

Lucretius, *On the Nature of Things* (ca. 60 BCE)

**[How natural science dispels doubt and fear of nature]**

...I will essay to discourse to you of the most high system of heaven and the gods and will open up the first beginnings of things, out of which nature gives birth to all things and increase and nourishment, and into which nature likewise dissolves them back after their destruction.

These we are accustomed in explaining their 'reason to call matter and begetting bodies of things and to name seeds of things and also to term first bodies, because from them as first elements all things are.

When human life to view lay foully prostrate upon earth crushed down under the weight of religion, who showed her head from the quarters of heaven with hideous aspect lowering upon mortals, a man of Greece ventured first to lift up his mortal eyes to her face and first to withstand her to her face.

Him neither story of gods nor thunderbolts nor heaven with threatening roar could quell: they only chafed the more the eager courage of his soul, filling him with desire to be the first to burst the fast bars of nature's portals.

Therefore the living force of his soul gained the day: on he passed far beyond the flaming walls of the world and traversed throughout in mind and spirit the immeasurable universe; whence he returns a conqueror to tell us what can, what cannot come into being; in short on what principle each thing has its powers defined, its deep-set boundary mark.

Therefore religion is put underfoot and trampled upon in turn; us his victory brings level with heaven.

This is what I fear herein, lest haply you should fancy that you are entering on unholy grounds of reason and treading the path of sin; whereas on the contrary often and often that very religion has given birth to sinful and unholy deeds....

...Ay indeed for how many dreams may they now imagine for you, enough to upset the calculations of life and trouble all your fortunes with fear! And with good cause; for if men saw that there was a fixed limit to their woes, they would be able in some way to withstand the religious scruples and threatenings of the seers.

As it is, there is noway, no means of resisting, since they must fear after death everlasting pains.

For they cannot tell what is the nature of the soul, whether it be born or on the contrary find its way into men at their birth, and whether it perish together with us when severed from us by death or visit the gloom of Orcus and wasteful pools or by divine decree find

its way into brutes in our stead, as sang our Ennius who first brought down from delightful Helicon a crown of unfading leaf, destined to bright renown throughout Italian clans of men.

And yet with all this Ennius sets forth that there are Acherusian quarters, publishing it in immortal verses; though in our passage thither neither our souls nor bodies hold together, but only certain idols pale in wondrous wise.

From these places he tells us the ghost of everliving Homer uprose before him and began to shed salt tears and to unfold in words the nature of things.

Wherefore we must well grasp the principle of things above, the principle by which the courses of the sun and moon go on, the force by which every thing on earth proceeds, but above all we must find out by keen reason what the soul and the nature of the mind consist of, and what thing it is-which meets us when awake and frightens our minds, if we are under the influence of disease; meets and frightens us too when we are buried in sleep; so that we seem to 'see and hear speaking to us face to face them who are dead, whose bones earth holds in its embrace.

Nor does my mind fail to perceive how hard it is to make clear in Latin verses the dark discoveries of the Greeks, especially as many points must be dealt with in new terms on account of the poverty of the language and the novelty of the questions.

But yet your worth and the looked-for pleasure of sweet friendship prompt me to undergo any labor and lead me on to watch the clear nights through, seeking by what words and in what verse I may be able in the end to shed on your mind so clear a light that you can thoroughly scan hidden things.

This terror then and darkness of mind must be dispelled not by the rays of the sun and glittering shafts of day, but by the aspect and the law of nature; the warp of whose design we shall begin with this first principle, nothing is ever gotten out of nothing by divine power.

Fear in sooth holds so in check all mortals, because they see many operations go on in earth and heaven, the causes of which they can in noway understand, believing them therefore to be done by power divine.

### **[Why all natural things arise from the same fixed quantity of matter]**

For these reasons when we shall have seen that nothing can be produced from nothing, we shall then more correctly ascertain that which we are seeking, both the elements out of which everything can be produced and the manner in which all things are done without the hand of the gods.

If things came from nothing, any kind might be born of any thing, nothing would require seed.

Men for instance might rise out of the sea, the scaly race out of the earth, and birds might burst out of the sky; horned and other herds, every kind of wild beasts would haunt with changing broad tilth and wilderness alike.

Nor would the same fruits keep constant to trees, but would change; any tree might bear any fruit.

For if there were not begetting bodies for each, how could things have a fixed unvarying mother?

