytics*, Aristotle does not use syllogysms in the *Physics* but rather another kind of argument that can best be called the process of elimination. In response to a question or "impass" he will formulate three (or more) explanations, say A, B, and C. A and B can be ruled out with some simple arguments, and so, it is claimed, the correct answer is C. This is a treacherous argument, because it is usually impossible to prove that A, B, and C are the only possibilities. Perhaps the right answer is Z, which cannot even be formulated with the language and concepts at hand.

- Aristotle's definition of motion is difficult to make sense of. I will quote at length from Sachs's translation[6] of the crucial passage from Book III, Chapter 2.

  > Therefore, motion is the being-at-work-staying-itself of the movable, and happens to it by contact with what is moving, so that the latter too is acted upon. And what moves will always bear a form, whether a this or an of-this-kind or a this much, which will be the source and cause of its motion whenever it moves.

  The elaborate hyphenated noun, being-at-work-staying-itself, is Sach's attempt to translate *entelecheia*, a word that Aristotle has invented by combining and punning on several different words. In his commentary on this passage the translator makes the strange remark that this word has been misunderstood by "almost everybody" for the last thousand years. (I certainly don't understand it!) The point is that science is, first of all, a community enterprise. A useful scientific idea must be understandable to all the practitioners in the field, and it must be possible to reformulate it in many ways without losing it's content. A concept that has proved incomprehensible to a thousand years of serious scholarship hardly fits into that category.

[6] Joe Sachs, *Aristotle's Physics; A Guided Study*, Rutgers University Press, 1995

3 Metaphysics

Any reader in the late twentieth century who visits a second-hand book store is likely to find a shelf marked "Metaphysics." He or she will find therein a strange farrago of topics: pyramid power, astrology, tarot cards, palmistry, and spiritual self-levitation; topics that survive for purposes of entertainment and perhaps exploitation in an age of gullibility. The chain of association that leads from that branch of philosophy called "metaphysics" to these book store curiosities is a long and tortured one. I do not care to trace it out.

The origin of the word "metaphysics" is also problematic. Every modern list of the works of Aristotle indicates that he wrote something called *Metaphysics* despite the fact that the word was unknown in his time. It originated with a later editor named Andronicus of Rhodes, one of the later masters of the Lyceum that Aristotle founded, who compiled a collection of essays and called it *ta meta ta phusika,* "what comes after the *Physics*." The phrase was eventually transliterated into Latin and then into English as "metaphysics." Scholars have since disputed what Andronicus meant by "comes after." Did he mean that it comes after the *Physics* in some manuscript collection or perhaps "comes after" in some (unspecified) logical or philosophical sense? We don't know. Scholars also dispute whether the material collected in the *Metaphysics* is really one topic or several. I will return to that issue below.

Most modern translations of the *Metaphysics* are full of words like "substance" and "accident" and "essense," common English words that are used to mean something much different from their primary dictionary definition. These words are in fact a legacy of medieval Latin scholarship. Take for example one of Aristotle's favorite words, *ousia.* The common meaning had something to do with inherited wealth or estate, that which cannot be taken away from the one who is born with it. It is also related to the participle of the verb "to be." For Aristotle it refers to an entire complex of things that are not easy to pin down. It is way of being that is primary in the sense that it belongs to things that have attributes but which are themselves not attributes of anything. Joseph Owens in *The Doctrine of Being in the Aristotelian 'Metaphysics,'* devotes an entire chapter to the question of how it should be translated into English and eventually decides on "entity." Joe Sachs, in the translation already alluded to, comes up with "thinghood." The standard translation is "substance," a transliteration of the Latin word, *substantio.* It has often been argued that by using the Latin terms we are buying into medieval Latin scholarship with all its prejudices

and errors. Choices like "thinghood" and "entity" are intended to circumvent this. I would argue that "thinghood," "entity," and "substance" are equally acceptable if we remember that they are only place holders for the phrase, "what Aristotle meant by *ousia*" and that much of the discussion in and about the *Metaphysics* is really about the meaning of words.

The *Metaphysics* as it has come down to us consists of fourteen "books" of varying length labeled with the Greek letters A, α, B, Γ, Δ, E, Z, H, Θ,I, K, Λ, M, and N. These symbols are pronounced (and often written) Alpha, "Little Alpha," Beta, Gamma, Epsilon, Zeta, Eta, Theta, Iota, Kappa, Lambda, Mu and Nu respectively. Alpha is an introduction beginning with the famously quotable line,

> All men by their very nature feel the urge to know.[7]

Aristotle describes Wisdom as the study of "first principles" or "first causes." (What we call metaphysics he usually called "first philosophy.") The book concludes with a historical survey together with some criticism of Plato's theory of Ideals. Little Alpha is an alternative introduction with some comments about philosophical methodology. Book Beta is a list of metaphysical problems, some of which are discussed in subsequent chapters. Gamma looks like another introduction in which Aristotle explains that metaphysics (or first philosophy) is the study of "being *qua* being." Delta is composed of thirty short chapters each defining a philosophical term. Epsilon is another short book in which Aristotle reiterates that "We are seeking the principles and causes of existing things."

