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AN INTRODUCTION TO THE PHILOSOPHY OF NATURE

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Preface

This text is designed to introduce the student pursuing the liberal arts to the study of the philosophy of nature. With a view toward making the book flexible enough to meet the needs of different teachers of the subject I have made it a compilation of certain fundamental texts. For those who wish to give a rapid survey of the principles of the subject and of the science, as we try to do here at the College of St. Thomas, there are the three introductory chapters and St. Thomas' *Principles of Nature*. In such a survey the other texts will be used only as reference materials. However, for those who have more time and wish to use this for a more advanced study, there are the texts of the Commentary on the first two books of the *Physics* of Aristotle. In either employment of this text, I have presupposed that the teacher will supplement the material given here.

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My indebtedness for the material in the book is obvious. However, I must say also that even the choice of the texts to be presented is not mine alone but was made with the help of the members of the Philosophy Department here at the College of St. Thomas. Practically the only parts which I can claim are the few introductory notes and the translations of the texts, along with any errors pertaining thereto. I want to take this occasion to thank Father E. P. Emmans, O.P. for his persevering efforts to show me the difficulties of translation. Finally, I wish to thank Miss Natalie Lincoln whose truly Christian charity has been an *assisting* efficient cause in my philosophical development.
R. A. K.

Introduction

The rapid development of experimental science in this century, culminating as it did in the development of atomic fission, has compelled the educated man to take a deeper interest in the works of Nature. This curiosity is not shown only in the larger registration for courses in physics, chemistry and biology. This trend was growing even before these later discoveries. The really profound interest in the works of Nature is being expressed by the students in every field who have a truly liberal education. These men are asking such questions as the following: Should the scientist use his discoveries for war? Has the scientist any obligation or right to direct his research towards good or evil? What right or obligation has the State with regard to purely scientific research and discovery?

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These questions, while being timely and of urgent importance, are exceedingly difficult. Most thinkers would recognize in them what might be called 'a philosophical dimension'. As such they depend in their resolution on the solution of other problems which are at least equally difficult. We must know, for example, what relation exists between experimental science and philosophy. This will bring up further problems: What is philosophy? What are the answers given by the philosopher and how are they to be evaluated? What is the difference between 'Philosophy', 'Philosophy of Nature' and 'Metaphysics'? What is meant by 'practical philosophy'?

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The student with a liberal education rightly feels that such questions should be intelligent to him and that, further, he should be equipped, at least rudimentarily, with the tools necessary for resolving such doubts. Obviously it is not required that any one course resolve all or even any large portion of such questions and difficulties. This *Introduction to the Philosophy of Nature* is offered as the first step into a field of knowledge which, for most students, is a dialectician's nightmare 'full of sound and fury'. As an introductory course, it will primarily consider the subject of the Philosophy of Nature with a brief reference to the causes by which conclusions about that subject are demonstrated. The text for this part of the course will be the work of St. Thomas Aquinas *On the Principles of Nature* with references to his commentary on the first two books of Aristotle's *Physics*. However, before proceeding with that part of the course, certain notions will be set forth suppositionally in order that the student might orientate himself and thus get a better perspective in the work to follow.

Text

Chapter 1: EXPERIMENTAL SCIENCE AND THE PHILOSOPHY OF NATURE

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Even a casual glance at the universe around us will raise a multitude of questions requiring an explanation. However, before we ask for any explanations, it might be well to find out what 'an explanation' is. In order to find out how the modern scientists 'explain' things, let us examine briefly one of the more recent problems in the science of astronomy. From certain 'facts' at their disposal the modern scientists 'know' that the nebulae in the universe are speeding away from each other—our universe is expanding. The scientist now wants to know why this is so. An 'explanation' has been given by the French scientist l'abbé Georges Lemaitre. He said that at the beginning of the universe all matter was gathered together in a very small space—a sort of 'primitive atom'. For some reason (the 'explanation' does not precisely resolve this question) this primitive atom exploded. As a result of this explosion there is now a force in the universe called 'cosmic repulsion' which is driving the parts of the original atom farther and farther apart. The presently existing stars, planets and nebulae are 'explained' by another force, opposed to the first, which is called 'gravitation'. Now, if we suppose that there is such a force as cosmic repulsion, we can explain the expansion of the universe. The argument is as follows:

That which has cosmic repulsion is expanding.
But the universe possesses cosmic repulsion.
Therefore the universe is expanding.

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In mathematics also we have a similar form of explanation. If we wish to explain the fact that the interior angles of a triangle are equal to two right angles, we can do so by saying that any exterior angle of a triangle is equal to the two opposite interior angles with the following argument:

A figure which has one of its exterior angles equal to the two opposite interior angles has its interior angles equal to two right angles.
The triangle is such a figure.
Therefore the triangle has its interior angles etc.

