CHAPTER 1

Socrates' Predecessors

Human beings have lived on this planet for hundreds of thousands of years. We, of course, cannot know all the experiences and thoughts of the earliest people. Still, it is reasonable to suppose that people then, as now, were driven by a desire to explain the world. Perhaps our earliest ancestors thought about how the world was formed, whether they were unique among the animals, and whether there was a world beyond the earthly one surrounding them. They may have also wondered whether there was a uniform standard of moral behavior or social order that applied to the various tribes they encountered. Whatever they may have thought about these subjects, their opinions are now irretrievably lost to time. It is only through the introduction of writing—a comparatively recent invention—that we know the precise speculations of any of our ancestors. When we look at the earliest writings from around the globe, we find that various regions had their own speculative traditions—such as those of East Asia, the Indian subcontinent, the Middle East, and Africa. This book is an account of one such tradition, namely, that which developed within Europe and was later exported to the Americas and elsewhere around the world. This tradition is often called "Western," designating its origin within the western part of the Eurasian landmass.

The story of Western philosophy begins in a series of Greek islands and colonies during the sixth century BCE (that is, Before the Common Era). Some original thinkers were driven by very specific puzzles, most notably, "What are things really like?" and "How can we explain the process of change in things?" The solutions they gave to these puzzles were shortly thereafter dubbed "philosophy"—the love of wisdom. What underlies these speculations was the gradual recognition that things are not exactly what they seem to be. Appearance often differs from reality. There are brute facts of birth, death, growth, and decay—coming into being and passing away. These facts raised sweeping questions of how things and people come into existence, can differ at different times, and pass out of existence only to be followed by other things and persons. Many of the answers given to these questions by the earliest philosophers are not as

important as the fact that they focused upon these *specific* questions. They approached these problems with a fresh point of view that was in stark contrast to the more mythical approach taken by the great poets of the time.

The birthplace of Greek philosophy was the seaport of Miletus, located across the Aegean Sea from Athens, on the western shores of Ionia in Asia Minor. Because of their location, the first Greek philosophers are called either Milesians or Ionians. By the time the Milesian philosophers began their systematic work, in roughly 585 BCE, Miletus had been a crossroads for both seaborne commerce and cosmopolitan ideas. The wealth of the city allowed for leisure time, without which the life of art and philosophy could not develop. Further, the broad-mindedness and inquisitiveness of its people created a congenial atmosphere for philosophical intellectual activity. Earlier, Ionia had produced Homer (ca. 700 BCE), author of the *Iliad* and *Odyssey*. In these timeless classics of epic poetry, Homer describes the scene of Mount Olympus, where the gods pursued lives very similar to those of their human counterparts on earth. This poetic view of the world also depicted ways in which the gods intruded into people's affairs. In particular, the Homeric gods would punish people for their lack of moderation and especially for their pride or insubordination, which the Greeks called *hubris*. It is not that Homer's gods were exceptionally moral beings. Instead, they were merely *stronger* than humans, and demanded obedience.

Although Homer depicts the gods with largely human features, he occasionally hints at a rigorous order in nature. Specifically, he suggests that there is a power called "fate," to which even the gods are subject and to which everyone and everything must be subordinate. Nevertheless, Homer's poetic imagination is dominated so thoroughly by human terms that his world is peopled everywhere with human types. Also, his conception of nature is that of capricious wills at work instead of the reign of physical natural laws. It was Hesiod (ca. 700 BCE), writing around the same time as Homer, who altered this concept of the gods and fate. He thus removed from the gods all capriciousness and instead ascribed to them a moral consistency. Although Hesiod retains the notion that the gods control nature, he balances this personal element in the nature of things with an emphasis on the impersonal operation of the moral law of the universe. The moral order, in Hesiod's view, is still the product of Zeus' commands. However, contrary to Homer, these commands are neither capricious nor calculated to gratify the gods, but instead are fashioned for the good of people. For Hesiod the universe is a moral order, and from this idea it is a short step to say, without *any* reference to the gods, that there is an impersonal force controlling the structure of the universe and regulating its process of changes.

This was the short step taken by three great Milesian philosophers, namely, Thales (ca. 585 BCE), Anaximander (ca. 610–546 BCE), and Anaximenes (585–528 BCE). Whereas Hesiod still thought in terms of traditional mythology with humanlike gods, philosophy among the Milesians began as an act of independent thought. To ask, as they did, "What are things really like?" and "How can we explain the process of change in things?" substantially departs from the poetry of Homer and Hesiod and moves toward a more scientific way of

thinking. In point of fact, at this stage of history, science and philosophy were the same thing, and only later did various specific disciplines separate themselves from the field of philosophy. Medicine was the first to do so. Thus, we can rightly call the Milesians primitive scientists, as well as the first Greek philosophers. The important thing to keep in mind, though, is that Greek philosophy from the start was an *intellectual* activity. It was not a matter only of seeing or believing, but of *thinking*, and philosophy meant thinking about basic questions with an attitude of genuine and free inquiry.

WHAT IS PERMANENT IN EXISTENCE?