Aristotle gets down to hard work in the next three books (Z, H, Θ), which deal with substance, potency and actuality. They appear to be the heart of the *Metaphysics*. They are extremely difficult reading due to the unfamiliarity of the language and the obscurity of the argument. The subsequent book Iota discusses the notions of unity and plurality. Kappa is a summary of Gamma, Delta, Epsilon, and part of the *Physics*. It is believed to be spurious, *i.e.* not written by Aristotle. It is certainly more intellegible than the books it summarizes.

The book Lambda contains Aristotle's theology. It develops his theory of the Eternal Prime Mover, the Supreme Intellect, and the nature and operation of good in the world. Books Mu and Nu, which are closely related, discuss the philosophy of mathematics with special reference to Plato's theory of Ideals.

This is a very superficial summary of the material in the *Metaphysics*. It is well to remember that it is a collection put together by a later editor.

[7] *Aristotle's Metaphysics* trans. by John Warrington, J. M. Dent & Sons, 1956

There is certainly no program or unifying principle that one can discern by reading through it. In fact, we do not even know for what purpose the documents were originally intended. Often they have the "feel" of a man thinking out loud. Scholars like to make a distinction between *ex*oteric books, those written for a general audience, and *es*oteric books written for a special group of insiders. Plato's *Dialogs* are certainly exoteric in this sense. The *Metaphysics* is esoteric, and we are not among the insiders!

What then is the *Metaphysics about*? At the beginning of Gamma we are told

> There is a science which investigates being *qua* being and its essential attributes. This science differs from all the so-called special sciences in that none of the latter deals generally with being as such. They isolate one part of it and study the essential attributes of that one part, as do, for example, the mathematical sciences.

Translators often render the phrase, "being *qua* being," as "beings *qua* being." The point is that even though the subject is singular in Greek, it really refers to "things that exist," *i.e.* "beings." The purpose of first philosophy is not to study statues or bronze spheres or beds (Aristotle's favorite examples) for the attributes that make them different from one another, but rather to study the things they all share by virtue of the fact that they exist.

This program immediately encounters a difficulty, however, that to us seems purely verbal; the word "exist" means different things in different contexts. Take compound nouns, for example. Does a flock of sheep exist in the same way that a single sheep exists? What about things that are parts of some larger whole; does a finger exist in the same way as the body of which it is a part? Qualities present additional problems as do the things of mathematics. Does "hardness" exist? What about beauty, numbers, right triangles, *etc.*? Aristotle's approach to this problem is to argue that all uses of "exist" point back to some one primary meaning of the word. A flock of sheep, for example, exists in a way that is secondary to the existence of individual sheep. To put it in a silly way, there can be sheep without flocks, but there can't be flocks of sheep without sheep. That which exist in this primary way Aristotle calls "substance" (or *ousia* as described above).

> The ancient and everlasting question 'What is being?' really amounts to 'What is substance?' $\cdots$ it must be our first and principal, if not our *only* subject.

Much of the *Metaphysics* is concerned with making this concept of substance more precise. The final conclusion is paradoxical. The definition in Delta puts it this way:

> Hence 'substance' has two senses: (a) The ultimate substratum which cannot be further predicated of anything else, and (b) that which is individual and separable.

This seems like a clear contradiction. "Individual and separable" is clear enough; I am a substance as is my dog and, individually, each one of my cats. "Substratum," however, seems to imply something continuous and so by definition, not individual and not separable. Unfortunately, the meaning of this passage, like so much else in Aristotle, turns on the exact meanings of words and thus on translation. Jonathan Barnes in his essay on Aristotle's *Metaphysics* translates this passage as follows:

> things are called substances in two ways: a substance is whatever is an ultimate subject, which is no longer said of anything else; and a substance is a this so-and-so which is also separable.

This reference to an "ultimate subject" avoids the appearance of contradiction with regard to continuity versus separability, but, according to Barnes, entails a more subtle contradiction. An individual, Aristotle says, cannot be defined. (How would you define yourself?) Substances, on the other hand, must be knowable, ultimate subjects. It must be possible to say what a substance is, and this seems to imply that they are definable. As Barnes puts it:

> Substances are individuals: Mozart is a substance, man is not.
> Substances are definable: man is a substance, Mozart is not.