This basic form of explanation will be found to be the one which was studied in logic under the form of the syllogism. In general it is exemplified by the first mode of the first figure:

M is P
S is M
Therefore S is P

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Notice, however, that in both the example of an explanation taken from experimental science and that taken from mathematics there is a possibility, or even the necessity, of a further explanation. We can demand a reason for the cosmic repulsion and a reason for the equality of the exterior angle to its two opposite interior angles. How far back can we push these 'reasons'? According to Aristotle, St. Thomas and many other philosophers, we shall finally come to sense perception as the ultimate reason or foundation for our conclusions. *All human knowledge begins with sense perception.*

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However, although all our intellectual knowledge depends upon sense perception, this dependence can be either essential or accidental. If we take two such propositions as the following:

1. A whole is composed of parts.
2. All snow is white.

we shall see that, while both depend upon sense perception, they do not have the same sort of dependence. While it is true that the first proposition cannot be formed if we have not had a prior sense percept, we have a notion that, having formed the proposition, we will hold to its truth regardless of future sense knowledge. This is another way of saying that our intellect grasps something in this first proposition which it is able to understand independently of the sense perception which originated it. Once we have understood the terms 'whole' and 'part' we can know that the terms are correlative in such a way that one necessarily implies the other. On the other hand, we can never be certain of the second proposition in this way. Our intellect does not see in the terms 'snow' and 'white' any necessary connection. Although our senses tell us that these two terms are connected, our intellect can see no necessary connection between these as it did between 'whole' and 'part'. It is not unthinkable that at some time in the future snow would be some other color and still be snow. Thus we say that the terms 'snow' and 'white' are combined in our judgment only because of the sense perception, while the terms 'whole' and 'part' would be combined in our judgment even without sense perception, if that were possible.

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Starting from the two kinds of propositions drawn from sense-knowledge our intellect goes on to formulate further truths by the use of the syllogism. These syllogisms, from the point of view of their form, will be equally valid or 'rigorous'. However, from the point of view of their matter, they will be radically different. When I see in the terms themselves that a proposition is true and then deduce a further proposition from this, I am certain that the conclusion is true, if the syllogistic form is valid. On the other hand, when I begin my reasoning from a proposition which is enunciated only because I see the connection of the terms in sense perception, in other words when the proposition is not self-evident, or deduced from self-evident propositions, my conclusion will retain this uncertainty.

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Aristotle and St. Thomas have distinguished these two kinds of knowledge and have called the first *science* and the second *dialectic*. In the strictly scientific syllogism the middle term is a definition, while in the dialectical definition it is an hypothesis. Returning to the examples of explanations given earlier, we might show them in schematic form as follows:

D is P H is P
S is D S is H
therefore S is P therefore S is P

where P is a property, D a definition and H a hypothesis.

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Aristotle usually uses *science* only in this very restricted sense. Considering only the causal definition, he defines science as certain knowledge through causes. He restricts the term *demonstration* to this type of knowledge, as when he says that demonstration is a syllogism which proves that a property belongs to a subject by means of a definition.

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From all this it should be evident that men have very little *science* in the very strict meaning of that term. Still, however small that knowledge may be, it is better, as knowledge, than the mass of data which man derives from all his other natural modes of knowing. It is this type of knowledge which we are seeking in the Philosophy of Nature.

Chapter 2: THE PROBLEM OF MOTION

Chapter 2: THE PROBLEM OF MOTION

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One of the most obvious percepts of the world around us is the fact that things move. The fact is so obvious that we usually fail to see the problem involved. However, even a very superficial examination of this phenomena will reveal many difficulties. We say that things move. By motion we mean not only a change of place but also a change of quality and even a change of substance: The oak tree is a different substance from the acorn. This means that mobile things are successively *other*; they do not remain the same. But this seems to be a contradiction: The mobile being, in order to be, must be successively other. If it is always other, how can it be what it is? Moreover, if it is not always the same throughout the succession, how can we say that the succession is continuous? It seems that the mobile being is a being which changes and which does not change.

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Can we say that a mobile being is one which is composed of two parts, one of which changes while the other is immobile? This solution is too easy. The same problem would arise as to the changing *part*: how could we say that the successive change in this part is continuous? Still some distinction must be made. How are we going to make this distinction?

