

**CHAPTER 2**  
**THE SUBJECT AND PRINCIPLES**  
**OF NATURAL SCIENCE**  
(Book 2, Lessons 1-4)

After the determination of the principles of **natural things**, namely subject, form and privation, Aristotle turns to the determination of the subject and principles of **natural science**. What are they? In any science it is necessary to know its **subject** and the **middle term** through which it demonstrates. Consequently, the first thing to be treated in this respect is the **subject** of natural science.

**The definition of nature**

Since the subject-matter of natural science is mobile being, which is equivalent to the world of nature, it is necessary to begin by defining nature.

Among the things around us, we say that some are “natural”, while others are “artificial”, or else they are designated in some other way, such as they are the result of “chance”.

We call animals “natural”, also plants and elements. What is the common note in all these, that is implied in our calling them “natural”? It is that they have **within** themselves some **principle of motion and rest**, whether this motion is growth, or local motion, or qualitative change.

Artificial things do not have as such a principle of motion within themselves, but only that of the natural substances which compose them. Thus a car does not move of itself, but by reason of distinct, independent parts which compose it, reacting to the combustion of fuel.

This principle of motion **in** natural things may be either **active** or **passive**. Thus fire burns actively, while a body attracted by a magnet is moved passively. It is an intrinsic ability to act or to be acted upon. Gravitational motion also is passive, but comes from active principles:

For gravity in earth is not a principle ordained to its moving actively, but rather that it be moved—since just as other accidents follow upon substantial form, so also does place, and consequently being moved to a place, not however in such a way as for the natural form to be the mover, but the mover is the generator which gives such a form, upon which such a motion follows.

Since natural things differ from the non-natural by virtue of having their principle of motion **within** themselves, it is possible to arrive at the following definition:

**Nature is the principle of motion and rest in that in which it is primarily and per se and not according to accident.**

- “Principle”: This principle whence motion originates either actively or passively is found in living things when one thing gives birth to or generates another. Hence the word “nature” is from the Latin *nasci, natum*, “to be born”; Greek Φύσις comes from Φύ- “to sprout”. Nature, as form, is sometimes a cause in the active sense of acting on another, sometimes in the passive sense of initiating self-motion, as in the case of gravity. Matter it is a cause in the passive sense of receiving motion, either from the form [natural motion] or from without [violent or para/supra-natural motion].
- “Of motion and rest”: Just as nature designates the principle which causes something to move to a certain place, as in the case of gravity, so also nature is the principle of remaining at rest in its proper place when it reaches it.
- “In that in which it is”: In distinction from artificial things, like machines, which do not have a nature of their own and only have the nature of their natural components, nature is **in** natural things.

- “Primarily”: Thus in composite things, even though natural, one must distinguish between what is generic or remote and what is proper to the nature in question. For example, when an animal falls, it is not because of its nature as **animal**, but because of the generic nature of the **matter** out of which it is composed.
- “Per se and not according to accident”: Thus when a doctor cures himself, the active principle of his cure is within himself, but only accidentally: The patient as patient has within himself only the ability **to be cured**, not the active ability to **cure**, as a doctor has. In all **artificial** things, the active principle is from without, as in the case of a house or a table.

The existence of nature is not demonstrated, but is self-evident. It is plain to the senses that there are many things which have the principle of their motion within themselves, i.e. are from nature. To try to prove the existence of nature is to try to prove the self-evident by something something that is less evident: the more known by the less known. However, **what** the nature of each thing is, or **what** is the principle of its motion, is not immediately clear and evident. Thus we can know that there is a principle of motion within something without knowing what it is.

## **The different senses of nature**

### **Matter as nature**

For the first natural philosophers, who had not yet arrived at the concept of prime matter, the basic matter of all things was some sensible body such as fire or air or water. Consequently, since all forms came to matter already in existence, they were in the order of accident, as with the forms of artificial things. The basic substantial elements might be either one or more than one. Empedocles, for example, proposed what became the traditional four: air, earth, fire and water.

Not only were these material elements the substance of things, but also they were perpetual and incorruptible, while the succeeding accidental forms they received came and went.

This opinion was true in that it considered matter as the subject and a constitutive part of natural things, but it was false in considering matter the whole substance. For them, there was no natural unit beyond the elements.

### **Form as nature**

Actually a thing does not come into being until it receives a certain form. It is the form which gives it identity and actuality. We do not call something which is only potential by the name of that which is actual; we do not call a piece of lumber chair when it is potentially a chair, but only when it is actually a chair.

Matter is nature, and form is nature, yet the **composite** is not properly called nature, since it is the product of nature. That is because nature is a principle, and the composite is an effect or product of the principles. [Elsewhere in a secondary or loose sense, Thomas sometimes uses the word “nature” as equivalent to “essence”, which is the composite of matter and form. Another equivalent word is “substance”, which is the composite as the subject of accidents.]

Since the identity of a thing comes more from its act than from its potency, the word nature applies more to the **form** than to the **matter**.

## **How natural science differs from mathematics**

We have seen in Chapter 1 that while natural science abstracts from matter in its individuality, mathematics abstracts from the aspects of matter that are proper to the different senses, such as sound, colour, smell and hardness.

