On the Nature of Things According to Their Own Proper Principles

CHAPTER I

That the construction of the world of nature, and the magnitude of bodies therein contained, should be investigated not by reason alone as the ancients believed, but by sense experience.

It appears that those who before us diligently investigated the construction of the world and the nature of things only imagined what they thought they knew: for it is clear that they achieved no certain knowledge. What they said is filled with internal contradiction. These investigators are not even in substantial agreement among themselves. Overly confident of themselves, as if competing with God himself in wisdom, they neither looked upon the things of nature in the light of nature’s own laws, nor did they see them in relation to the powers with which things come naturally endowed. Thus, in their daring to search for the principles and causes of this world by the use of the unaided reason, and in their strong desire to succeed in this endeavor, they only invented a world according to their arbitrary will.

To the bodies of which this world is composed they conceded neither the magnitude which properly belongs to them, nor the position which they have come to occupy, robbing them of the dignity and the power with which they come naturally endowed. They ascribed to the things of nature only those characteristics which their reason dictated they ought to have. I say that it is not proper that men should be so proud as to attempt to take precedence over all nature and emulate thus not only the wisdom, but also the power of the Almighty.

Bernardino Telesio

We, not so confident of ourselves, endowed with a slower intelligence, and less ambitious lovers and students of all human knowledge, desire more humbly to investigate the nature of this world and every part of it, together with the passions, actions, and operations of the things contained therein. Our knowledge will have reached completion when the things that sense experience now displays are shown to be conformable with things already known. Only then will we have attained perfect knowledge. Indeed, if we really attain to this condition, the magnitude and the form of each thing will be revealed to us; and with these, the property, power, and nature of all things.

If these writings do not show anything of divine worth or great subtlety, we hope the reader will not be offended or hold this against us. We shall follow nothing but our observations, sense experience, and natural powers as they operate naturally and in harmony with one another.

CHAPTER II

That the whole world appears to be composed of sky, earth, ocean and air in addition to large bodies.
That the sky is of the same substance as the sun and the stars.

At first view, the world-universe would seem to be composed of sky, earth, ocean, and air: the latter filling all of space and obtaining between the earth, ocean, and sky. We cannot by means of our senses attain to the farthest reaches of this great expance of air, but only to that portion which, contiguous with the earth, thrusts itself against us when it is slightly stirred, entering into such things as bellows, wineskins and, indeed, into our very bodies.

That portion of the air which includes the distant sky,
and which is very remote from us is quite unknown to us as it is wholly hidden to sense. Nevertheless, these facts can be drawn from what we know by experience: that all the space between the earth's atmosphere and the stars, and even the sky beyond, must contain some kind of body that is similar to and compatible with those bodies to which it is contiguous and neighbor. It is quite evident that nature is propelled by self-interest. In fact, nature can tolerate neither a vacuum nor anything without purpose. All things enjoy touching one another, and maintain and conserve themselves by this mutual contact. Indeed, they so hate being disjoined and separated, that if some body is pulled away from its neighbor in such a way that neither air nor any other substance is allowed to replace it, its divorced partner will immediately follow it even if it is immobile in its own nature or its own proper motion is contrary to that which it thus pursues.

We cannot believe that the outer reaches of this air of ours can of itself be that which prevents stars and other bodies from touching. Rather we should say that continuous and contiguous bodily being obtains between the air and the stars. The diverse and simultaneous movements of all the stars shows that they are fixed onto a single body about which they wheel. Indeed, if they moved of their own accord, since they are all of the same nature, those with great paths to traverse and those with lesser paths would never be juxtaposed, as we often observe them to be. This must follow from the fact that they are contained and carried in one body. Otherwise, all would revolve eternally about the same center with the same velocity.

We must concede that the body on which the sun and the other stars are fixed must be of the same substance as they are. We cannot conceive of this body as being contrary or dissimilar to them since they are neighbors and contiguous. Also, we cannot believe that they oppose or exclude one another but, rather, that they must be similar and compatible. Indeed, we believe that they aid, mutually embrace, and conserve one another. Nor can we believe that the observable, fixed wheeling could ever characterize the motion of the stars if they and their neighbor bodies were not of the same nature and endowed with the same powers. Those things which entities accomplish, they accomplish not by means of alien powers; nor do they receive their proper powers from any foreign source.

The sky is of the same substance and, in every way, of the same nature as the stars. Not that like them it heats, sheds light, or is wholly visible; but because in the stars, light and heat have become extremely lethargic and sluggish. Indeed, it is evident that the sky is endowed with an extreme tenuity and subtlety. The sky neither changes nor diminishes our view of the dense stars which are situated in that rare and fine vapor. These visible star-flames clearly demonstrate that heat and light diminish as they become more tenuous, rarefied, and weak. By contrast, in the dense and aggregate, they swell and increase in power. Heat applied in things more dense will quickly make them appear hotter and brighter. By contrast, in the more rarefied and subtle, heat is sensibly weakened and diminished. Thus, no matter how close heat and light may be, in a tenuous and subtle medium they appear neither luminous nor clear. Hence it must be the case that the sky is endowed with the same forces and the same form as the stars; but only when these forces are more numerously collocated and dense do they become manifest to us. The world-universe is composed, like the great bodies, of sky, earth, sea, and air; and the sky is of one and the same substance as the sun and the stars.
CHAPTER III

That the world-universe is composed only of sky, earth, and large bodies.

If now we consider the matter carefully, it becomes clear that neither the air nor the seas are the principal parts of the world-universe, but, rather, only the sky and the earth. Nor can we believe that everything between the sky and the earth is air, and that it is completely homogeneous. We ought perhaps to regard all of the air in our immediate and contiguous skies in terms of that air which obtains on the summits and above the mountains. Although the upper sky touches directly our own lower air and is one with it, this latter is yet contained in the vast and immense sky. We must admit that the whole is identical. All the air must be similar and conforming, since it is all quite naturally hot, like that substance which becomes sky when it becomes excessively hot or earth when excessively cold. This matter, air, has in its upper part entirely become hot.