But in fact because things are all produced from fixed seeds, each thing is born and goes forth into the borders of light out of that in which resides its matter and first bodies; and for this reason all things cannot be gotten out of all things, because in particular things resides a distinct power.

Again, why do we see the rose put forth in spring, corn in the season of heat, vines yielding at the call of autumn, if not because, when the fixed seeds of things have streamed together at the proper time, whatever is born discloses itself, while the due seasons are there and the quickened earth brings its weakly products in safety forth into the borders of light?

But if they came from nothing, they would rise up suddenly at uncertain periods and unsuitable times of year, inasmuch as there would be no first-beginnings to be kept from a begetting union by the unpropitious season.

No nor would time be required for the growth of things after the meeting of the seed, if they could increase out of nothing.

Little babies would at once grow into men and trees in a moment would rise and spring out of the ground.

But none of these events it is plain ever comes to pass, since all things grow step by step [at a fixed time], as is natural, [since they all grow] from a fixed seed and in growing preserve their kind; so that you may be sure that all things increase in size and are fed out of their own matter.

Furthermore without fixed seasons of rain the earth is unable to put forth its gladdening produce, nor again if kept from food could the nature of living things continue its kind and sustain life; so that you may hold with greater truth that many bodies are common to many things, as we see letters common to different words, than that anything could come into being without first-beginnings.

Again why could not nature have produced men of such a size and strength as to be able to wade on foot across the sea and rend great mountains with their hands and

outlive many generations of living men, if not because an unchanging matter has been assigned for begetting things and what can arise out of this matter is fixed? We must admit therefore that nothing can come from nothing, since things require seed before they can severally be born and be brought out into the buxom fields of air.

Lastly, since we see that tilled grounds surpass untilled and yield a better produce by the labor of hands, we may infer that there are in the earth first-beginnings of things which by turning up the fruitful clods with the share and laboring the soil of the earth we stimulate to rise.

But if there were not such, you would see all things without any labor of ours spontaneously come forth in much greater perfection.

Moreover nature dissolves every thing back into its first bodies and does not annihilate things.

For if aught were mortal in all its parts alike, the thing in a moment would be snatched away to destruction from before our eyes; since no force would be needed to produce disruption among its parts and undo their fastenings.

Whereas in fact, as all things consist of an imperishable seed, nature suffers the destruction of nothing to be seen, until a force has encountered it sufficient to dash things to pieces by a blow or to pierce through the void places within them and break them up.

Again if time, whenever it makes away with things through age, utterly destroys them eating up all their matter, out of what does Venus bring back into the light of life the race of living things each after its kind, or, when they are brought back, out of what does earth manifold in works give them nourishment and increase, furnishing them with food each after its kind? Out of what do its own native fountains and extraneous rivers from far and wide keep full the sea? Out of what does ether feed the stars? For infinite time gone by and lapse of days must have eaten up all things which are of mortal body.

Now if in that period of time gone by those things have existed, of which this sum of things is composed and recruited, they are possessed no doubt of an imperishable body, and cannot therefore any of them return to nothing.

Again the same force and cause would destroy all things without distinction, unless everlasting matter held them together, matter more or less closely linked in mutual entanglement: a touch in sooth would be sufficient cause of death, inasmuch as any amount of force must of course undo the texture of things in which no parts at all were of an everlasting body....

...None of the things therefore which seem to be lost is utterly lost, since nature replenishes one thing out of another and does not suffer any thing to be begotten, before she has been recruited by the death of some other.

### **[How we know that matter consists of parts too small to see]**

Now mark me: since I have taught that things cannot be born from nothing, cannot when begotten be brought back to nothing, that you may not haply yet begin in any shape to mistrust my words, because the first-beginnings of things cannot be seen by the eyes, take moreover this list of bodies which you must yourself admit are in the number of things and cannot be seen.

First of all the force of the wind when aroused beats on the harbors and whelms huge ships and scatters clouds; sometimes in swift whirling eddy it scours the plains and straws them with large trees and scourges the mountain summits with forest-rending blasts: so fiercely does the wind rave with a shrill howling and rage with threatening roar.

Winds therefore sure enough are unseen bodies which sweep the seas, the lands, ay and the clouds of heaven, tormenting them and catching them up in sudden whirls.