Thales

We do not know as much as we would like about Thales of Miletus, and what we do know is rather anecdotal in nature. He left no writings, and all that is available are fragmentary references to him by later writers who recorded memorable incidents in his career. He was a contemporary of Greek king Croesus and statesman Solon, and the years of his life are set between 624 and 546 BCE. During a military campaign against Persia, he apparently solved the difficult logistical problem of enabling the Lydian king's army to cross the wide Halys River. His solution was to dig a channel that diverted part of the flow, thereby making two narrower rivers over which bridges could be built. While traveling in Egypt, Thales worked out a way of measuring the height of the pyramids. His solution was to use the simple procedure of measuring a pyramid's shadow at that time of day when his own shadow was equal in length to his own height. It may have been during these Egyptian travels, too, that he became acquainted with the kinds of knowledge that enabled him to predict the eclipse of the sun on May 28, 585 BCE. In a practical vein, while in Miletus, he constructed an instrument for measuring the distance of ships sighted at sea. And, as an aid to navigation, he urged sailors to use the constellation Little Bear as the surest guide for determining the direction of the north.

It was probably inevitable that tradition would attach questionable tales to such an extraordinary person as Thales. For example, Plato (427–347 BCE) writes about "the joke which the clever witty Thracian handmaid is said to have made about Thales, when he fell into a well as he was looking up at the stars. She said that he was so eager to know what was going on in heaven that he could not see what was before his feet." Plato adds that "this is a jest which is equally applicable to all philosophers." Aristotle (384–322 BCE) describes another episode:

> There is . . . the story which is told of Thales of Miletus. It is a story about a scheme for making money, which is fathered on Thales owing to his reputation for wisdom. . . . He was criticized for his poverty, which was supposed to show the uselessness of philosophy. But observing from his knowledge of meteorology (as the story goes) that there was likely to be a heavy crop of olives [during the next summer], and having a small sum at his command, he paid down earnest-money, early in the year, for the hire of all the olive-presses in

> Miletus and Chios. And he managed, in the absence of any higher offer, to secure them at a low rate. When the season came, and there was a sudden and simultaneous demand for a number of presses, he let out the stock he had collected at any rate he chose to fix; and making a considerable fortune, he succeeded in proving that it is easy for philosophers to become rich if they so desire, though it is not the business which they are really about.

However, Thales is famous, not for his general wisdom or his practical shrewdness, but because he opened up a new area of thought for which he has rightly earned the title of "First Philosopher" of Western civilization.

Thales' novel inquiry concerns the nature of things. What is everything made of, or what kind of "stuff" goes into the composition of things? With these questions Thales was trying to account for the fact that there are many different kinds of things, such as earth, clouds, and oceans. From time to time some of these things change into something else, and yet they still resemble each other in certain ways. Thales' unique contribution to thought was his notion that, in spite of the differences between various things, there is nevertheless a basic similarity between them all. *The many* are related to each other by *the One*. He assumed that some single element, some "stuff," a stuff that contained its own principle of action or change, lay at the foundation of all physical reality. For Thales this One, or this stuff, is *water*.

Although there is no record of how Thales came to the conclusion that water is the cause of all things, Aristotle writes that he might have derived it from observation of simple events, "perhaps from seeing that the nutriment of all things is moist, and that heat is generated from the moist and kept alive by it." Thales, Aristotle continues, "got his notion from this fact and from the fact that the seeds of all things have a moist nature, and water is the origin of the nature of moist things." Other phenomena such as evaporation and freezing also suggest that water takes on different forms. But the accuracy of Thalès' analysis of the composition of things is far less important than the fact that he raised the question concerning the nature of the world. His question set the stage for a new kind of inquiry, one that could be debated on its merits and could be either confirmed or refuted by further analysis. Admittedly, Thales also said that "all things are full of gods." But this notion apparently had no theological significance for him. Thus, when he tried to explain the power in things, such as magnetic powers in stones, he shifted the discussion from a mythological base to a scientific one. From his starting point others were to follow with alternative solutions, but always with his problem before them.

Anaximander

Anaximander was a younger contemporary and a pupil of Thales. He agreed with his teacher that there is some single basic stuff out of which everything comes. Unlike Thales, however, Anaximander said that this basic stuff is neither water nor any other specific element. Water and all other definite things, he argued, are only specific variations or offshoots of something that is more primary. It may well be, he thought, that we find water or moisture in various

forms everywhere. Water is only one specific thing among many other elements, and all these specific things need some more elementary stuff to account for their origin. The primary substance out of which all these specific things come, Anaximander argued, is an *indefinite* or *boundless* realm. Thus, on the one hand, we find specific and determinate things in the world, like a rock or a puddle of water; yet, on the other hand, we find the origin of these things, which he calls the *indeterminate boundless*. Whereas actual things are specific, their source is indeterminate, and whereas things are finite, the original stuff is infinite or boundless.

Besides offering a new idea about the original substance of things, Anaximander advanced philosophy by attempting some explanation for his new idea. Thales had not dealt in any detail with the problem of explaining how the primary stuff became the many different things we see in the world. Anaximander, though, addressed this question precisely. Although his explanation may seem strange, it represents an advance in knowledge. Specifically, it deals with known facts from which hypotheses can be formulated, instead of explaining natural phenomena in mythical, nondebatable terms. His explanation is this: The indeterminate boundless is the unoriginated and indestructible primary substance of things, yet it also has eternal motion. As a consequence of this motion, the various specific elements came into being as they "separated off" from the original substance. Thus, "there was an eternal motion in which the heavens came to be." First *warm* and *cold* were separated off, and from these two came *moist;* then from these came *earth* and *air*.