Therefore we do not doubt that the further the air moves from the earth, the more thin and warm it naturally becomes. From this phenomenon, it appears manifest that all the upper air is endowed with the nature and the power of the sky. When it is compressed, it becomes as we see it, lighted and stunning, as is clearly shown by the stars which run through the firmament, and by the comets which Aristotle thinks are generated in the air. But these comets are not generated in the air. It is more likely that they are made of something that is a little more dense than air, so that, by nothing really contrary to their nature, they are brought to their condition. Beyond this, we conclude from the fact that the air in the sky turns into or performs the same operation as the sky, that it is of the same nature as the sky. The motion of the comets themselves shows that the air moves with the sky and the stars. Each comet turns or faces the fixed stars and moves with them. We must conclude that they are of the same nature. But this is not to say that the lower air which remains, and can be observed, does not move with the sky and is not one with it.

Now all this expanse of lower air together with the oceans stretch for such tremendous reaches that they can be located from any part of the world. But even if the two were conjoined, they would still be greatly surpassed in size not only by the sky, but by the earth as well.

The truth of this may not be immediately apparent; still it may be safely assumed. For the sea, which is superimposed upon half the earth, does not descend to its center, or even to its deeper parts. The sea lies in such a way that it is a shallow whole, its depth not to be compared with that of the earth upon which it rests. According to some mathematicians, the total area is only twenty-eight thousand stadii. Others think it to be much more. According to the usual measurements, the depth of the ocean hardly extends a single degree at its greatest depth. At this depth, cerulean color is generally manifested; when deeper, the water appears darker and more obscure. But even in the Strait of Sicily where it appears very deep and very dark, the water's depth does not exceed two degrees; and it is as deep at this point as anywhere in the ocean. Clearly, the ocean cannot be compared to the greatness or the extension of the earth upon which it is superimposed.

Leaving the sea for a moment, the air which is contained amidst the mountains is seen to obtain in very little space. The highest mountains, according to some expert mathematicians, rise not more than ten degrees in height. Therefore—even assuming that they exceed this measure—the space which remains between them is nevertheless in proportion to the ambit of the earth's circuit at any moment. Thus, as was said, the magnitude of the ocean and air taken together is greatly surpassed by that of the sky and the earth. Indeed, they are not to be compared either in quantity of material or in weight.

Meanwhile, having compared the oceans and the air to the earth and the sky, we can now consider the parts of the
world in a larger context. The earth cannot be considered very large in comparison to the great sky. Not because it is far surpassed by the totality of the bodies in the sky taken together, but because of their superior space and magnitude, quantity of matter and weight. The earth cannot be considered as being any part of the sky. Hence, if the earth became rarefied and its density were diminished, or if the sky itself became glutinated, restricted, or made more dense, then perhaps on these grounds the earth would greatly increase to the extent of appearing a larger part of the world-universe. For it would then contain, if not greater space, at least greater density of material.

CHAPTER IV

That the sky and the earth alone are the principal bodies of the world-universe.

We can see then that the sky and the earth are not merely large parts of the world-universe, but are of primary—very of principal—rank. We mean to say that they transcend all other parts not only in magnitude, but also in power and in strength. They are like mother and father to all the others, and are that from which all the others are constituted and made. Not only are all things below the surface of the earth made by them, and manifestly composed of earth by the sun; but also the air and all the waters including the sea are similarly constituted. Certainly the sky and the earth present themselves always the same. It appears that neither of them is constituted or corrupted by the other but remains always unaltered. Only the uppermost parts of the earth seem to be altered by the sun, while nothing appears to change the sky. Nevertheless, the sun’s operation and the operation of those things which are greatly similar to it are changed by the earth. Also, those things which are made in the depths of the earth, or those which derive or grow therefrom: the metals, the broken sulphuric, bituminous, or nitrogenous rocks; and, furthermore, those sweet and gentle waters, as well as the plants and animals—if these are not made of earth by the sun, one cannot imagine of what else or by what other agent they could be made.

The ancients doubted not that everything is made of earth. Some, however, thought that the quantity of the sea and the air take precedence and are endowed with supreme powers. They also believed that these depended on nothing else, and were converted and reduced to the nature of earth, bringing about all changes out of their own substance. It is a fact that no amount of earth mixed with any quantity of water or air has ever been observed to become either of these. However, it may be seen that the air in water, even marine waters, is transformed into crystal and ice, thus taking on the nature of earth. But it cannot be that cold is the sole characteristic of any of these substances, for the air, the water, and the sea are all corrupted by cold and reduced to earthlike matter. We cannot doubt that all those things would be finally reduced to earth if the power of the cold were not impeded or turned back by the sun.

Considering primary things and their constitution, it would appear that they are all made of earth by the sun; and that in the constitution of all things the earth and the sun enter respectively as mother and father. From this observation we can see that all the waters, and the ocean itself have been made by the sun out of the earth, since they never cease to run and never become sweeter or more diffused. If they were not made of earth long before the rest, and particularly from the earth’s uppermost parts, so many fountains of water would not be emanating, but all would long since have disappeared—including stagnant pools and deep-filled crevices. Furthermore, we would not be able to understand, contrary to opinions of the ancients, how those currents could return to the sun from the earth; since, of the lands from which rivers flow into the sea, those
which seem to be lowest are yet higher than the sea. Grow as they may by the flux and reflux of waters, no matter how much freedom they be given in their course, they will still always flow into the earth. That which has already run downward will be elevated, and will in this way surpass the altitude of the sea; because if the entire ocean has need for a larger place it will seek it as a whole, and not merely raise its separate parts. Also there can be no doubt that the rivers return from the sea; for if they did not, then they would no longer spring abundantly from the higher places, as we see happening in all lands but, rather, proceed from the lower ones. Therefore, as we said, since the sources of water never cease, we must admit that they are made by the sun out of the earth, including the sea, because it never ceases or diminishes.

As can be verified by the sense experience of everyone, the ocean is continually diminished by the sun, becoming less salty and less dense, its salinity and density continually diminished. Thus when ocean water is reduced to vapor by some degree of heat, and then reconverted into water, it becomes sweeter. Clearly this shows that when the ocean is made less dense it becomes sweeter. Now the ocean is constantly being reduced to vapors which then return to the sea; hence there is forever pouring into the sea an immense quantity of soft and sweet waters. Because therefore, always, and in many ways, the density and salinity of the seas are continuously being diminished, it is clear that these properties come to the sea from some other source, or doubtless it would have long ago all become soft and sweet.