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The metaphysician demonstrates that the essence and the existence of any finite being are really distinct. Can we use this distinction to resolve our difficulty? Can we say that the existence is constantly changing while the essence remains immobile and by this immobility the identity of the being is safeguarded? No, this solution will not resolve the difficulty. Such an essence would have an existence which was at the same time simultaneous and successive. By this we see that the mobility of which we are speaking penetrates the very essence of the mobile being. But how can mobility penetrate my essence if my essence is that which makes me what I am. If, while enduring, I change essentially, I am always essentially other: my identity vanishes. I can no longer say that yesterday I taught a class because I am no longer myself.

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The problem is becoming more and more difficult. My essence must necessarily be capable of receiving existence successively without losing its identity. This forces us to say that this essence must be *multiple*. This is not to be understood as a multiplicity of things because then the same problem arises all over again (it would be like saying that a mobile being is possible only if it is non-mobile), rather the multiplicity should be of elements of another order. The multiple in question must show us how a being which endures successively and continuously is possible. The elements, therefore, by their very definition will be the conditions of the being of the mobile. They will be principles of the essence of the mobile being. One of these will permit this essence to receive existence successively while the other will safeguard the identity of that essence.

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Keeping this problem in mind, we turn now to St. Thomas' *Principles of Nature*.

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1. Since some things can be, although they are not, and some things now are; those which can be and are not are said to be in potency, but those which are said to be in act. But existence is twofold: one is essential existence or the substantial existence of a thing, for example *man exists*, and this is existence *simpliciter*. †1 The other is accidental existence, for example *man is white*, and this is existence *secundum quid*. †2

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2. Moreover, for each existence there is something in potency. Something is in potency to be man, as sperm or the ovum, and something is in potency to be white, as man; and that which is in potency to existence can be called matter: for example sperm is the matter of man and man is the matter of whiteness.

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3. But these differ, because that which is in potency to substantial existence is called the matter *from which*, but that which is in potency to accidental existence is called the matter *in which*. Again, properly speaking, that which is in potency to substantial existence is called *prime matter*; but that which is in potency to accidental existence is called the *subject*. The subject gives existence to the accident, namely the act of existing, because the accident has existence only through the subject. Hence we say that accidents are *in a subject*, but we do not say that the substantial form is *in a subject*.

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4. Accordingly, matter differs from subject, because the subject is that which does not have existence by reason of something which comes to it, rather it exists *per se* †3 and has complete existence, just as man does not have existence through whiteness. But that is called matter which has existence by reason of what comes to it, because, of itself, it has incomplete existence; indeed, it does not have any existence, as the Commentator †4 says in the second book of the treatise *On the Soul*. Hence, simply speaking, the form gives existence to matter; the accident, however, does not give existence to the subject, rather the subject gives existence to the accident; although sometimes the one is used for the other, namely, matter for subject and conversely.

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5. But, just as everything which is in potency can be called matter, so also everything from which something has existence, whether that existence be substantial or accidental, can be called form; for example man, since he is white in potency, becomes actually white through whiteness, and sperm, since it is man in potency, becomes actually man through the soul. Also, because form causes existence in act, we say that the form is the act. However, that which causes substantial existence in act is called substantial form and that which causes accidental existence in act is called accidental form.

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6. Because generation is a motion to form, there is a twofold generation corresponding to this twofold form. Generation *simpliciter* corresponds to the substantial form and generation *secundum quid* corresponds to the accidental form. When a substantial form is introduced we say that something comes into being *simpliciter*, for example we say that man comes into being or man is generated. But when an accidental form is introduced, we do not say that something comes into being *simpliciter*, but that it comes into being as this; for example when man comes into being as white, we do not say *simpliciter* that man comes into being or is generated, but that he comes into being or is generated as white.

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7. There is a twofold corruption opposed to this twofold generation: *simpliciter* and *secundum quid*. Generation and corruption *simpliciter* are only in the genus of substance, but generation and corruption *secundum quid* are in all the other genera. Also, because generation is a change from non-existence or nonbeing to existence or being, contrarily, corruption should be from existence or being to non-existence or non-being. However, generation does not take place from just any non-existence, but from the non-being which is being in potency; for example a statue comes to be from bronze which is a statue in potency and not in act.

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8. In order that there be generation three things are required: *being in potency* which is matter, *non-existence in act* which is privation, and *that through which something comes to be in act* which is form. For example when a statue is made from bronze, the bronze which is in potency to the form of the statue is the *matter*; the shapeless or undisposed something is the *privation*; and the shape because of which it is called a statue is the *form*. But it is not a substantial form because the bronze, before it receives the shape, has existence in act and its existence does not depend upon that shape; rather it is an accidental form, because all artificial forms are accidental. Art operates only on that which is already constituted in existence perfected by nature.