Turning to the origin of human life, Anaximander said that all life comes from the sea and that, in the course of time, living things came out of the sea to dry land. He suggested that people evolved from creatures of a different kind. This, he argued, follows from the fact that other creatures are quickly self-supporting, whereas humans alone need prolonged nursing and that, therefore, we would not have survived if this had been our original form. Commenting on Anaximander's account of the origin of human beings, Plutarch writes that the Syrians

> actually revere the fish as being of similar race and nurturing. In this they philosophize more suitably than Anaximander. For he declares, not that fishes and men came into being in the same parents, but that originally men came into being inside fishes. Having been nurtured there—like sharks—and having become adequate to look after themselves, they then came forth and took to the land.

Returning to the vast cosmic scene, Anaximander thought that there were many worlds and many systems of universes existing all at the same time. All of them die out, and there is a constant alternation between their creation and destruction. This cyclical process, he believed, is a matter of rigorous necessity. Opposite forces in nature conflict and cause an "injustice"—poetically speaking—that requires their ultimate destruction. The only sentence that survives from Anaximander's writings makes this point, again somewhat poetically: "From what source things arise, to that they return of necessity when they are destroyed; for they suffer punishment and make reparation to one another for their injustice according to the order of time."

Anaximenes

The third and last of the Milesian philosophers was Anaximenes (ca. 585–528 BCE), who was a young associate of Anaximander. He considered Anaximander's answer to the question concerning the composition of natural things but was dissatisfied with it. The notion of the *boundless* as being the source of all things was simply too vague and intangible. He could understand why Anaximander chose this solution over Thales' notion that water is the cause of all things. The boundless could at least help explain the "infinite" background to the wide variety of finite and specific things. Still, the indeterminate boundless had no specific meaning for Anaximenes, and therefore he chose to focus on a definite substance just as Thales did. Yet, the same time, he tried to incorporate the advance achieved by Anaximander.

Attempting to mediate between the two views of his predecessors, Anaximenes designated *air* as the primary substance from which all things come. Like Thales' notion of water, air is a definite substance, and we can readily see it at the root of all things. For example, although air is invisible, we live only as long as we can breathe, and "just as our soul, being air, holds us together, so do breath and air encompass the whole world." Like Anaximander's boundless in continued motion, air is spread everywhere—although unlike the boundless it is a specific and tangible material substance that can be identified. Moreover, the air's motion is a far more specific process than Anaximander's "separating off." To explain how air is the origin of all things, Anaximenes argued that things are what they are by virtue of how condensed or expanded the air is that makes up those things. In making this point he introduced the important new idea that differences in *quality* are caused by differences in *quantity*. The expansion and contraction of air represent quantitative changes, and these changes occurring in a single substance account for the variety of things that we see in the world around us. Expansion of air causes warming and, at the extreme, fire, whereas contraction, or condensation, causes cooling and the transformation of air into solids by way of a gradual transition whereby, as Anaximenes says, "air that is condensed forms winds . . . if this process goes further, it gives water, still further earth, and the greatest condensation of all is found in stones."

Although these Milesian philosophers proceeded with scientific concerns and temperaments, they did not form their hypotheses the way modern scientists would, nor did they devise any experiments to test their theories. Their ideas have a dogmatic quality—an attitude of positive assertion rather than the tentativeness of true hypotheses. But we must remember that the critical questions concerning the nature and limits of human knowledge had not yet been raised. Nor did the Milesians refer in any way to the problem of the relation between spirit and body. Their reduction of all reality to a material origin certainly raises this question, but only later did philosophers recognize this as a problem. Whatever may be the usefulness of their specific ideas about *water*, the *boundless*, and *air* as the primary substance of things, the real significance of the Milesians is, again, that they for the first time raised the question about the ultimate nature of things and made the first halting but direct inquiry into what nature really consists of.

THE MATHEMATICAL BASIS OF ALL THINGS

Pythagoras

Across a span of water from Miletus, located in the Aegean Sea, was the small island of Samos, the birthplace of a truly extraordinary and wise man, Pythagoras (ca. 570–497 BCE). From the various scraps of information we have about him and his followers, an incomplete but still fascinating picture of his new philosophical reflections emerges. Apparently dissatisfied with conditions not only on Samos but generally in Ionia during the tyrannical rule of the rich Polycrates, Pythagoras migrated to southern Italy and settled there in the prosperous Greek city of Crotone. His active philosophical life there is usually dated from about 525 to 500 BCE. Aristotle tells us that the Pythagoreans "devoted themselves to mathematics, they were the first to advance this study, and having been brought up in it they thought its principles were the principles of all things." In contrast to the Milesians, the Pythagoreans said that things *consist of numbers*. Although this account of things sounds quite strange, it makes more sense when we consider why Pythagoras became interested in numbers and what his conception of numbers was.

Pythagoras became interested in mathematics for what appear to be religious reasons. His originality consists partly in his conviction that the study of mathematics is the best purifier of the soul. He is in fact the founder both of a religious sect and a school of mathematics. What gave rise to the Pythagorean sect was people's yearning for a deeply spiritual religion that could provide the means for purifying the soul and for guaranteeing its immortality. The Homeric gods were not gods in the theological sense, since they were as immoral as human beings. As such they could be neither the objects of worship nor the source of any spiritual power to overcome the pervading sense of moral uncleanliness and the anxiety that people had over the shortness of life and the finality of death. The religion of Dionysus had earlier stepped into this area of human concern and was widespread during the seventh and sixth centuries BCE. The worship of Dionysus satisfied to some extent those yearnings for cleansing and immortality. Organized into small, secret, and mystical societies, the devotees would worship Dionysus under various animal forms. Working themselves into a frenzy of wild dances and song, they would drink the blood of these animals, which they had torn apart in a state of intoxication. They would finally collapse in complete exhaustion, convinced that at the height of their frenzy, the spirit of Dionysus had entered their bodies, purifying them and conferring his own immortality upon their souls.