We cannot doubt that such great quantities of water can be drawn from the earth by the sun. Nor can we doubt that the salt which is reduced to sea water originates owing to the deprivation of whatever heat obtained in its more rarefied parts. Again, considering the lesser quantity of ocean as compared to earth, we may well raise the question as to whether the earth, when deprived of so much of its waters and vapors, will not in the end come to lack them altogether. Having become supremely dry and dense, it could no longer be softened and converted by the sun. Again, although the sea is continually augmented by so many waters, we may well inquire as to why it does not increase to infinity.

Now the more rarefied parts of the sea—those which continually flow into the earth—cause rarefaction in the mass of which the earth is continually divested, and return it thus to the sea. In this manner the sea takes away that from itself which is continuously added to it. It cannot be that the waters which flow in and out of the sea and which are continually made by the sun, enter the earth and are carried to its uppermost parts. Nor can it be observed, in any way, that these return again to the ocean. Such is not the property or the nature of waters. They cannot be attracted by the earth from their lowest depths to its uppermost parts. Nothing presses us to say that if the sea and the waters did not flow back, there would be nothing to make them return. Nor can we deny that the earth can be converted into water: for any dense earth, and even rocks, are resolvable by heat into vapor. This fact, indeed, was known to the ancients.

The sea can be reduced into extremely hot and rare vapors, and can become something very dissimilar to water. It is clear that the sun, drawing all the waters from the earth, can also pull the air from it in the same way. We can thus see that all the waters are resolvable by a small amount of heat. From them, and particularly from the oceans as we have said, we see vapors rising. These vapors are commonly denser than air, but in no way different, although they are carried a little higher by it and become thus more rarefied when they pass into the nature of air. Vapors do not appear as higher parts of the earth from which the sun daily derives its vapor. Also this diffused substance does not manifest itself to us, because it is made of a denser stuff and by a heat that is not so strong. Yet in reality it is more rare than that substance which can be seen breathed forth. Thus it can be understood, if we seriously seek to comprehend those things which are between the sky and the earth, that they, as all others, are made by the sun. This fact will be made more clear when we look at the sky, the earth,
beyond; and at every other thing: at actions, passions, the species of both, and of all.

The earth and everything else is changed by the sun. Things are also observed beginning to interpenetrate; and all are reduced almost to the same nature. Supreme heat, whiteness, light, and motion are found in the sun. By contrast, there is in the earth supreme cold, darkness, and immobility. Also, in exactly the same way, in all other things there is nothing but hot and cold, light and dark, power and impotence for self-motion. There obtain contrasts of such a kind that the form and the powers of all things are like those of the sun and of the earth; differing only in that they are not supreme and entire in these other things, but are rather diminished and subdued. They are diminished by contraries, and reduced to being something between one and the other. We mean to say that all entities are either hot or cold, light or dark, mobile or immobile. None of them, however, except perhaps fire, which may be considered as one with the sun, is equal in heat, light, or mobility to the sun. None, moreover, is equal in cold, darkness, or immobility to the earth; none, again, appears to be all earth or to be made the same as the sun; but all derive change from these into their own nature, power, and form.

The parts of which we have been speaking are to be considered as the primary and most important parts of the world-universe; preceding all others in power, dignity, and time. But in truth, only the sky and the earth can be so considered. Not being constituted by anything else, they do not depend on anything other than themselves. They are self-constituted. They are changed solely by themselves, while they generate and undo everything else. Therefore, the air, the ocean, and all other things are secondary parts: made, like all the others, from earth and sun. It is by these that they are continually changed and corrupted.

In support of these observations, the sacred and divine letters testify that the sky and the earth were the first bodies: saying that in the beginning they were those that God first created.

CHAPTER V

That all things are constituted of two natures: of one that is made and unmade and of another which remains unchangeable. That from the latter is given the mass and the body of things, and from the former the form and the property.

Basic as sky and earth may be said to be, the underlying substance which makes up everything is neither sun nor earth but something else. Those entities which become corrupted are not destroyed, but are really converted into different substances. Thus they do not show up in the generation or corruption of anything or everything, although they are involved in the thing's change or mutation. The being that is newly generated is constituted in such a way that it remains what it was, but takes on a new form. Hence that which is corrupted does not altogether perish. Only its form and its properties perish, while its body and mass remain the same. Hence, properly speaking, all entities are composed of a certain corporeal mass and of a certain other feature, but are not made of numerically the same mass or of the same nature. Each thing is constituted more or less on its own. Substances are very different—sometimes even in opposition to one another. Further, we can see that this same matter is arranged and modified in different ways. Although it may be compressed in itself and reduced, and then decompressed and dilated, it nevertheless neither perishes nor reduces to nothing. Nothing comes to take its place. However, natures differ, and some perish altogether, becoming nothing; and other natures succeed in their place. Sometimes these latter natures are very opposed to those whose place they take.

Now the earth appears to be a certain corporeal mass, very much compressed unto itself and confined: entirely dense and cold; full of darkness and obscurity; immobile
and lazy—almost as if dead. Fire also is truly a certain corporeal mass; but it is supremely expanded and dilated; endowed with heat, whiteness, light, and with a supreme capacity for self-motion. When the earth becomes fire, nothing else but earth appears, and the things of which it is composed disappear, becoming nothing. Its whole mass remains, that is, but its arrangement and other characteristics perish absolutely.

In place of the density, cold, darkness, obscurity, and immobility, there succeed opposite natures: rarity, heat, whiteness, light, and mobility. Therefore earth, sky, the sun itself, or any other being, however much it may appear homogeneous and simple, is never constituted by one and the same nature. Rather, any being whatsoever which fluctuates between creation and extinction, however endowed or composed of whatever number of natures, displays its own nature. It follows then, that if there are two works of a single nature, one of which is matter, the latter never perishes or dies but perpetually remains in all beings. The other brings or induces in things their arrangement, their form, powers, and capacities. It is one nature alone which induces all changes, and brings into being the things that really perish and are really born.