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9. Therefore there are three principles of nature: matter, form and privation. One of these, form, is that by reason of which generation takes place; the other two are found on the part of that from which there is generation. Hence matter and privation are the same in subject but they differ in definition, because bronze and what is shapeless are the same before the advent of the form; but for one reason it is called bronze and for another reason it is called shapeless. Wherefore, privation is not said to be a *per se* principle, but rather a *per accidens* principle; because it is coincident with matter. For example we say that it is *per accidens* that the doctor builds, because he does not do this insofar as he is a doctor but insofar as he is a builder, which is coincident with being a doctor in the same subject.

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10. But there are two kinds of accidents: the necessary, which is not separated from the thing, for example risible in man; and the non-necessary, which can be separated, for example white from man. Thus, although privation is a *per accidens* principle, still it does not follow that it is not necessary for generation, because matter is never entirely without privation. For insofar as it is under one form it has the privation of another and conversely, just as there is the privation of fire in air and the privation of air in fire. †1

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11. Also, we should note that, although generation is from non-existence, we do not say that negation is the principle but that privation is the principle, because negation does not determine a subject. *Non-seeing* can be said even of non-beings, for example we say that the dragon does not see and we say the same of beings which are not apt to have sight, as stones. But privation is said only of a determined subject in which the habitus is apt to come to be; for example blindness is said only of those things which are apt to see. Also, because generation does not come to be from non-being *simpliciter*, but from the non-being which is in some subject, and not in just any subject, but in a determined subject, because fire does not come to be from just any non-fire, but from such non-fire as is apt to receive the form of fire; therefore we say that privation is the principle, and not negation.

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12. Privation differs from the other principles, because the others are principles both in existence and in becoming. For in order that a statue come to be, it is necessary that there be bronze and, further, that there

becoming. For in order that a statue come to be, it is necessary that there be bronze and, further, that there be the shape of the statue. Again, when the statue already exists, it is necessary that these two exist. But privation is a principle in becoming and not in existing, because until the statue comes to be it is necessary that it not be a statue. For, if it were, it would not come to be, because whatever comes to be is not, except in successive things, for example in time and motion. But from the fact that the statue already exists, the privation of statue is not there, because affirmation and negation are not found together, and neither are privation and habitus. Likewise, privation is a *per accidens* principle, as was explained above, but the others are *per se* principles.

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13. Therefore, from what was said, it is plain that matter differs *per se* from form and it differs from privation by definition. Matter is that in which form and privation are understood, just as in bronze the form and that which is shapeless are understood. Still, *matter* sometimes designates privation and sometimes does not designate privation. For example, when bronze becomes the matter of the statue, it does not imply a privation because when I speak of bronze in this way I do not mean what is undisposed or shapeless. Flour, on the other hand, since it is the matter with respect to bread, implies in itself the privation of the form of bread; because when I say *flour* the lack of disposition or the inordination opposed to the form of bread is signified. Also, because in generation the matter or the subject remains, but the privation does not, nor does the composite of matter and privation; therefore that matter which does not imply privation is permanent, but that which implies privation is transient.

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14. We should notice, too, that some matter has a composition of form, for example bronze. For, although it is the matter with respect to the statue, the bronze itself is composed of matter and form. Therefore bronze is not called prime matter, because it has a form. But that matter which is understood without any form and privation, but rather is subject to form and privation, is called prime matter by reason of the fact that there is no other matter before it. This is also called *hyle*, which means *chaos* or confusion in Greek. Also, because all knowledge and every definition comes by way of the form, prime matter cannot be defined or known in itself but only by a comparison with the form; consequently it might be said that that is prime matter which is related to all forms and privations as bronze is to the statue and the shapeless; and this is called first *simpliciter*. A thing can also be called prime matter with respect to some genus, as water with respect to aqueous solutions; this, however, is not first *simpliciter*, because it is composed of matter and form. Hence it has a prior matter.

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15. Note, also, that prime matter, and likewise form, is neither generated nor corrupted, because every generation goes from something to something. But that from which generation takes place is matter, and that in which generation terminates is form. Therefore, if matter and form were generated, there would be a matter of matter and a form of form, and so on *ad infinitum*. Hence, properly speaking, there is generation only of the composite.

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16. Again, notice that prime matter is said to be numerically one in all things. But to be numerically one can be said in two ways: that which has a determined numerically one form, as Socrates; prime matter is not said to be numerically one in this way, since it does not have in itself a form. Also, something is said to be numerically one because it is without the dispositions which would cause it to differ numerically; prime matter is said to be numerically one in this way, because it is understood without all the dispositions which would cause it to differ numerically or without those things by which there is numerical difference.