The Pythagoreans were also concerned with the mystical problems of purification and immortality. It was for this reason that they turned to science and mathematics, the study of which they considered the best purge for the soul. In scientific and mathematical thought they saw a type of life that was purer than any other kind. Thought and reflection represent a clear contrast to the life of vocational trade and competition for various honors. Pythagoras distinguished three different kinds of lives, and by implication the three divisions of the soul. By way of illustration, there are, he said, three different kinds of people who go

to the Olympian games. The lowest class is made up of those who go there to buy and sell, to make a profit. Next are those who go there to compete, to gain honors. Best of all, he thought, are those who come as spectators, who reflect upon and analyze what is happening. Of these three the spectator illustrates the activity of philosophers who are liberated from daily life and its imperfections. To "look on" is one of the meanings of the Greek word *theory*. Pythagoreans considered theoretical thinking, or pure science and pure mathematics, to be a purifier of the soul. Mathematical thought could liberate people from thinking about particular things and lead their thoughts to the permanent and ordered world of numbers. The final mystical triumph of the Pythagorean is liberation from "the wheel of birth," from the migration of the soul to animal and other forms in the constant progress of death and birth. In this way the spectator achieves a unity with god and shares his immortality.

To connect this religious concern with the philosophical aspects of the Pythagoreans, we should first mention their interest in music. They considered music highly therapeutic for certain nervous disorders. There was, they believed, some relation between the harmonies of music and the harmony of a person's interior life. But their true discovery in the field of music was that the musical intervals between the notes could be expressed numerically. They discovered that the length of the strings of a musical instrument is proportionate to the actual interval of the sounds they produce. Pluck a violin string, for example, and you will get a specific note. Divide that string in half, and you will get a pitch one octave higher, the ratio here being 2:1. All the other intervals could similarly be expressed in numerical ratios. Thus, for the Pythagoreans, music was a remarkable example of the pervasive relevance of numbers in all things. This led Aristotle to say that "they saw that the attributes and the ratios of the musical scales were expressible in numbers; all other things seemed in their whole nature to be modeled after numbers, and numbers seemed to be the first things in the whole of nature, and the whole heaven to be a musical scale and a number."

Pythagoreans had a special practice of counting and writing numbers, and this may have facilitated their view that all things *are* numbers. Apparently, they built numbers out of individual units, using pebbles to count. The number *one* was therefore a single pebble, and all other numbers were created by the addition of pebbles, somewhat like our present practice of representing numbers on dice by the use of dots. But the significant point is that the Pythagoreans discovered a relation between arithmetic and geometry. A single pebble represents *one* as a single point. But *two* is made up of two pebbles or two points, and these two points make a line. Three points, as in the corners of a triangle, create a plane or area, and four points can represent a solid. This suggested to Pythagoreans a close relationship between number and magnitude, and Pythagoras is credited with what we now call the Pythagorean theorem: The square of the hypotenuse is equal to the squares of the other two sides of a right-angled triangle. This correlation between numbers and magnitude provided immense consolation to those who sought evidence of a principle of structure and order in the universe. It is understandable how an interesting but possibly apocryphal story could

have arisen. A Pythagorean named Hippasus, so the story goes, was drowned in the Hellespont for letting out the secret that this principle does not hold true in the case of the isosceles right-angled triangle. That is, in such cases the relation between hypotenuse and sides cannot be expressed by any numerical ratio, only by an irrational number.

The importance of the relation between number and magnitude was that numbers, for the Pythagoreans, meant certain figures, such as a triangle, square, and rectangle. The individual points were "boundary stones," which marked out "fields." Moreover, the Pythagoreans differentiated these "triangular numbers," "square numbers," "rectangular numbers," and "spherical numbers" as being odd and even, thereby giving themselves a new way of treating the phenomenon of the conflict of opposites. In all these forms numbers were, therefore, far more than abstractions; they were specific kinds of entities. To say, then, as the Pythagoreans did, that all things *are* numbers meant for them that there is a numerical basis for all things possessing shape and size. In this way they moved from arithmetic to geometry and then to the structure of reality. All things had numbers, and their odd and even values explained opposites in things, such as one and many, square and oblong, straight and curved, or rest and motion. Even light and dark are numerical opposites, as are male and female, and good and evil.

This way of understanding numbers led the Pythagoreans to formulate their most important philosophical notion, namely, the concept of *form*. The Milesians had conceived the idea of a primary *matter* or stuff out of which everything was constituted, but they had no coherent concept of how specific things are differentiated from this single matter. They all spoke of an unlimited stuff, whether it be water, air, or the indeterminate boundless, by which they all meant some primary *matter*. The Pythagoreans now came forth with the conception of *form*. For them form meant *limit*, and limit is understandable especially in numerical terms. The concept of limit, they believed, was best exemplified in music and medicine. For in both of these arts the central fact is harmony, and harmony is achieved by taking into account proportions and limits. In music there is a numerical ratio by which different notes must be separated in order to achieve concordant intervals. Harmony is the form that the limiting structure of numerical ratio imposes upon the unlimited possibilities for sounds possessed by the strings of a musical instrument. In medicine the Pythagoreans saw the same principle at work. Health is the harmony or balance or proper ratio of certain opposites, such as hot and cold, or wet and dry, and the volumetric balance of various specific elements later known as biochemicals. Indeed, the Pythagoreans looked upon the body as they would a musical instrument. Health, they said, is achieved when the body is "in tune," and disease is a consequence of undue tensions or the loss of proper tuning of the strings. In the literature of early medicine, the concept of number was frequently used in connection with health and disease, particularly when number was translated to mean "figure." The *true* number, or figure, therefore, refers to the proper balance of all the elements and functions of the body. Number, then, represents the application of *limit* (form) to the *unlimited* (matter), and the Pythagoreans

referred to music and medicine only as vivid illustrations of their larger concept, namely, that all things *are* numbers.