On they stream and spread destruction abroad in just the same way as the soft liquid nature of water, when all at once it is borne along in an overflowing stream, and a great downfall of water from the high hills augments it with copious rains, flinging together fragments of forests and entire trees; nor can the strong bridges sustain the sudden force of coming water: in such wise turbid with much rain the river dashes upon the piers with mighty force: makes havoc with loud noise and rolls under its eddies huge stones: wherever aught opposes its waves, down it dashes it.

In this way then must the blasts of wind as well move on, and when they like a mighty stream have borne down in any direction, they push things before them and throw them down with repeated assaults, sometimes catch them up in curling eddy and carry them away in swift-circling whirl.

Wherefore once and again I say winds are unseen bodies, since in their works and ways they are found to rival great rivers which are of a visible body.

Then again we perceive the different smells of things, yet never see them coming to our nostrils; nor do we behold heats nor can we observe cold with the eyes nor are we used to see voices.

Yet all these things must consist of a bodily nature, since they are able to move the senses; for nothing but body can touch and be touched.

Again clothes hung up on a shore which waves break upon become moist, and then get dry if spread out in the sun.

Yet it has not been seen in what way the moisture of water has sunk into them nor again in what way this has been dispelled by heat.

The moisture therefore is dispersed into small particles which the eyes are quite unable to see.

Again after the revolution of many of the sun's years a ring on the finger is thinned on the under side by wearing, the dripping from the eaves hollows a stone, the bent plowshare of iron imperceptibly decreases in the fields, and we behold the stone-paved streets worn down by the feet of the multitude; the brass statues too at the gates show their right hands to be wasted by the touch of the numerous passers by who greet them.

These things then we see are lessened, since they have been thus worn down; but what bodies depart at any given time the nature of vision has jealously shut out our seeing.

Lastly the bodies which time and nature add to things by little and little, constraining them to grow in due measure, no exertion of the eyesight can behold; and so too wherever things grow old by age and decay, and when rocks hanging over the sea are eaten away by the gnawing salt spray, you cannot see what they lose at any given moment Nature therefore works by unseen bodies.

### **[How we know that there are void spaces]**

And yet all things are not on all sides jammed together and kept in by body: there is also void in things.

To have learned this will be good for you on many accounts; it will not suffer you to wander in doubt and be to seek in the sum of things and, distrustful of our words.

If there were not void, things could not move at all; for that which is the property of body, to let and hinder, would be present to all things at all times; nothing therefore could go on, since no other thing would be the first to give way.

But in fact throughout seas and lands and the heights of heaven we see before our eyes many things move in many ways for various reasons, which things, if there were no void, I need not say would lack and want restless motion: they never would have been begotten at all, since matter jammed on all sides would have been at rest Again however solid things are thought to be, you may yet learn from this that they are of rare body: in rocks and caverns the moisture of water oozes through and all things weep with abundant drops; food distributes itself through the whole body of living things; trees grow and yield fruit in season, because food is diffused through the whole from the very roots over the stem and all the boughs.

Voices pass through walls and fly through houses shut, stiffening frost pierces to the bones.

Now if there are no void parts, by what way can the bodies severally pass? You would see it to be quite impossible.

Once more, why do we see one thing surpass another in weight though not larger in size? For if there is just as much body in a ball of wool as there is in a lump of lead, it is natural it should weigh the same, since the property of body is to weigh all things downwards, while on the contrary the nature of void is ever without weight.

Therefore when a thing is just as large, yet is found to be void in it; while on the other hand that which is lighter, it proves sure enough that it has more of 'heavier shows that there is in it more of body and that it contains within it much less of void.

Therefore that which we are seeking with keen reason exists sure enough, mixed up in things; and we call it void. And herein I am obliged to forestall this point which some raise, lest it draw you away from the truth.

The waters they say make way for the scaly creatures as they press on, and open liquid paths, because the fish leave room behind them, into which the yielding waters may stream; thus other things too may move and change place among themselves, although the whole sum be full.

This you are to know has been taken up on grounds wholly false.

For on what side I ask can the scaly creatures move forwards, unless the waters have first made room? Again on what side can the waters give place, so long as the fish are unable to go on? Therefore you must either strip all bodies of motion or admit that in things void is mixed up from which every thing gets its first start in moving.

Lastly if two broad bodies after contact quickly spring asunder, the air must surely fill all the void which is formed between the bodies.

Well however rapidly it stream together with swift-circling currents, yet the whole space will not be able to be filled up in one moment for it must occupy first one spot and then another, until the whole is taken up.