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17. Notice, likewise, that although prime matter does not have in its definition any form or privation —for

17. Notice, likewise, that, although prime matter does not have in its definition any form or privation, —for example neither shaped nor shapeless is in the definition of bronze,—nevertheless, matter is never completely without form and privation, because it is sometimes under one form and sometimes under another. Moreover, it can never exist by itself; because, since it does not have any form in its definition, it cannot exist in act, since existence in act is only from the form. Rather it exists only in potency. Therefore whatever exists in act cannot be called prime matter.

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18. From this it is plain, therefore, that there are three principles of nature; matter, form and privation. But these are not sufficient for generation. What is in potency cannot reduce itself to act; for example, the bronze which is in potency to being a statue cannot cause itself to be a statue, rather it needs an agent in order that the form of the statue might pass from potency to act. Neither can the form draw itself from potency to act. I mean the form of the thing generated which we say is the term of generation, because the form exists only in that which has been made to be. However, what is made is in the state of becoming as long as the thing is coming to be. Therefore it is necessary that besides the matter and form there be some principle which acts. This is called the efficient, moving or agent cause, or that whence the principle of motion is. Also, because, as Aristotle says in the second book of the *Metaphysics*, everything which acts acts only by intending something, it is necessary that there be some fourth thing, namely, that which is intended by the agent; and this is called the end.

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19. Again, we should notice that, although every agent, both natural and voluntary, intends an end, still it does not follow that every agent knows the end or deliberates about the end. To know the end is necessary in those whose actions are not determined, but which may act for opposed ends as, for example, voluntary agents. Therefore it is necessary that these know the end by which they determine their actions. But in natural agents the actions are determined, hence it is not necessary to choose those things which are for the end. Avicenna gives the following example. A harpist does not have to deliberate about the strings that he will pluck, since these are already determined for him; otherwise there would be a delay between the notes which would cause uneveness. However, it seems more reasonable to attribute deliberation to a voluntary agent than to a natural agent. Thus it is plain, by reasoning *a maiori*, that, if a voluntary agent, for whom deliberation is more proper, sometimes does not deliberate, therefore neither does the natural agent. Therefore it is possible for the natural agent to intend the end without deliberation; and to intend this is nothing else than to have a natural inclination to something.

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20. From the above it is plain that there are four causes: material, efficient, formal and final. But, although *principle* and *cause* are used convertibly, as is said in the fifth book of the *Metaphysics*, still, in the *Physics*, Aristotle gives four causes and three principles; because he takes as causes both what is extrinsic and what is intrinsic. Matter and form are said to be intrinsic to the thing because they are parts constituting the thing; the efficient and final causes are said to be extrinsic because they are outside the thing. But he takes as principles only the intrinsic causes; privation, however, is not listed among the causes because it is a principle *per accidens*, as was said.

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21. When we say that there are four causes we mean the *per se* causes, to which all the *per accidens* causes are reduced, because everything which is *per accidens* is reduced to that which is *per se*.

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22. And, although Aristotle calls intrinsic causes *principles* in the first book of the *Physics*, still *principle* is applied properly to extrinsic causes, as is said in the fifth book of the *Metaphysics; element* is used for those causes which are parts of the thing, namely for the intrinsic causes; *cause* is applied to both

those causes which are parts of the thing, namely for the intrinsic causes, *cause* is applied to both. Nevertheless, one is sometimes used for the other: Every cause can be called a *principle* and every principle a *cause*.

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23. However, *cause* seems to add something to *principle* as commonly used, because that which is a principle, †1 whether the existence of a posterior follows from it or not, can be a *principle*; for example the manufacturer is called the principle of the knife because the existence of the knife comes from his operation. But, when something is moved from whiteness to blackness, whiteness is said to be the principle †2 of that motion; and universally, everything from which motion begins is called a *principle*. †3 However, whiteness is not that from whose existence the existence of a posterior, in this case blackness, follows. Hence we say that a cause is that from whose existence another follows. Therefore that principle from which motion begins cannot really be called a *cause*, even though it may be called a *principle*. Because of this, privation is placed among the principles and not among the causes, because privation is that from which generation begins. But it can also be called a *per accidens* cause insofar as it is coincident with matter, as was said above.

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24. *Element*, on the other hand, is applied properly only to the causes of which the thing is composed, which are properly the materials. Moreover, it is not said of just any material cause, but of that one of which a thing is primarily composed; for example we do not say that the members of the body are the *elements* of man, because the members, also, are composed of other things; rather, we say that earth and water are the *elements*, because these are not composed of other bodies, but natural bodies are primarily composed of them.