The brilliance of Pythagoras and his followers is measured to some extent by the great influence they had upon later philosophers, particularly Plato. There is much in Plato that first came to light in the teachings of Pythagoras, including the importance of the soul and its threefold division, and the importance of mathematics as related to the concept of form and the Forms.

ATTEMPTS TO EXPLAIN CHANGE

Heraclitus

Earlier philosophers attempted to describe the ultimate constituents of the world around us. Heraclitus (ca. 540–480 BCE), an aristocrat from Ephesus, shifted attention to a new problem, namely, the problem of *change*. His chief idea was that "all things are in flux," and he expressed this concept of constant change by saying that "you cannot step twice into the same river." The river changes because "fresh waters are ever flowing in upon you." This concept of *flux*, Heraclitus thought, must apply not only to rivers but to all things, including the human soul. Rivers and people exhibit the fascinating fact of becoming different and yet remaining the same. We return to the "same" river although fresh waters have flowed into it, and the adult is still the same person as the child. Things change and thereby take on many different forms; nevertheless, they contain something that continues to be the same throughout all the flux of change. There must be, Heraclitus argued, some basic *unity* between these many forms and the single continuing element, between the many and the one. He made his case with such imaginative skill that much of what he had to say found an important place in the later philosophies of Plato and the Stoics; in more recent centuries he was deeply admired by Hegel and Nietzsche.

Flux and Fire To describe change as unity in diversity, Heraclitus assumed that there must be *something* that changes, and he argued that this something is *fire*. But he did not simply substitute the element of fire for Thales' water or Anaximenes' air. What led Heraclitus to fasten upon fire as the basic element in things was that fire behaves in such a way as to suggest how the process of change operates. Fire is simultaneously a deficiency and a surplus; it must constantly be fed, and it constantly gives off something either in the form of heat, smoke, or ashes. Fire is a process of transformation, then, whereby what is fed into it is transformed into something else. For Heraclitus it was not enough simply to point to some basic element, such as water, as the underlying nature of reality; this would not answer the question of how this basic stuff could change into different forms. When, therefore, Heraclitus fastened upon fire as the basic reality, he not only identified the *something* that changes but thought he had discovered the principle of change itself. To say that everything is in flux meant for Heraclitus that the world *is* an "ever-living Fire" whose constant movement is assured by "measures of it kindling and measures going out."

These "measures" meant for Heraclitus a kind of balance between what kindles and what goes out of the fire. He describes this balance in terms of financial exchange, saying that "all things are an exchange for Fire, and Fire for all things, similar to merchandise for gold and gold for merchandise." With this explanation of exchange, Heraclitus maintained that nothing is really ever lost in the nature of things. If gold is exchanged for merchandise, both the gold and the merchandise continue to exist, although they are now in different hands. Similarly, all things continue to exist, although they exchange their form from time to time.

There is a stability in the universe because of the orderly and balanced process of change or flux. The same "measure" comes out as goes in, just as if reality were a huge fire that inhaled and exhaled equal amounts, thereby preserving an even inventory in the world. This inventory represents the widest array of things, and all of them are simply different forms of fire. Flux and change consist of the movements of fire, movements that Heraclitus called the "upward and downward paths." The downward path of fire explains the coming into being of the things that we experience. So, when fire is condensed it becomes moist, and this moisture under conditions of increased pressure becomes water; water, in turn, when congealed becomes earth. On the upward path this process is reversed, and the earth is transformed into liquid; from this water come the various forms of life. Nothing is ever lost in this process of transformation because, as Heraclitus says, "fire lives the death of earth, and air the death of fire; water lives the death of air, earth that of water." With this description of the constant transformation of things in fire, Heraclitus thought he had explained the rudiments of the unity between the *one* basic stuff and the *many* diverse things in the world. But there was another significant idea that Heraclitus added to his concept of Fire, namely, the idea of *reason* as the universal law.

Reason as the Universal Law The process of change is not a haphazard movement but the product of God's universal Reason (*logos*). This idea of *Reason* came from Heraclitus' religious conviction that the most real thing of all is the soul, and the soul's most distinctive and important attribute is wisdom or thought. But when he speaks about God and the soul, he does not have in mind separate personal entities. For him there is only one basic reality, namely, Fire, and it is this material substance, Fire, that Heraclitus calls the One, or God. Inevitably, Heraclitus was a *pantheist*—a term meaning that God is identical with the totality of things in the universe. For Heraclitus all things are Fire/God. Since Fire/God is in everything, even the human soul is a part of Fire/God. As wisdom is Fire/God's most important attribute, wisdom or thought is human beings' chief activity. But inanimate things also contain the principle of reason, since they are also permeated with the fiery element. Because Fire/God *is* Reason and because Fire/God is the One, permeating all things, Heraclitus believed that Fire/God is the universal Reason. And, as such, Fire/God unifies all things and commands them to move and change in accordance with thought and rational principles. These rational principles constitute the essence of *law*—the universal law immanent in all things. All people share

this universal law to the degree that they possess Fire/God in their own natures and thereby possess the capacity for thought.