Suppose it were possible to find a consistent interpretation of what Aristotle has written about substance. What would one have learned, or to use Aristotle's language, what Wisdom would one have acquired? A critic might argue that the whole enterprise is meaningless. One invents a word like *ousia* that seems to convey some significance and then proceeds with torturous arguments to specify what that significance might be. From this point of view, it seems a game played entirely with words.

I believe that our hypothetical critic would be missing an important point. Let's reformulate the question of being *qua* being in more modern language: what is the nature of ultimate reality? Modern science has a ready answer. Matter is composed of atoms. (Democritus said as much

2400 years ago.) Atoms in turn are composed of elementary particles that obey a set of mathematical laws. This is all there is to say. The theory has a few loose ends, (we will return to this point when we discuss Theories of Everything) but the loose ends will be tied up one day, and then, in a sense, we will know everything there is to know.

I find this answer enormously unsatisfying. What about Life, the Universe and Everything, I would like to know. I realize that the question is not well formulated, but surely there is something more to the meaning and splendor of life than the accidental collocation of atoms. (A hypothesis, incidentally, that Aristotle rejected.) But when I try to specify just wherein lies that "something more," I find myself traveling in the footsteps of Aristotle. I am asking, in effect, about being *qua* being. Aristotle's methodology may be flawed, but the "ancient and everlasting question" is still with us.

In Aristotle's mind, at least, the question of being *qua* being is tied up with several other issues that we have not yet discussed. The introduction (Book A), in fact, speaks of Wisdom as the knowledge of "first causes," and both the words "first" and "cause" require further explanation.

There are according to Aristotle four kinds of causes, which he usually calls the material, formal, effficient, and final causes. To use the canonical example, let us imagine that a man is making a statue out of marble. The marble is the material cause of the statue. The formal cause is the plan or design, Aristotle would say the *essence* of the statue. The efficient cause is the chisel chipping away at the surface of the marble, and the final cause is the end or purpose the sculptor has in mind for his creation. In modern usage "cause" usually means the efficient cause, but this is certainly not the most interesting or important cause to Aristotle's way of thinking.

> The most authoritative science, reigning supreme over the subsidiary, is that which knows for what purpose every act takes place, *i.e.* the final cause, the good in each particular instance, and in general *the summum bonum* in nature as a whole.[8]

Metaphysics, "the most authoritative science," is thus concerned, paradoxically, with first final causes. By the same token, "first" does not refer to chronological sequence but "first" in the sense of ultimate explanation. Why did the man make the statue? Because he was commissioned by the city. Why did the city commission him? Because $\cdots$ Aristotle believes that this chain of explanation eventually terminates in an explanation for which there is no explanation, an answer to which the question Why? is no longer appro-

[8] *Metaphysics*, Book A, Chapter ii

priate.[9] This is the *first* cause. Aristotle goes on to say that the knowledge of first causes is not only the most honorable of the sciences, it is in fact divine, in part because God is one of these first causes, and also because the knowledge of first causes is the sort of knowledge that God preeminently possesses.[10]. In modern language one might say that by studying the first causes we come to know the mind of God.[11]

There are several things about this theory that seem unsatisfactory. Why, for example, does the chain of explanation have to terminate? Aristotle rejects the notion of infinite regress; that is just not how things are. We would also like to know why this sequence of explanation is a *chain.* It seems that most things have several causes, and each of these causes have several causes, so that the appropriate image is not a chain but rather a branching network with many crisscrossing causal links. Aristotle would probably argue that each thing has a single *primary* cause, and it is the chain of primary causes that concerns us.

4 Theology

So it is that the study of causes leads finally to theology, the *science* of God. Aristotle's writing on theology is limited to a short book, Lambda, in the *Metaphysics* and some related material in the *Physics.* Aristotle identifies the first cause with the "prime mover," that perfect substance that is eternal and unchangeable. It is the role of the prime mover to cause the perfect circular motion of the stars and planets.

> The unmoved mover, on the other hand, has no contingency; it is not subject even to the minimal change (spatial motion in a circle) since that is what it originates. It exists therefore, of necessity; its being is therefore good, and it is in this way that it is a principle of motion.
>
> On such a principle, then, the whole physical universe depends.

So the prime mover or unmoved mover is finally equated with God.

> God must also have life; for the actuality of thought is life, and God is that actuality. His essential actuality is life most good and eternal. God therefore is a living being, eternal, and most good;

[9] *An. Post.* I 24

[10] *Metaphysics* Book A, Chapter ii

[11] Compare this with the conclusion of Stephen Hawking's *A Brief History of Time*

> to Him belong – or rather He *is* – life and duration, continuous and eternal.