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25. Hence Aristotle says, in the fifth book of the *Metaphysics*, that an element is that of which a thing is primarily composed, which is in that thing, and which is not divided by a form. The explanation of the first part of the definition, *that of which a thing is primarily composed*, is plain from the preceding. The second part, *which is in that thing*, differentiates it from that matter which is entirely corrupted by generation; for example bread is the matter of blood, but blood is generated only by the corruption of bread. Thus bread does not remain in blood; and therefore bread cannot be called an element of blood. But the elements must remain in some way, since they are not entirely corrupted, as is said in the book *On Generation*. The third part, *and which is not divided by a form*, i.e., a species, differentiates an element from those things which have parts diverse in form, i.e., in species, as the hand whose parts are flesh and bone which differ according to species. An element is not divided into parts diverse according to species, rather it is like water whose every part is water. For an element to exist, it need not be undivided by quantity, rather it is sufficient that it be undivided by form. Even if it is in no way divided, it is called an element, just as letters are the elements of words. Thus it is plain from what was said that *principle*, in some way, applies to more than does *cause*, and *cause* to more than does *element*. This is what the Commentator says in the fifth book of the *Metaphysics*.

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26. Now that we have seen that there are four genera of causes, we must understand that it is not impossible that the same thing have many causes, for example the statue whose causes are both the bronze and the artist: the artist is the efficient cause while the bronze is the material cause. Nor is it impossible that the same thing be the cause of contraries, for example the captain is the cause of the safety of the ship and of its sinking. He is the cause of the latter by his absence and of the former by his presence, as the Philosopher says in the second book of the *Physics*.

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27. Also, notice that it is not impossible that the same thing be a cause and the thing caused, not, however, in the same respect, but in diverse ways; for example walking is sometimes the cause of health, as the efficient cause, but health is the cause of the walking, as the end: Walking is sometimes the cause of health and sometimes on account of health. Also, the body is the matter of the soul, but the soul is the form of the body.

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28. The efficient cause is called a cause with respect to the end, since the end is actual only by the operation of the agent. But the end is called the cause of the efficient cause, since the efficient cause does not operate except by the intention of the end. Hence the efficient cause is the cause of that which is the end, for example walking in order to be healthy. However, the efficient cause does not cause the end to be the end. Therefore it is not the cause of the causality of the end, i.e., it does not cause the end to be the final cause; for example the doctor causes health to actually exist, but he does not cause health to be the end.

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29. Also, the end is not the cause of that which is the efficient cause, but it is the cause of the efficient cause being an efficient cause; for example health does not cause the doctor to be a doctor—I am speaking of the health which comes about by the doctor's activity—but it causes the doctor to be an efficient cause. Therefore the end is the cause of the causality of the efficient cause, because it causes the efficient cause to be an efficient cause. Likewise, the end causes the matter to be the matter and the form to be the form, since matter receives the form only for the sake of the end and the form perfects the matter only through the end. Therefore we say that the end is the cause of causes, because it is the cause of the causality in all causes.

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30. Also, we say that matter is the cause of the form, insofar as the form exists only in matter. Likewise, the form is the cause of the matter, insofar as matter has existence in act only through the form; because matter and form are spoken of in relation to each other, as is said in the second book of the *Physics*. They are also spoken of in relation to the composite, as the part to the whole and as the simple to the composed. Likewise, the composite is spoken of in relation to the parts.

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31. But, because every cause, as cause, is naturally prior to that which it causes, notice that we say a thing is prior in two ways, as Aristotle says in the third book of the treatise *On the Soul*. Because of this diversity, we can call something prior and posterior with respect to the same thing, both the cause and the thing caused. We say that one thing is prior to another from the point of view of generation and time, and likewise from the point of view of substance and completeness. Since the operation of nature proceeds from the imperfect to the perfect and from the incomplete to the complete, the imperfect is prior to the perfect, namely, from the point of view of generation and time but the perfect is prior to the imperfect from the point of view of substance. For example we can say that the man is before the boy according to substance and completeness, but the boy is before the man according to generation and time. But, although in generable things the imperfect is prior to the perfect and potency to act when we consider that in one and the same thing the imperfect is prior to the perfect and potency to act, still, simply speaking, the act and the perfect must be prior, because it is what is in act that reduces potency to act and it is the perfect that perfects the imperfect.