CHAPTER VI

That the nature which appears and disappears is not one and the same, but multiple and endowed with active powers; and that it is incorporeal.

We see that the inducing nature which comes and goes in bodies brings them form, properties, and power; and that these natures are not only different in different entities, but are, as well, opposites, tending to destroy one another. We must not think this nature to be one and the same, lazy, dead, or inactive; but rather as being multiple—such that whatever portion and species of it be endowed with active virtue, this part throws all other parts out of their own proper place. By itself this active part dominates and constitutes things, and works in those already constituted. We must not think, however, that because the heat, rarefaction, whiteness, light, and mobility are the nature and condition of the sun and of fire, they are of the same substance as the others that are in the earth, such as cold, density, darkness, obscurity, and immobility. They are not of the same nature in the same way. We have no objection to the idea that those things which are not endowed with opposite powers, or which differ not in powers but vary only in degree of power, are all made up of the same nature. It can be understood from this observation that their structure is so closely related as to be almost one and the same. In fact, they mutually support and conserve one another, in no way offending or offsetting one another, so that where one thing is made, the others also come about immediately.

This is not the case with the things that are in the earth. They perpetually oppose one another; forever disturbing or destroying each other. They do not desire to be together, nor can they remain together in any way. While one of these is being made, if all others do not perish, at least those which are opposed to it either quickly perish, run out, or suffer diminution. These are made of opposite natures. Moreover, those which are of a nature similar to that of the sun, but which yet are not endowed with identical powers, appear to be constituted, though not entirely, by a single nature. Still these are endowed with different powers; and for this reason and in this respect they are differently constituted and hence entirely different from the substance of the sun.

The natures and conditions of things which are in the earth differ from those which are in the sun, even as they differ from the sun. The conditions of any such substance, in whatever bodies they may be found, come entirely from
the earth of which they have been constituted and made. Furthermore, no thing is of a nature different than that of the thing which has constituted or made it. Natures cannot, and do not, introduce themselves into the beings in which they are found. These facts are true for anything whatsoever that is made in nature. However, sometimes the natures and conditions of things which seem to be made of the same substance do differ and greatly disagree with one another, so that they mutually offend and persecute each other to the point of destruction.

That there are things in the sun and the earth which are not homogeneous substances, but are composed by one of them as mixed entities, does not mean that the nature which comes and goes in a thing is double. It is really one and then the other. That from which each thing is constituted is divided in many—distinct in species. Thus, as was said, things make one another reciprocally. If they did not mutually disturb one another, and occupy one another's place; and if each did not constitute itself, they would never convert into one another as we constantly see them do. However much we would wish to see them come together and to join with one another, each tends to conserve itself in its own nature.

We have seen that only those natures which are active introduce themselves into the things in which they operate. Hence those which never perish, never become altogether extinguished or turn into something else, but only change into their opposites. Those, moreover, which are of a nature that partakes of both, are correspondingly altered, diminished, and reduced to their opposites. These fly only from those things which are opposed and disturbing. Opposites act in this manner as a counterforce.

It must therefore be admitted that the natures which are generated and corrupted are endowed with the power of insinuating themselves into their contraries, and destroying them. They also suffer, and are destroyed by them in turn, and by all constituted things as well, so that they may operate in the things already existing. Having discarded the nature which was first there, the same matter and the same mass remain; and another nature enters into the same mass. Another operation is thus born, which characterizes the newly acquired nature. It also appears that this nature is incorporeal; and that in itself it could not be hosted by any body whatsoever. We can see that things have not changed entirely into other things by virtue of any corporeal acting nature which changed them, influenced them, or added to their matter. The active agent only structures them differently: that is, it makes them more rare, more diffuse, more dilated; or more dense, more compressed and restricted. All this is accomplished according to the property of the active nature as it enters afresh into the thing.

Since it was this agency that made the thing what it is to become—changing neither its mass, its particular appearance, nor anything else that can be seen—it seems endowed with a different nature and with different powers. This nature, as we said, is incorporeal. Things are made different by its coming and going, in response to which they take on individual natures and distinct powers. Nothing would be truly one or perfectly whole, or endowed with the same virtues, if the nature it had received were not incorporeal. Indeed, if that nature were corporeal, it would not enter into that mass. It could not mix with it, becoming one with it; nor, as we can observe, would it appear homogeneous with the whole. As corporeal, it could never make itself one and the same with the substance into which it enters. If it were not thus, it would be impossible to distinguish between the received nature, the original nature, or the newly mixed nature.

It is the case, then, that the nature which comes into things and departs from them is indeed multiple. Thus, whatever its quantity and species, it is incorporeal and endowed with active powers—powers which drive out some things from their own place and destroy others, producing themselves in their place. These forces change and constitute substances, and are operative in bodies already formed.
CHAPTER VII

That the remaining nature is corporeal, all one, without action and operation whatever. That it receives and conserves the active natures which operate.

The nature which remains must be taken to be entirely corporeal and one and the same throughout. Although all things manifestly become corrupted and change into other things, or take on other arrangements and other forms, nevertheless, the mass and the body remain. If it were incorporeal we should not be able to comprehend the way that a body is constituted, or how incorporeal natures become bodies. Not even the Peripatetics, although they inquired into the matter very diligently, were ever able to discover how this could occur. The very best of them thought this nature to be corporeal. If it was not all one, proper and common to all active natures, joining equally with all, or if all things were not constituted from a single matter, but were made of various entities by different substances; then no active nature whatever—which we see happening—would introduce itself into matter. Nothing could be made of a common matter, but only certain kinds of active natures would enter into certain kinds of matter. In this case all things could be made only of certain entities, and would not be able to enter into a heterogeneous mixture with any other substance. Indeed, only those things could be made which are mutually interchangeable with one another, because they have to have a common matter.

The said receptive nature, that is, matter, does not appear to be endowed with any active virtue, but seems entirely passive, as if dead. We can thus see that action does not derive from anything except that to which it properly belongs and from which it takes its origin. When another nature supervenes upon the same matter, another ac-

CHAPTER VIII

That the active natures contend with one another because each desires to occupy the whole of matter. Yet in the same matter there cannot be contained many natures together.