Logically, this account of our rational nature would mean that all of our thoughts are God's thoughts, since there is a unity between the One and the many, between God and human beings. We all must share in a common stock of knowledge since we all have a similar relation to God. Even stones partake in that part of God's Reason which makes them all equally behave according to the "law" of gravity. But people notoriously disagree and behave quite inconsistently. Recognizing this fact about human disagreement, Heraclitus says that "those awake have one ordered universe in common, but in sleep everyone turns away to one of his own." "Sleep," for Heraclitus, must mean to be thoughtless or even ignorant. Unfortunately, he does not explain how it is possible for people to be thoughtless if their souls and minds are part of God. In spite of it's limitations, Heraclitus' theory had a profound impact on succeeding thinkers. This is particularly so concerning his conviction that there is a common universe available to all thoughtful people and that all people participate in God's universal Reason or universal law. In later centuries it was this concept that provided the basis for the Stoics' idea of cosmopolitanism—the idea that all people are equally citizens of the world precisely because they all share in the One, in God's Reason. According to the Stoics, we all contain in ourselves some portion of the Fire, that is, sparks of the divine. It was this concept, too, that formed the foundation for the classic theory of *natural law*. With some variations the natural law passed from Heraclitus, to the Stoics, to medieval theologians, and eventually became a dynamic force in the American Revolution. Even today natural law is a vital component of legal theory.

The Conflict of Opposites Although human beings can know the eternal wisdom that directs all things, we do not pay attention to this wisdom. We therefore "prove to be uncomprehending" of the reasons for the way things happen to us. We are distressed by meaningless disorders in the world and overwhelmed by the presence of good and evil, and we long for the peace that means the end of strife. Heraclitus offers us little comfort here, since, for him, strife is the very essence of change itself. The conflict of opposites that we see in the world is not a calamity but simply the permanent condition of all things. According to Heraclitus, if we could visualize the whole process of change, we would see that "war is common and justice is strife and that all things happen by strife and necessity." From this perspective, he says, "what is in opposition is in concert, and from what differs comes the most beautiful harmony." Even death is no longer a calamity, for "after death things await people which they do not expect or imagine." Throughout his treatment of the problem of strife and disorder, Heraclitus emphasizes again and again that the many find their unity in the One. Thus, what appear to be disjointed events and contradictory forces are in reality intimately harmonized. For this reason, he says, people "do not know how what is at variance agrees with itself. It is an attunement of opposite tensions, like that of the bow and the lyre." Fire itself exhibits this tension of

opposites and indeed depends on it. Fire *is* its many tensions of opposites. In the One the many find their unity. Thus, in the One "the way up and the way down is the same," "good and ill are one," and "it is the same thing in us that is quick and dead, awake and asleep, young and old." This solution of the conflict of opposites rests upon Heraclitus' major assumption that nothing is ever lost, but merely changes its form. Following the direction of Reason, the eternal Fire moves with a measured pace, and all change requires opposite and diverse things. Still, "to God all things are fair and good and right, but people hold some things wrong and some right." Heraclitus did not come to this conclusion because he believed that there was a personal God who judged that all things are good. Instead, he thought that "it is wise to agree that all things are one," that the One takes shape and appears in many forms.

Parmenides

A younger contemporary of Heraclitus, Parmenides was born about 510 BCE and lived most of his life in Elea, a colony founded by Greek refugees in the southwest of Italy. He flourished there in more than one capacity, giving the people of Elea laws and establishing a new school of philosophy whose followers became known as Eleatics. Dissatisfied with the philosophical views of his predecessors, Parmenides offered the quite startling theory that the entire universe consists of one thing, which never changes, has no parts, and can never be destroyed. He calls this single thing the *One*. Granted, it may *appear* as though things change in the world, such as when a large oak tree grows from a tiny acorn. It may also *appear* as though there are many different things in the world, such as rocks, trees, houses, and people. However, according to Parmenides, all such change and diversity is an illusion. In spite of appearances, there is only one single, unchanging, and eternal thing that exists. Why would Parmenides offer a theory that is so contrary to appearances? The answer is that he was more persuaded by logical reasoning than by what he saw with his own eyes.

The logic of Parmenides' theory begins with the simple statement that *something is, or something is not*. For example, cows exist, but unicorns do not exist. On further consideration, though, Parmenides realizes that we can assert only the first part of the above statement, that *something is*. The reason is that we can only conceptualize and speak about things that exist; we are unable to do this with things that don't exist. Can any of us form a mental picture of the nonexistent? Thus, according to Parmenides, we must reject any contention that implies that *something is not*. Parmenides then unpacks several implications from this observation. First, he argues that nothing ever changes. Heraclitus, we have seen, held that *everything* is in constant change; Parmenides holds the exact opposite view. We typically observe that things change by coming into existence and then going out of existence. A large oak tree, for example, comes into existence when it emerges from a tiny acorn; the tree then goes out of existence when it dies and decomposes. Although this is how things appear to our eyes, Parmenides argues that this alleged process of change is logically flawed. We

first say that the tree *is not*, then *it is*, then once again it *is not*. Here we begin and end with the impossible contention that *something is not*. Logically, then, we are forced to reject this alleged process of change, chalking it up to one big illusion. Thus, nothing ever changes.