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32. Matter is prior to form from the point of view of generation and time because that to which something comes is prior to that which comes to it. But form is prior to matter from the point of view of substance and completeness, because matter has completed existence only through the form. Likewise, the efficient cause is prior to the end from the point of view of generation and time, since the motion to the end comes

cause is prior to the end from the point of view of generation and time, since the motion to the end comes from the efficient cause. But the end is prior to the efficient cause, insofar as it is the efficient cause, from the point of view of substance and completeness, since the action of the efficient cause is completed only through the end. Therefore these two causes, the material and the efficient, are prior by way of generation, but the form and the end are prior by way of perfection.

p 17

33. It must be noted that there are two kinds of necessity: absolute and conditional. Absolute necessity is that which proceeds from the causes prior by way of generation: the material and the efficient causes. An example of this is the necessity of death which comes from the matter and the disposition of the composing contraries. This is called *absolute* because it does not have an impediment. It is also called the necessity of matter. Conditional necessity, on the other hand, proceeds from causes posterior in generation, namely, the form and the end. For example we say that it is necessary that there be conception if a man is to be generated. This is called *conditional* because it is not necessary simply that this woman conceive, but only conditionally, namely, if a man is to be generated. This is called the necessity of the end.

p 18

34. Notice, also, that three causes can coincide in one thing, namely, the form, the end and the efficient cause, as is plain in the generation of fire. Fire generates fire; therefore fire is the efficient cause insofar as it generates; also, fire is the formal cause insofar as it causes to exist actually that which before was in potency; again, it is the end insofar as the operations of the agent are terminated in it and insofar as it is intended by the agent.

p 18

35. But the end is twofold: the end of generation and the end of the thing generated, as is plain in the generation of a knife. The form of the knife is the end of generation; but cutting, which is the operation of the knife, is the end of the thing generated, namely, of the knife. Moreover the end of generation sometimes is coincident with the two aforementioned causes, namely, when generation takes place from what is similar in species, as when man generates man and the olive, an olive. But this cannot be understood of the end of the thing generated.

p 18

36. Notice, nevertheless, that the end coincides with the form in something which is numerically the same, because that which is the form of the thing generated and that which is the end of generation are the same numerically. But it does not coincide with the efficient cause in a thing numerically the same, but in a thing specifically the same, because it is impossible that the maker and the thing made be numerically the same, but they can be specifically the same. Thus, when man generates man, the man generating and the one generated are numerically diverse, but they are specifically the same. However, matter does not coincide with the others. This is because matter, by the fact that it is being in potency, has the nature of something imperfect; but the other causes, since they are in act, have the nature of something perfect. However, the perfect and the imperfect do not coincide in the same thing.

p 19

37. Therefore, now that we have seen that there are four causes, the efficient, formal, material and final, we must note that any of these causes can be spoken of in many ways. We call one thing a prior cause and another a posterior cause; for example we say that art and the doctor are the cause of health, but art is a prior cause and the doctor is a posterior cause; and it is similar in the formal cause and in the other causes. Notice, also, that we must always bring the question back to the first cause. For example, if it be asked: *Why is this man healthy*?, we would answer: *Because the doctor has healed him*. Likewise, if it be asked: *Why did the doctor heal him*?, we would say: *Because of the art of healing which the doctor has*.

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38. Notice, also, that the proximate cause is the same as the posterior cause and that the remote cause is the same as the prior cause. Hence these two divisions of causes into prior and posterior, remote and proximate signify the same thing. Moreover, it must be observed that that which is more universal is always called the remote cause, but that which is more particular is called the proximate cause. For example we say that the proximate form of man is his definition, namely, rational animal; but animal is more remote and substance is still more remote. All superiors are forms of the inferiors. †1 Again, the proximate matter of the statue is bronze, but the remote matter is metal, and the still more remote is body.

p 19

39. Further, there is one cause which is a *per se* cause, another which is *per accidens*. *Per se* cause is said of one which is the cause of something as such, for example the builder is the cause of the house and the wood is the matter of the bench. *Per accidens* cause is said of one which happens to a *per se* cause. For example we say that the grammarian builds; the grammarian is called the building cause *per accidens*, not insofar as he is a grammarian, but insofar as it happens to the builder that he is a grammarian; and it is similar in the other causes.

p 19

40. Likewise, some causes are simple, others are composed. A cause is simple when that alone is said to be the cause which is the *per se* cause, or that alone which is the *per accidens* cause; as if we were to say that the builder is the cause of the house and likewise if we were to say that the doctor is the cause of the house. A cause is composed when both are said to be the cause, as if we were to say that the medical builder is the cause of the house.

p 20

41. According to the explanation of Avicenna, that can be called a simple cause also which is a cause without the addition of another; for example bronze is the cause of the statue without the addition of another matter because the statue is made of bronze; and we say that the doctor causes health or that fire heats. But a cause is composed when many things must come together in order that there be a cause; for example not one man, but many are the cause of the motion of a ship; and not one stone, but many are the cause of a house.