It is not blind and senseless chance, then, that brings the active natures into perpetual conflict. They all desire in the highest degree to preserve themselves; they strive, furthermore, to grow and to reproduce in their individual subjects, all of which are capable of every variety of growth. But a multiplicity of natures operating together in a single subject could not move in a single direction.

Now, not any subject selected at random would be a fitting host to any nature, but only to that nature which is proper and adequate to it. It does not happen in living beings that the nature which comes upon a particular material becomes indistinguishably and numerically one with...
it. Indeed, if such were the case, this nature could not manifest its activity in more than a single subject.

Further, it is necessary that the nature be proper and adequate to the action. It is important that the instruments and organs involved be not artificial—because the subject, host to the nature which operates in it, must be wholly in accord with its manner of functioning. The activity of such a nature depends upon the whole, is attached to the whole, and is entirely unified; so that those operations which characterize it cannot be intrinsically more active than the capacity of the matter which contains it.

Thus we see that any nature which supervenes and renders the matter into which it enters capable of its proper action and operation is neither capable nor desirous of being alien to that matter. In this way, in the quarrel and strife of the active natures, one nature will at times win over another, defeating it; and on yet other occasions it will become defeated by the other and lose out.

### CHAPTER IX

That rarity, denseness, light, darkness, motion, and immobility are not endowed with the power of operating actively on themselves.

We see, then, that the sun and the earth operate actively, not in the mass or the body of the whole, but in those natures which are generated and corrupted in things. If we realize that these agents are all actively operating in relation to those which are opposed to them, and which in turn suffer opposition, thus constituting themselves in the subject of their opposites, it will become evident that all things are endowed equally with active power and with passivity. If we see that only one nature is of this kind and that all the others are constituted by it, it will clearly be the case that only this one is active and the maker of all the others, and that all the others are merely passive, the work of one agent.

Rariness, however, whiteness, light, and mobility—in so far as these are in the sky, in the sun, and in things that are generated—we see constantly made and unmade. It is evident, then, that they are not endowed with active powers. Nor is it clear that these dispel any of the opposites of subjects, producing in them their own substance and taking their place. Indeed, notwithstanding that rarefied and fine things are opposed to thick and dense ones, the rare do not become dense and the dense do not become rare. Only in those cases where the mixture of two things is accomplished such that both are changed can we find two agents obtaining in an opposite.

However, it is not admissible that those things which are extremely rarefied, thin, and apparently ready to move, depend for their motion upon the rariness. The rariness is itself the work of that same nature which also produces motion as subject-agent proper to itself, as we will later show in detail. It is also the case that light actively operates in darkness and obscurity, and that it renders the air—which in itself is invisible and dark—visible, making it shine. Light spreads by means of darkness, and in it makes itself visible. Those things which are dark and obscure and opposed to light, illumination casts away and prevents from occurring. As we have shown elsewhere, this character is the virtue, the action, and the property of all light. It can in a flash reach over to any other thing, no matter how rare or dense it may be.

Nevertheless, it is not evident that darkness and obscurity disturb the light from its own subject, constituting themselves in it as do the active natures. Neither does the light which comes to occupy the place of darkness and obscurity chase these latter from its own place. Light does not perform this action by its own operation, nor could it ever accomplish this if it were joined with a little heat, for great heat is requisite. As we said, the light of the sun, even be-
fore it is great and splendid, does not constitute itself, but performs this act only after its power has become almost that of fire.

Certainly it is not for the reason that it is shiny that light produces itself and the other things which we see generated by it but, rather, because it is hot. Thus, if the light, powerful and whole, is not seen as being endowed with power to activate in the darkness or to generate subjects by itself, it must be very far away and possessed of a diminished and weak light. Indeed, as long as light does not appear, it is nothing else but a living whiteness, visible only as such. Whiteness glows as a light not visible in itself, but diminished and weak. Yet when it is placed against things which are howsoever black, it does not appear that black affects it, or that it in any way changes anything in the black. Where one and the other are mixed, it is the case that color is produced between them. It is because the one, that is to say, when it is mixed with the other is changed by it from its own proper subject, that they can be seen together. If, furthermore, one could be separated from the other, it would be evident that neither had suffered any change whatever, but that each had preserved its own proper nature.

But to expand: mixed things do not eliminate mobility, nor does immobility change them in any way, in cases wherein they respectively constitute themselves in place of one another. Also, moving beings do not lend the power of motion to immobile ones; nor do the immobile diminish the mobility of those that move and render them static. Even the sky which is supremely mobile and is perpetually turning around the earth has never made it move, but transforms it from a distance. We also can observe that the sky and the air which turns with the sky not far from the earth are never divested of the power to move.

CHAPTER X

That hot and cold operate actively within one another. That from this depends rarefaction and denseness, light, darkness, motion, and immobility.

It is evident that hot and cold are active in and of themselves and that they continually fight and displace one another, the one occupying the subject of the other. Also, from these, rareness, whiteness, light, and motion come about, as also density, darkness, obscurity, and immobility. But not all are equally made by hot and cold; some, rather, by cold, and some by hot. The actions, aspects, and operations of all opposites depend ultimately upon these contrary natures.

We see that rarefaction is engendered by heat, follows it, and is properly its very own. Indeed, where there is heat in active operation, capable of converting, there is also, if the heat be great and overpowering, rarefaction in its extreme forms: smoke and very fine vapors. But where the heat is not great or not continuous, minute particles will remain. Even very dense and very hard things, such as stones, iron, and earth itself are converted by great heat and are finally resoluble to vapors and smoke.

On the contrary side, we see that all things that become cold become dense, frozen, and in every way solid and hard. Also, very fine vapors become water and snow, and water— even the sea itself—becomes ice and crystal. Finally, if the cold is extreme, these vapors are reducible even to earth. Such an event, however, cannot occur in the uppermost parts of this earth, as these are kept warm by the sky and the stars.