But if haply any one supposes that, when the bodies have started asunder, that result follows because the air condenses, he is mistaken; for a void is then formed which was not before, and a void also is filled which existed before; nor can the air condense in such a way, nor supposing it could, could it methinks without void draw into itself and bring its parts together.

Wherefore however long you hold out by urging many objections, you must needs in the end admit that there is a void in things....

...But now to resume the thread of the design which I am weaving in verse: all nature then, as it exists by itself, is founded on two things: there are bodies and there is void in which these bodies are placed and through which they move about...

**[Why there must be solid atoms (“first beginnings” or “first bodies”)]**

Bodies again are partly first-beginnings of things, partly those which are formed of a union of first beginnings.

But those which are first-beginnings of things no force can quench: they are sure to have the better by their solid body.

Although it seems difficult to believe that aught can be found among things with a solid body.

For the lightning of heaven passes through the walls of houses, as well as noise and voices; iron grows red-hot in the fire and stones burn with fierce heat and burst asunder the hardness of gold is broken up and dissolved by heat; the ice of brass melts vanquished by the flame; warmth and piercing cold ooze through silver, since we have felt both, as we held cups with the hand in due fashion and the water was poured down into them.

So universally there is found to be nothing solid in things.

But yet because true reason and the nature of things constrains, attend until we make clear in a few verses that there are such things as consist of solid and everlasting body, which we teach are seeds of things and first-beginnings, out of which the whole sum of things which now exists has been produced.

First of all then since there has been found to exist a two-fold and widely dissimilar nature of two things, that is to say of body and of place in which things severally go on, each of the two must exist for and by itself and quite unmixed.

For wherever there is empty space which we call void, there body is not; wherever again body maintains itself, there empty void no wise exists.

First bodies therefore are solid and without void.

Again since there is void in things begotten, solid matter must exist about this void, and no thing can be proved by true reason to conceal in its body and have within it void, unless you choose to allow that that which holds it in is solid.

Again that can be nothing but a union of matter which can keep in the void of things.

Matter therefore, which consists of a solid body, may be everlasting, though all things else are dissolved.

Moreover, if there were no empty void, the universe would be solid; unless on the other hand there were certain bodies to fill up whatever places they occupied, the existing universe would be empty and void space.

Therefore sure enough body and void are marked off in alternate layers, since the universe is neither of a perfect fulness nor a perfect void.

There are therefore certain bodies which can vary void space with full.

These can neither be broken in pieces by the stroke of blows from without nor have their texture undone by aught piercing to their core nor give way before any other kind of assault; as we have proved to you a little before.

For without void nothing seems to admit of being crushed in or broken up or split in two by cutting, or of taking in wet or permeating cold or penetrating fire, by which all things are destroyed.

And the more anything contains within it of void, the more thoroughly it gives way to the assault of these things.

Therefore if first bodies are as I have shown solid and without void, they must be everlasting.

Again unless matter had been eternal, all things before this would have utterly returned to nothing and whatever things we see would have been born anew from nothing.

But since I have proved above that nothing can be produced from nothing, and that what is begotten cannot be called to nothing, first-beginnings must be of an imperishable body, into which all things can be dissolved at their last hour, that there may be a supply of matter for the reproduction of things.

Therefore first-beginnings are of solid singleness, and in no other way can they have been preserved through ages during infinite time past in order to reproduce things....

### **[How we know that space is infinite]**

But since I have taught that most solid bodies of matter fly about for ever unvanquished through all time, mark now, let us unfold whether there is or is not any limit to their sum; likewise let us clearly see whether that which has been found to be void, or room and space, in which things severally go on, is all of it altogether finite or stretches without limits and to an unfathomable depth.

Well then, the existing universe is bounded in none of its dimensions; for then it must have had an outside.

Again it is seen that there can be an outside of nothing, unless there be something beyond to bound it, so that that is seen, farther than which the nature of this our sense does not follow the thing.

Now since we must admit that there is nothing outside the sum, it has no outside, and therefore is without end and limit.

And it matters not in which of its regions you take your stand; so invariably, whatever position any one has taken up, he leaves the universe just as infinite as before in all directions.

Again if for the moment all existing space be held to be bounded, supposing a man runs forward to its outside borders, and stands on the utmost verge and then throws a winged javelin, do you choose that when hurled with vigorous force it shall advance to the point to which it has been sent and fly to a distance, or do you decide that something can get in its way and stop it?