Parmenides argues similarly that the world consists of one indivisible thing. Again, we typically observe that the world contains many different things. Suppose, for example, that I see a cat sitting on a carpet. My common perception of this is that the cat and the carpet are different things, and not simply one undifferentiated mass of stuff. But this common view of physical differentiation is logically flawed. I am, in essence, saying that beneath the cat's feet the cat *is not*, but from its feet through its head the cat *is*, and above the cat's head the cat *is not*. Thus, when I demarcate the physical borders of the cat, I begin and end with the impossible contention that *something is not*. I must then reject the alleged fact of physical differentiation and once again chalk it up to one big illusion. In short, only one indivisible thing exists.

Using similar logic, Parmenides argues that the One must be motionless: If it moved, then it would not exist where it was before, which involves illogically asserting that *something is not*. Also, Parmenides argues that the One must be a perfect sphere. If it were irregular in any way—such as a bowling ball with three holes drilled in it—this would involve a region within the ball where nothing existed. This too would wrongly assert that *something is not*.

Even if we grant the logical force of Parmenides' arguments, it is not easy for us to cast off our commonsense view that the world exhibits change and multiplicity. Everywhere we see things in flux, and to us this represents genuine change. But Parmenides rejected these commonsense notions and insisted on a distinction between appearance and reality. Change and multiplicity, he says, involve a confusion between appearance and reality. What lies behind this distinction between appearance and reality is Parmenides' equally important distinction between opinion and truth. Appearance cannot produce more than opinion, whereas reality is the basis of truth. Common sense tells us that things appear to be in flux and, therefore, in a continuous process of change. However, Parmenides says that this opinion based on sensation must yield to the activity of reason. Reason, in turn, is able to discern the truth about things, and reason tells us that if there is a single substance of which everything consists, then there can be no movement or change. To some extent Thales made a similar point when he said that everything derives from water. Thales thus implies that the appearance of things does not give us the true constitution or stuff of reality. But Parmenides explicitly emphasized these distinctions, which became crucial to Plato's philosophy. Plato took Parmenides' basic idea of the unchangeability of being and developed from this his distinction between the intelligible world of truth and the visible world of opinion.

At the age of 65, Parmenides went to Athens accompanied by his chief pupil Zeno, and according to tradition, on this visit he conversed with the young Socrates. Parmenides' radical views about change and multiplicity inevitably incited critical challenges and ridicule. It was left to Zeno to defend his master's position against his attackers.

Zeno

Born in Elea about 489 BCE, Zeno was over 40 years old when he visited Athens with Parmenides. In defending Parmenides, Zeno's main strategy was to show that the so-called commonsense view of the world led to conclusions even more ridiculous than Parmenides'. The Pythagoreans, for example, rejected the basic assumption Parmenides had accepted, namely, that reality is One. Instead, they believed in a plurality of things—that there exist a quantity of separate and distinct things—and that, therefore, motion and change are real. Their argument seemed to accord more closely with common sense and the testimony of the senses. But Parmenides' approach, which Zeno followed, required a distinction between appearance and reality. To philosophize, according to Parmenides and Zeno, we must not only *look* at the world but also *think* about it in order to understand it.

Zeno felt strongly that our senses give us no clue about reality but only about appearances. Accordingly, our senses do not give us reliable knowledge but only opinion. He demonstrates this using the example of a millet seed. If we take a millet seed and drop it to the ground, it will not make a sound. But if we take a half-bushel of millet seeds and let them fall to the ground, there will be a sound. From this difference Zeno concluded that our senses have deceived us: Either there is a sound when the single seed falls or there is not a sound when the many seeds fall. So, to get at the truth of things, it is more reliable to go by way of thought than by way of sensation.

Zeno's Four Paradoxes In answering Parmenides' critics, Zeno fashioned his arguments in the form of paradoxes. The commonsense view of the world rests on two principal assumptions: (1) Changes occur throughout time, and (2) a diversity of objects are spread throughout space. Following Parmenides, Zeno, of course, rejects both of these assumptions. However, in arguing against the commonsense view of things, Zeno provisionally grants the above two assumptions and then notes paradoxes that follow from them. The consequences are in fact so absurd that the commonsense view of the world no longer seems so commonsensical. By contrast, then, Parmenides' view of the One seems to be the more reasonable account of the world. Zeno presents four principal paradoxes:

1. *The racecourse.* According to this paradox of motion, a runner crosses a series of units of distance from the beginning to the end of the racecourse. But, Zeno asks, just what takes place in this example? Is there really any motion? In order to traverse the racecourse, the runner, according to the Pythagorean hypothesis, would have to cross an infinite number of points, and do so in a finite number of moments. But the critical question is, how can one cross an infinite number of points in a finite amount of time? The runner cannot reach the end of the course until first reaching the halfway point; but the distance from the beginning to the halfway point can also be divided in half, and the runner must first reach that point, the one-quarter mark, before reaching the halfway point. Likewise, the distance between the beginning and the one-quarter point is divisible, and this process of

division must go on to infinitude since there is always a remainder and every such unit is divisible. If, then, the runner cannot reach any point without first reaching its previous midpoint, and if there are an infinite number of points, it is impossible to cross this infinite number of points in a finite amount of time. For this reason, Zeno concludes that motion does not exist.