Anything which is hardened or made dense appears to be the work of heat. Some things, however, which are not wholly homogeneous are not wholly made dense by it. Only their rarer and thinner parts become converted into smoke.
and vapors and seem to disappear. But having thus had the parts consumed which were softest and most liquid, those which remain become more dense and hard, so that these, not having been converted by the heat, are then free to perform the operations proper to the things they have become.

Nevertheless, that material which has been overcome and converted by heat and is already exhausted in rareness would be converted even more dramatically if the heat were stronger and more continuous. But in the case just discussed this conversion does not take place with respect to the solids which remained.

Even light, doubtless, belongs properly to heat and manifestly follows it, since it is generated by it. However, that heat which is in the highest degree powerful and pure, that which exists in rarefied things and in that which is made up of great quantities of heat, is seen only in fire. Therefore, it is this power which is in those substances that are supremely hot and supremely rarefied and in those that are so formed as to be resplendent and to cast light.

Not only smoke, but also anything tinged with sulphur, when put close to the flame becomes luminous and splendid. Thus it is only when the heat which it lacked before is added to the sulphur that it can become flame. Cold, on the other hand, is completely and entirely in opposition to the nature of light. The flames demonstrate this observation when they are set in the deepest parts of the earth where obtains the greatest cold. There we see flaming bodies extinguished. They become extinguished because the cold is stronger and can smother and destroy the heat which is followed by light. From this fact we can see that whiteness is made from heat. Indeed, it cannot be that the diminished and soft can be made from any other nature than this whiteness from which light itself in all its power derives. Moreover, whiteness is entirely proper to rarefaction which stems from this principle and perpetually follows it, as shown in the treatise On the Generation of Color. Whiteness, even as rarefaction, is the work of heat.

Finally, it can be noted that motion is exclusively the work of heat; and conversely, immobility is altogether due to cold. All things moving and immobile prove this point clearly. All cold things appear to be made of earth and its constituents. The others, on the contrary, are warm—like the sky, fire, and the animals. Also those beings quick to move are still warmer. We cannot conceive that rarefaction or density, light or whiteness, darkness or obscurity, or motion and immobility operate actively, even by their opposites. Rather, all of these are born from hot and cold. We must attribute the entire power of activity to these two principles. However, it may seem that motion creates heat and other things that appear, indeed, to be made by heat. Thus we have next to consider whether motion is made by heat, or heat by motion, and also whether both interchangeably make things, and are therefore of the same status and dignity.

CHAPTER XI

That heat is prior to motion in nature, time, and dignity. That motion is wholly the work of heat. Why motion makes heat.

Those who search for the excellence and the dignity of heat and motion and of whatever is prior to them must properly consider the nature and properties of the one and the other. They must also note the way in which they reciprocally generate one another. Furthermore, things which concern their substance and their powers must not be overlooked. Let us then consider the condition of both, and what belongs to each in particular, and to their reciprocal generation. We intend to establish that heat is the substance of those things in which it is found. We will also show more clearly, in its proper place, that heat remains
it can possibly be born out of any other substance. Indeed, we see that wherever there is heat, there also is motion in operation. Furthermore, this operation is not common to other natures in the same way, nor is it contingently attached to heat. Heat does not produce this operation by chance, nor does it in some irrational way cease to effect it. Coming solely from heat, motion is joined to it, and dependent on it in such a way that heat and motion are indistinguishable.

That the nature of heat must be considered as highest and most rarefied and as entirely perfect for its subject, we must concede. In fire, for example, it is evident that heat is in no way conserved and vivified by motion, but is preserved solely by its own nature which, if not actively in motion, would lead the fire to be extinguished. Motion so depends on heat that it is not born from any substance which is not constituted by heat. Who can say that the operation which we have seen, belonging to heat itself, and constituted by the sky, is not in accordance with the natural properties of heat and what it produces? All the elements in the sky are gathered and conserved by heat. This heat-force operates perpetually, without sucession. It is seen to be born from nothing else, and derives simply from the nature and property of heat, never being dependent on another nature.

It is for this reason, then, that heat makes motion: because it is born of heat's substance and nature. Motion cannot derive from any other nature, for wherever motion appears, there also must be heat. That thing, therefore, which is agitated and forced to move itself must necessarily be set in motion by the nature and property of moving entities which are hot. The earth, however, remaining always the same, will not effect those operations which depend on the nature of the sky and of fire, but is itself converted into sky and fire. It cannot be denied, then, that earth assumes the property and the powers of sky and fire, whose operation it is to effect.
We see then that heat expands and that cold contracts, conglutinates, and condenses. Heat, producing motion, renders the affected subject proportionate to itself, so that it can raise and transport it. Heat’s power makes the subject thin and light, such that it is oppressed and impaired in its self-motion only by the remaining traces of matter. Indeed, flames lighted in denser things remain motionless, retreating from their own nature. Only those parts of these things which have become more rarefied rise. Therefore, heat rises and moves, having made itself proportionate to the light subject. By contrast, cold thickens the things that it occupies, since, enjoying this immobility, it organizes the subject to its most dense capacity.

Thus it is evident that hot and cold strongly abhor one another, and are contrary to one another. The one and the other desire the same matter and the same subject, but want to organize it very differently. The dense, which is most in accordance with and favorable to the nature and the operation of cold—if we speak of immobility as an operation rather than as the cessation of functioning—is extremely unfit and ill-adapted to the workings of the sky, which embraces and conserves heat. Notwithstanding the fact that rarefaction, light, and motion belong to heat, while density, darkness, and immobility belong to cold, they are not to be thought of as dynamically unrelated forces. Rarefaction is proper arrangement for the subject

It appears that only the sky and the earth are the first and principal parts of the world, and that from these everything else is made. It is also true that of the substances in the sky and in the earth, respectively, only heat and cold operate actively. Furthermore, all other conditions of the one and the other do not act at all, but are brought about entirely by heat and owe wholly to its operation. Thus everything in the sky is made from heat and constituted by the sky. Everything is actively made by heat or by those substances which heat actively engenders. The earth itself contains nothing that acts, or makes anything, except those things which are made and constituted by cold. It therefore must be admitted that the sky and the earth are composed respectively of hot and cold. There is in the sky and the earth no other natural agent; and without these everything would remain inoperative and inactive.