For you must admit and adopt one of the two suppositions; either of which shuts you out from all escape and compels you to grant that the universe stretches without end.

For whether there is something to get in its way and prevent its coming whither it was sent and placing itself in the point intended, or whether it is carried forward, in either case it has not started from the end.

In this way I will go on and, wherever you have placed the outside borders, I will ask what then becomes of the javelin.

The result will be that an end can nowhere be fixed, and that the room given for flight will still prolong the power of flight.

Lastly one thing is seen by the eyes to end another thing; air bounds off hills, and mountains air, earth limits sea and sea again all lands; the universe however there is nothing outside to end.

Again if all the space of the whole sum were enclosed within fixed borders and were bounded, in that case the store of matter by its solid weights would have streamed together from all sides to the lowest point nor could anything have gone on under the canopy of heaven, no nor would there have been a heaven nor sunlight at all, inasmuch as all matter, settling down through infinite time past, would lie together in a heap.

But as it is, sure enough no rest is given to the bodies of the first-beginnings, because there is no lowest point at all, to which they might stream together as it were, and where they might take up their positions.

All things are ever going on in ceaseless motion on all sides and bodies of matter stirred to action are supplied from beneath out of infinite space.

Therefore the nature of room and the space of the unfathomable void are such as bright thunderbolts cannot race through in their course though gliding on through endless tract of time, no nor lessen one jot the journey that remains to go by all their travel: so huge a room is spread out on all sides for things without any bounds in all directions round....

### **[Why the universe cannot have a centre]**

...And herein, Memmius, be far from believing this, that all things as they say press to the center of the sum, and that for this reason the nature of the world stands fast without any strokes from the outside and the uppermost and lowest parts cannot part asunder in any direction, because all things have been always pressing towards the center (if you

can believe that anything can rest upon itself); or that the heavy bodies which are beneath the earth all press upwards and are at rest on the earth, turned topsy-turvy, just like the images of things we see before us in the waters.

In the same way they maintain that living things walk head downwards and cannot tumble out of earth into the parts of heaven lying below them any more than our bodies can spontaneously fly into the quarters of heaven; that when those see the sun, we behold the stars of night; and that they share with us time about the seasons of heaven and pass nights equal in length to our days.

But groundless [error has devised such dreams] for fools, because they have embraced [false principles of reason.]

For there can be no center [where the universe is] infinite; no nor, even if there were a center, could anything take up a position there [any more on that account] than for some quite different reason [be driven away.]

For all room and space, which we term void, must through center, through no-center alike give place to heavy bodies, in whatever directions their motions tend.

Nor is there any spot of such a sort that when bodies have reached it, they can lose their force of gravity and stand upon void; and that again which is void must not serve to support anything, but must, as its nature craves, continually give place.

Things cannot therefore in such a way be held in union, o'er-mastered by love of a center.

Again since they do not suppose that all bodies press to the center, but only those of earth, and those, of water, [both such as descend to the earth in rain] and those which are held in by the earth's body, so to say, the fluid of the sea and great waters from the mountains; while on the other hand they teach that the subtle element of air and hot fires at the same time are carried away from the center and that for this reason the whole ether round bickers with signs and the sun's flame is fed throughout the blue of heaven, because heat flying from the center all gathers together there, and that the topmost boughs of trees could not put forth leaves at all, unless from time to time [nature supplied] food from the earth to each [throughout both stem and boughs, their reasons are not only false, but they contradict each other.

Space I have already proved to be infinite; and space being infinite matter as I have said must also be infinite] lest after the winged fashion of flames the walls of the world should suddenly break up and fly abroad along the mighty void, and all other things follow for like reasons and the innermost quarters of heaven tumble in from above and the earth in an instant withdraw from beneath our feet and amid the commingled ruins of things in it and of heaven, ruins unloosing the first bodies, should wholly pass away along the unfathomable void, so that in a moment of time not a wrack should be left behind, nothing save untenanted space and viewless first-beginnings.

For on whatever side you shall first determine first bodies to be wanting, this side will be the gate of death for things, through this the whole crowd of matter will fling itself abroad.

If you will thoroughly con these things, then carried to the end with slight trouble [you will be able by yourself to understand all the rest.]

For one thing after another will grow clear and dark night will not rob you of the road and keep you from surveying the utmost ends of nature: in such wise things will light the torch for other things.