p 20

42. Again, some causes are in act, others are in potency. A cause in act is one which causes a thing in act, as the builder while he is building or the bronze when a statue is made of it. A cause in potency is one which, although it does not cause a thing in act, can, nevertheless, cause it; thus a builder is a cause, not because he is building, but because he is able to build, and the same is true of bronze when it is not a statue.

p 20

43. Note that, in speaking of causes in act, it is necessary that the cause and the thing caused exist at the same time, so that if one exists the other does also. If there is a builder in act, it is necessary that he be building and, if there is building in act, it is necessary that there be a builder in act. But this is not necessary in causes which are only in potency.

p 20

44. Moreover, it should be noted that the universal cause is compared to the universal thing that is caused and the singular cause is compared to the singular thing that is caused, for example we say that a builder is the cause of a house and that this builder is the cause of this house.

p 20

45. Also, notice that, when we speak of intrinsic principles, namely matter and form, according to the agreement and difference of things that are from principles and according to the agreement and difference of principles, we find that some are numerically the same, as are Socrates and this man—in the Socrates now pointed out; others are numerically diverse and specifically the same, as Socrates and Plato who, although they differ numerically, have the same human species; others differ specifically but are generically the same, as man and ass have the same genus *animal*; others are generically diverse and are only analogically the same, as substance and quantity which have no common genus and are only analogically the same, because they are the same only insofar as they are beings. *Being*, however, is not a genus because it is not predicated univocally, but only analogically.

p 21

46. In order to understand this last we must notice that something is predicated of many things in three ways: univocally, equivocally and analogically. Something is predicated *univocally* according to the same name and the same nature, i.e., definition, as *animal* is predicated of man and of ass, because each is called *animal* and each is a sensible, animated substance, which is the definition of *animal*. That is predicated *equivocally* which is predicated of some things according to the same name but according to a different nature, as *dog* is said of the thing that barks and of the star in the heavens, which two agree in the name but not in the definition nor in signification, because that which is signified by the name is the definition, as is said in the fourth book of the *Metaphysics* That is said to be predicated *analogically* which is predicated of many whose natures and definitions are diverse but which are attributed to one same thing, as health is said of the animal body, of urine and of food, but it does not signify entirely the same thing in all three; it is said of urine as of a sign of health, of body as of a subject and of food as of a cause. But all these natures are attributed to one end, namely, to health.

p 21

47. Sometimes those things which agree according to analogy, proportion and comparison are attributed to one end, as was plain in the preceding example of health. Sometimes they are attributed to one agent, as medical is said of one who acts with art, of one who acts without art, as a midwife, and even of the instruments; but it is said of all by attribution to the genus which is medicine. Sometimes it is said by attribution to one subject, as *being* is said of substance, quantity, quality and the other predicaments, because it is not entirely for the same reason that substance is *being*, and quality and the others. Rather, all are called *being* insofar as they are attributed to substance which is the subject of the others.

p 22

48. Therefore *being* is said primarily of substance and secondarily of the others. Therefore *being* is not a genus of substance and the other predicaments, because no genus is predicated of its species according to prior and posterior; rather, *being* is predicated analogically. This is what we mean when we say that substance and quantity differ generically but are the same analogically.

p 22

49. Therefore the form and matter of those things which are numerically the same are themselves likewise numerically the same, as are the form and matter of Tullius and Cicero. The matter and form of those things which are specifically the same and numerically diverse are not the same numerically, but specifically, as the matter and form of Socrates and Plato. Likewise, the matter and form of those things which are generally the same, as the soul and body of an ass and a horse differ specifically but are the same generically; likewise, the principles of those things which agree only analogically or proportionally are the same only analogically or proportionally, because matter, form and privation or potency and act are the principles of substance and of the other genera. However, the matter, form and privation of substance and

of quantity differ generically, but they agree according to proportion only, insofar as the matter of substance is to substance, in the nature of matter, as the matter of quantity is to quantity; still, just as substance is the cause of the others, so the principles of substance are all of them principles of the others.

Footnotes

p 8

†1 absolutely, completely, simply.

p 8

†2 relatively, in some respect, in some way.

p 8

†3 by itself.

p 8

†4 Averrhoes, a 12th Century Arab who commented extensively on the works of Aristotle.

p 10

†1 In the experimental science of the time of Aristotle and St. Thomas, fire, water, earth and air were the basic elements of which all things were composed.

p 14

†1 In the sense of *beginning*: That from which anything proceeds in any way whatsoever, whether in being, in becoming or in knowing, as is said in the fifth book of the *Metaphysics*.

p 14

†2 Ibid.

p 14

†3 Ibid.

p 19

†1 This refers to the divisions found within any genus, usually exemplified by the "tree of Porphyry" . . . for example, substance is divided into corporeal and incorporeal, corporeal into living and non-living, etc.