These passages are remarkable for the liberal use of the word "therefore." Often it is impossible to guess what intervening argument led from premise to conclusion.[12] One is also struck by the similarity between the language that Aristotle uses to describe God and the language traditionally used by the Christian church. This explains in part why Aristotle was so congenial to the Church Fathers, but it is also true that passages such as these shaped the way the Church thought and wrote about God.

Those who would see in Aristotle an ancient forerunner to modern monotheism, however, need to overlook a major stumbling block. After concluding in the beginning of Book viii that, "Therefore the unchangeable prime mover, and hence also the universe which is eternally moved, is one in number as well as in definition," he goes on to prove that there are either 47 or 55 of these eternal moving principles!

It is easy to see how he is forced to this conclusion. He had already established in the *Physics* that there are only two kinds of motion, straight-line and circular. Circular motion is perfect, so the prime mover who is perfect must move things in circles. Now the stars, for example, in the course of a single night appear to move in circles. It is easy to imagine that they are fixed to a large sphere that is turning with simple circular motion. In the course of a year, however, there are constellations that rise and set with the seasons. The sphere must also be turning (more slowly) about a different axis. When we come to the planets the situation is even more complicated, since the planets seem to wander among the stars tracing out complicated paths. This requires even more spheres and unmoved movers. Aristotle admits that he is no expert in these matters and relies on contemporary astronomers to decide how many spheres are required. In the course of adding up the spheres he apparently makes a simple arithmetic error and arrives at 47 where we would expect the number to be 49. All this is prefaced by the following ironic remark:

> If someone develops a theory contrary to that which I shall now put forth – well, with all respect to the other party, we shall follow the more accurate.[13]

[12] More than any of the other books in the *Meatphysics*, Lambda appears to be a set of lecture notes, literally notes written by Aristotle to himself with instructions as to what he should say and in what order.

[13] I hope the author will be forgiven for having some fun at Aristotle's expense.

The contradiction between one and 47 (or 49 or 55) unmoved movers can be brushed aside by attributing this argument to a "later fragment" that was somehow included in Lambda by Andronicus or some other editor. Aristotle's argument itself is not illogical, however, and the notion of "wheels within wheels" became a serious obstacle to medieval astronomy. It seems that the more accurately and systematically the planets are tracked across the sky, the more complicated their motion seems and the more spheres and unmoved movers are required to account for it. These complications disappear when one realizes (as Kepler first did at the beginning of the seventeenth century) that the orbits of planets are really ellipses (rather than circles) with the sun (rather than the earth) at one of the foci.

Whatever the origin and rightful place of this "later fragment," it contains a sort of epigram that should not be forgotten by any modern writer on the subject of science and theology.

> There is a very ancient tradition in the form of a myth, that the stars are gods and that the divine embraces the whole of nature. The remaining features of popular religion were added at a later date in order to frighted ignorant people, to lend sanction to the laws, and on general utilitarian grounds: these gods are said to be in the form of men or beasts, and other stories of that kind are told. But if we strip the original doctrine of its later accretions and consider it alone, we cannot but recognize it as inspired. It teaches that the prime substances are gods, and is a relic of of that perfect flowering of the arts and sciences which must have been so often achieved and often lost. It is, so to speak, the surviving relic of an ancient treasure, allowing us a fleeting glimpse of what our early ancestors believed.

Today Aristotle seems by turns an "ancient treasure" and a "later accretion" every bit as fantastic as the "men or beasts" that he ridicules. The notion that "the divine embraces the whole of nature" seems to me at least to be profoundly true; the god who makes things go in circles and eternally thinks about himself thinking[14] is hopelessly quaint. Perhaps it is the human condition that we are always caught between these two poles.

[14]Lambda, Chapter ix

5 Conclusion

The *Metaphysics* contains two main themes, the study of being *qua* being and the study of first causes. The first theme leads to the definition of substance and an exploration of all the ways in which a thing can be said to exist. The second leads to God, the unmoved mover, and the *summum bonum*. It is clear to Aristotle that these are really one subject, one science, first philosophy, or metaphysics as we now call it. The connecting links are missing, however. The first cause (or causes) results in perfect eternal circular motion. Its realm of activity is the heavens. Down below in the sublunary sphere all motion and change are imperfect. There is an endless chain of causing and being caused, of begetting and being begotten. Aristotle would surely have argued (if he had ever approached this problem directly) that a perfect being could not cause (or even think about) imperfect motion. Thus there is a disconnection between first causes and those of us and those things in the mundane world whose mode of being is not of the immortal and unchanging kind.

Perhaps Aristotle resolved this question in some work that has not survived. At any rate, most subsequent philosophy calling itself metaphysics has turned, loosely speaking, on these two themes, the nature of existence and in particular, the nature of those entities that transcend the mode of being familiar to everyday experience. Now these things are certainly "that which comes after physics" but not unrelated to it as subsequent chapters will show.