If any greater proof is needed that the sky is made by heat, we need only to observe that all things that we see produced by great heat become like sky. Pure fire and flame, which are made by extreme heat, may be observed to be very rarefied, white and light, like the stars. The sun is the first among all things formed by heat. From this fact, we see that the sky is distant from earth and is opposed to it, not perhaps so much in space but in operation. It follows that the sky is constituted by an opposite nature from that
of the earth. As we have said, all other things are made by the action of the whole sky, especially that of the sun on the earth, and are derived from the earth by this action of the entire firmament. There is nothing in the macrocosm which is not of the sky and the earth. All is akin to them, is composed of a mixture of their natures, or is entirely made from one of them. Those, however, which are heterogeneous in nature are not entirely potent and whole, but are subject to diminution and alteration by one or the other.

Since we are not able to discover any other natures except those which are actively produced by heat and cold, and which are affected and changed by these two principles, we must say that everything is made by them. It is incomprehensible that any other nature could be operating in anything except that nature which is self-constituted. Further, it can be seen that the thing that changes, although it may be endowed with diverse powers, is not altered by any agent except that which is contrary or similar to it. Moreover, no catalyst or active nature which obtains in a subject either abandons its own composition or ceases its own proper action. Those substances which are not similar to it and do not conform with it, it opposes and seeks to change. It thus extends itself into the internal nature of these while always preserving its own equilibrium, and perpetually expands, conserving itself, with all other subjects.

In conclusion, it can truly be restated that the principal agents of all things are heat and cold.

**CHAPTER XIV**

*That from two active natures many entities are constituted. That their powers vary greatly. That these, having become different, have diverse natures and that their*
or flowing quality. It does not cover that space between the things that are made and those that disappear in a single step without affecting bodies between them: it runs through all of them. Those things that it changes, it first takes over by all the means which it possesses, and afterward changes their form. Extreme density and hardness is transmuted into intense rarefaction and softness only after the rare and soft substance lying in between these limits is transmuted. Deep darkness and obscurity must become purple, cerulean, red, and all the other colors before it can pass into extreme whiteness and light. This action will occur if the color is uniform and heat is actively operating in a uniform way. Thus, although the sun is much more powerful than the earth, it cannot by an instantaneous action convert the things of the earth into its own substance. Also, it cannot instantly change cold, condensed, black, and obscure substance into sky and earth.

Only very slowly can the sun change the substances of earth and introduce them into its own nature. Thus, before the earth can be converted into the form of the sun and the sky, it must first be converted into many other forms and natures.

CHAPTER XV

That the earth is first converted into those things which are more akin to its nature, and then into those which appear to be more remote; not, as the ancients believed, that things are first converted into vapors, water, metals, and stones.

The sun changes the earth into something other than its own substance and only gradually clothes it with the sun's own arrangement and form. It is reasonable, therefore, to believe that those things are first converted into one another which are most similar to sky and sun, nearest to the earth, and closest to each other. Thus we find it impossible to believe, as the ancients believed, that the earth was first converted into vapors, the uppermost of which came to constitute the sublunar ether, and the lowest of which remained concealed by cold in the concavities of the earth, turning into stone. We hold, instead, that gradually the substances of earth were stripped of their own proper nature and arrangement. They became endowed with those powers and features that are halfway between sky and earth, converting first into many things, and finally into air.

The earth, which is very dense and very cold, must become tepid and soft before it can become rarefied and hot. The vapors cannot be converted into metals unless they are first changed into states that are in between and are no longer compressed and solid or liquid and flowing. Earth, as such, cannot be changed into metals without intermediate changes. These latter are constituted entirely by liquid and flowing substances. Vapors, therefore, need not first be formed which afterward become liquid and moving substances that finally, being greatly compressed, are restricted to metals. Metals, we believe, are made by the sun as something between vapor and earth, much nearer to the nature of earth than to that of vapor. From these, vapors are born.

Now Aristotle denies that earth and the vapors that are derived therefrom are converted into water, since the earth is arid and dry. Neither this material of the earth, as he sees it, nor the things that are made from it, are capable of constituting things that are humid. He thus found it necessary to place Plato's Tartar in the earth. Indeed, if this substance does not administer certain currents of water in certain amounts, that is, if it does not afford vapor to all the waters, we could never discover how or where so many vapors could arise. It is not reasonable, according to Aristotle, that bodies of water be contained in the earth, because all the waters are placed on its outer surface. If this
were the case, the waters would long ago have evaporated and disappeared. The Peripatetics' doubt that the continuous action of the sun is needed to convert earth into water, and that the currents of water are not constant, is not justified. The heat introduced into the earth from which the waters are particularly made does not actively operate in the whole of the earth. Only a certain portion of the heat melts and liquefies that part of the earth which it turns into water, but the heat which remains is yet not inactive. Similarly, when the flow of waters is diminished only a little, this is because not all of the heat is operating upon it; but it cannot be said that the heat which is not operating upon it is wholly inactive.

Now heat, in this way, is continuously changing the entire earth, although not uniformly, nor all at once, because the earth itself is of a mixed composition. Whereas certain parts of the earth are conformable only with water, those that are more dense and further from the nature of water are, in the meantime, being softened and brought closer to the liquid state. From this it follows that once the waters begin to flow, they will run unceasingly, granting only that there is no succedance of agency and matter. Note that during the summer the waters appear to be more shallow because of the stronger heat, even though there are more such bodies of water present. In turn, these variegated matters, after being converted into water, are then quickly converted into vapors.

During the winter, the waters in no way diminish. Instead, the rivers that flow from the earth—as even Aristotle agrees—are received, gathered together, and steadily augmented. In periods of the greatest heat we oftentimes observe that the strongest flow of waters, even those which are nearest the sun and have run all summer, disappear the moment the sun is gone. Again, all during the springtime, the waters continually increase, even when they are not augmented by snows or rains as they are in the winter.

The Peripatetics, then, have said nothing to show that the waters which derive from the earth are not generated from the sun, earth, and the heat working therein. They also do not deny that the earth first converts into things which are most like it before it converts into those things which are at a further remove and quite unlike it. We can no more deny, therefore, that vapors are not changed into water by the cold than that the cold congregates and condenses all fluid things.