It is plain that posterior things are not comprised in the understanding of prior things, but conversely: whence the prior may be understood without the posterior, and not conversely. Thus it is evident that “animal” is prior to “man”, and “man” is prior to “this man”—for man is in addition to animal, and this man is in addition to man. And because of this, “man” is not comprised in the understanding of “animal”, nor “Socrates” in the understanding of “man”—whence animal may be understood without man, and man without Socrates and other individuals. And this is to abstract the universal from the particular.

Likewise among all the accidents which come to substance, first there comes to it **quantity**, and then the sensible **qualities** and actions and passions and the motions following upon sensible qualities. Thus quantity does not comprise in its understanding sensible qualities or passions or motions; nevertheless it does comprise in its understanding **substance**. Therefore quantity may be understood without matter subject to motion and sensible qualities, nevertheless not without substance. And therefore such quantities and whatever occurs to them are according to understanding abstracted from motion and sensible matter, but not from intelligible matter, as is stated in *Metaphysics* VII.

Since, then, they are so abstracted from motion according to understanding that they do not comprise in their understanding sensible matter subject to motion, the mathematician is therefore able to abstract them from sensible matter. And it makes no difference as to the truth of the consideration whether they be considered in this way or that. For although they are not abstracted as to their being, nevertheless the mathematicians, who abstract them according to understanding, do not lie—since they do not assert them to exist outside of sensible matter, for this would be a lie. But rather they consider them without considering sensible matter, which may be done without untruth—just as one may consider “whiteness” without “music”, and truly so, even though they should co-exist in the same subject. But it would not be a true consideration if one should assert that “white” is not “musical”.

By virtue of the failure to recognize that things which may be **understood** apart, i.e. abstracted, do not necessarily **exist** apart, the Platonic school conceived of both types of abstraction as actual categories of being. According to Plato, in addition to individual men, there exists a universal man, called an “idea”; likewise, in addition to sensible bodies, there exist mathematical bodies devoid of any sensible qualities.

Although the concept of material body does not involve singular material characteristics, it does nevertheless involve universal material characteristics, and as such stands for the individual material body—but there is no individual body corresponding to a universal body conceived as devoid of sensible characteristics.

The mathematician, whose subject matter is the odd and even, straight and curved, number, line and figure etc., defines without motion and matter. Not so with the natural scientist: his definitions, such as those of flesh, bone, man etc., comprise sensible matter.

### **The mixed sciences**

The mixed, or intermediate, sciences are those which take their **principles** from purely mathematical sciences, and apply them to sensible **matter**. For example, perspective (in painting or architecture) applies to visual lines what geometry demonstrates concerning abstract lines; music applies to sounds what arithmetic considers concerning numerical proportions; astronomy applies both arithmetic and geometry to the heavens.

These sciences, even though their principles are derived from mathematics, nevertheless are considered more natural than mathematical. Why? The reason is because things have their determination from their term, and the term of these mixed sciences is natural things.

In this respect they are the converse of the purely mathematical sciences, for these begin from sensible matter and terminate in the abstract. The mixed sciences begin from the abstract and terminate in sensible matter. Because of this application on the part of the mixed sciences, it is plain that the purely mathematical sciences must abstract from sensible matter.

Since, however the mixed sciences are not purely natural, they will demonstrate their conclusions by another middle term than the natural sciences. Thus, whereas the natural scientist will demonstrate the sphericity of the earth from the properties of the matter composing it, i.e. by virtue of all its parts tending to the centre, the astronomer will do so, for example, from the shape of a lunar eclipse, or from the fact that the same stars are not seen from every part of the earth. [Most modern physics is “mixed science”].

### **Natural science considers both matter and form**

Since both matter and form are nature, as principles of motion and rest, natural science treats of both. This is in contrast to the first natural philosophers who thought of nature primarily in terms of **matter**, [and to the tendency of some modern scientists to restrict their consideration to the quantifiable or measurable aspect of things.]

That it is necessary to consider form equally with matter may be seen from all the **arts**, where both are considered: the builder considers his materials in view of the form of the building; the doctor considers medicine in view of the health he wishes to attain. Since the arts imitate nature, the same importance of form must be true of nature.

Another reason why natural science considers both form and matter is the fact that form is the **end** of matter. In effect, the final form intended dictates what will be done to the matter. Thus in the arts, the one who designs the form of a ship specifies what the matter shall be. The form of the ship induced into the matter is the **end** of the construction of the ship; ultimately the **use** of the ship determines the form, and the form determines the matter.

### **The limit of natural science**

Natural science considers “nature”, “form”, “cause” etc. only in so far as these exist in matter. To consider them absolutely, i.e. indifferently whether they exist in matter or are immaterial, belongs to metaphysics or “first philosophy”. Aristotle uses the comparison of a doctor and sinews: the doctor does not consider the sinew as such—since this belongs to the natural scientist—but only in so far as it pertains to health; so the natural scientist considers the forms of things only as they are in matter.

The limit of the consideration of natural science is, therefore, those forms which in a certain way are separated from matter, but still have their being in matter, namely, rational souls. These are separated in that the intellective power is not the act of any corporeal organ, but are in matter in that they give natural being to the body they inform.

The consideration of forms totally separated from matter, however, and even of the rational soul in the state of separation from the body, pertains to first philosophy.