Those things which are made humid by the heat, and which are soft and rarefied, are not reconverted to hard, stable, and dense entities by the cold. They change to this state only because the sun does not operate steadily and with the same action. As we will show, the sun operates with varied power, and makes different things in their proper order. As regards the earth, on the other hand, it actively performs in a contrary manner, making hard and more dense those things which are made soft and liquid by an oblique and moderate sun. Thus, when the sun gets closer and stronger, the substances become soft; but when it departs, they become congealed and thickened by the nighttime cold.

Were it not for this evidence, we might heedlessly believe that the earth first converts into those things which are most remote from its own nature, these in turn changing into others which are closer and more akin to the earth's nature. But in this case the arrangement which is in bodies would not appear to be derivative of the nature of the entity from which it is made. Yet, as we saw before, this is not true; the earth generally changes in an ordinary way.

Now we will return to our starting point in search of the cause of the diversity of things.
CHAPTER XVI

That since the sun actively operates with very different and heterogeneous heat on a varying and divergent earth, it converts the earth into many things, not all necessarily or continually rare or hot.

The earth is converted by the sun into many and various things. It is very far from the sun; and it is evident that because it is penetrated variously it receives many different forms and becomes endowed with many diverse properties. Perhaps it even becomes converted in many more and diverse ways than those of which we are aware. These conversions do not occur in some prescribed order; nor do they constitute a continuous operation governed by the same order which determines things closer to and similar in nature to the sky. Things which are shaped by the sun do not constantly become rarefied and hot. Some, indeed, are formed in the opposite way. These, becoming more dense and cold, acquire still other natures and become different things. In some instances, indeed, certain parts of them become endowed with many different natures.

The sun operates actively but with varying degrees of heat. It works on an earth which has been previously altered and made diverse by it. Thus, since the earth is itself not only extremely dissimilar to the sun but is also quite heterogeneous in its own constitution, and since also it is one entity in itself, it is understandable converted into things composed of very dissimilar parts. The sun, turning continuously around the earth, does not always actively operate on it. Sometimes it ceases to do so, conceding the earth a certain latitude so that it thus utilizes its own action to form things, rather than operating to corrupt or destroy the sun's produce. It slows down the motions of the sun and impedes them, converting them in this way into other things. Again, because the sun does not use its own action directly upon the earth, either continuously or for any steady length of time, since it changes both angle and place constantly, it performs its activities with many different powers. Indeed, direct-angle light differs from oblique-angled light, as is sufficiently demonstrated by the difference between the summer and winter sun, and even by the light reflected from mirrors. Thus oblique light is not felt to be warm; whereas the same light, focused directly, can be made to create warmth of any degree.

Furthermore, we can see that the sun actively operates not only with the heat which emanates directly from it, but also with that which it has for a long time daily introduced into the earth, not only in the earth's higher parts, but in its lowest depths. These latter parts suffer very little change. The sun hardly affects them at all. They can be influenced only by the heat which strikes the highest parts of the earth and descends gradually into its interior, diminished and diluted, greatly compressed, and unlike its former self. In fact, the sun, operating as it does on the surface of the earth, does not affect the whole of it; nor does it even affect the earth's nearest and most contiguous parts with the same force. This is a fact because the earth is divided not only into mountains and hills, which, being heated, reflect the sun in different ways, but even those parts of the earth which appear most spherical and flat are pockmarked with unequal but small irregularities which sense observation can detect.

Now everything on the earth is thus marked with minute changes in elevation. In this way it happens that the great mountains do not all receive and reflect the same light, but gather it strongly and directly on one side, and weakly and obliquely on the other. Also certain parts, such as depressed places, that is, valleys and the like, separate and further scatter this reflected light. Mirrors clearly show that light suffers from these inequalities: dense air will cause shadows; and other such causes work also to diminish its splendor and power. Hence it follows that mirrors, if not clean and flat on the surface and cleared of every blemish, do not
reflect full strength, but weakly, although they may be capable of profound reflecting power. The light is in some manner obscured by blemishes and impeded or aborted.

Therefore, not being able to reflect light whole and united, the mirror is no longer endowed with the same powers as the light. Furthermore, although the surface of the earth has been basically the same from the beginning, it has been altered in different ways, because it received the sun in different ways. It follows, hence, that its higher parts have acquired a different nature and arrangement from its internal parts, and those parts which have been exposed to the direct sun have become different from those upon which it shone but obliquely. Again, the same differentiation occurs with respect to even those parts that are close and contiguous to one another on the surface. It appears therefore to be the case that the sun converts these earth parts in the same way into different things, in that its light is alternating and varied. Indeed, if the diversity and lack of uniformity of heat and of matter are seen by themselves as capable of constructing different entities, then adding these deviations together makes them capable of making an immense variety of species of things. Some of these will even appear to have been entirely made from one or the other nature.

Tommaso Campanella

order to avoid the consequences of the enmity he was arousing, he traveled first to Rome, and then to Florence and Padua. The hostility with which he was met at every turn led, in 1600, to accusations of heresy, and of holding views inimical to the state. Subjected to the most inhumane persecution, Campanella was detained in prison for twenty-seven years. Even the indescribable horrors of his incarceration were not enough to break his spirit; while in prison he wrote, meditated, and studied. Finally he was freed and sent to Rome. The last years of his life were spent peacefully in France. He died in 1639. Among his most important writings are his Apologia pro Galileo, Civitas solis, and De sensu rerum et magia.

On the Sense and Feeling in All Things and on Magic

BOOK I

On that wonderful part of occult philosophy where it is demonstrated that the world is a living image of God and, therefore, that it is sentient and knowing in all its parts large and small, all of which have sense and feeling sufficient in degree for their preservation and the conservation of the whole in which they obtain, and in which may be discovered the reasons for all the secrets of nature.

TOMMASO CAMPANELLA

Tommaso Campanella was born in Stilo in 1568. He entered the Dominican order at fourteen years of age. His zeal and acuteness in disputing Aristotle soon gained him the reputation among his fellow monks of possessing occult powers. In