2. *Achilles and the tortoise.* This paradox is similar to the racecourse illustration. Imagine a race between the swift Achilles and a tortoise. Because he is a good sport, Achilles gives the tortoise a head start and is thus in pursuit of the tortoise. Zeno argues that Achilles cannot ever overtake the tortoise because he must always reach the point that the tortoise has passed. The distance between Achilles and the tortoise will always be divisible and, as in the case of the racecourse, no point can be reached before the previous point has been reached. The effect is that there can be no motion at all, and Achilles, on these assumptions, can never overtake the tortoise. What Zeno thought he had demonstrated here was, again, that although the Pythagoreans claimed the reality of motion, their theory of the plurality of the world made it impossible to think of the idea of motion in a coherent way.
3. *The arrow.* Does an arrow move when the archer shoots it at the target? Here again, the Pythagoreans, who had argued for the reality of space and therefore of its divisibility, would have to say that the moving arrow must at every moment occupy a particular position in space. But if an arrow occupies a position in space equal to its length, this is precisely what is meant when we say that the arrow is at rest. Since the arrow must always occupy such a position in space equal to its length, the arrow must always be at rest. Moreover, any quantity, as we saw in the example of the racecourse, is infinitely divisible. Hence, the space occupied by the arrow is infinite, and as such it must coincide with everything else, in which case everything must be One instead of many. Motion, therefore, is an illusion.
4. *The relativity of motion.* Imagine three passenger cars of equal length on tracks parallel to each other, with each car having eight windows on a side. One car is stationary, and the other two are moving in opposite directions at the same speed. In Figure 1 car *A* is stationary, and cars *B* and *C* are moving in opposite directions at the same speed until they reach the positions shown in Figure 2. In order to reach the positions in Figure 2, the front of car *B* would go past four of car *A*'s windows while the front of car *C* would go past all eight of car *B*'s windows. Each window represents a unit of distance, and each such unit is passed in an equal unit of time. Now, car *B* went

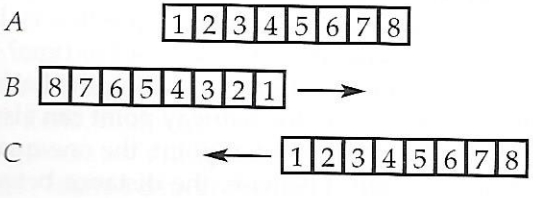

FIGURE 1

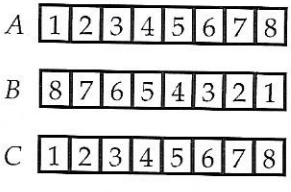

FIGURE 2

past only four of *A*'s windows while car *C* went past eight of *B*'s windows. Since each window represents the same unit of time, it follows that four units of time are equal to eight units of time or that four units of distance equal eight units of distance, which is absurd. Whatever may be the inner complications of this argument, Zeno's chief point was that motion has no clear definition, and it is a relative concept.

In all of these arguments, Zeno was simply counterattacking the adversaries of Parmenides, taking seriously their assumption of a pluralistic world—a world where, for example, a line or time is divisible. By pushing these assumptions to their logical conclusions, Zeno attempted to demonstrate that the notion of a pluralistic world lands one in insoluble absurdities and paradoxes. He, therefore, reiterated Parmenides' thesis that change and motion are illusions and that there is only one being, continuous, material, and motionless. In spite of Zeno's valiant efforts, the commonsense view of the world persisted, which prompted succeeding philosophers to take a different approach to the problem of change and constancy.

Empedocles

Empedocles was an impressive figure in his native Agrigentum, Sicily, where he lived probably from 490 to 430 BCE. His interests and activities ranged from politics and medicine to religion and philosophy. Legend has it that, wishing to be remembered as a godlike figure, he ended his life by leaping into the crater of Mount Etna, hoping thereby to leave no trace of his body so that the people would think he had gone up to heaven. He wrote his philosophy in the form of poetry, of which only a small portion survives. From it we see not an original or new philosophy, but rather a new way of putting together what his predecessors had already said. Empedocles believed that the arguments both for and against motion and change had some merit. Instead of taking either side, however, he ingeniously merged both points of view in what was the first attempt at combining the major philosophical contributions of his predecessors. He thereby discovered a consistent way of saying that there is change and at the same time affirming that reality is fundamentally changeless.

Empedocles agreed with Parmenides that being is uncreated and indestructible, that it simply *is*. He writes that "from what in no wise exists, it is impossible for anything to come into being; and for being to perish completely is incapable of fulfillment and unthinkable; for it will always be there, wherever any one may place it on any occasion." But, unlike Parmenides, he did not agree that existence consists simply of the One. To accept the notion of the One requires us to deny the reality of motion, but to Empedocles the phenomenon of motion was both too obvious and too compelling to deny. He therefore rejected the idea of the One. However, agreeing with Parmenides that being is uncreated and indestructible, Empedocles argued that being is not One but many. It is *the many* which are changeless and eternal.

According to Empedocles, the objects that we see and experience do, in fact, come into being and are also destroyed. But such change and motion are

possible because objects are composed of many material particles. Thus, although *objects* can change, as Heraclitus said, the *particles* of which they are composed are changeless, as Parmenides said about the One. But of what did these particles consist? Empedocles held that these particles are four eternal material elements, namely, earth, air, fire and water. He developed this idea by reinterpreting the philosophies of Thales and Anaximenes, who emphasized the primary elements of water and air, respectively. Following Greek tradition, which emphasized the four primary elements of earth, air, fire, and water, Empedocles expanded on Thales' and Anaximenes' theories. These four elements, he believed, are changeless and eternal, and can never be transformed into something else. What explains the changes in objects that we see around us is the *mixture* of the four elements, but not their transformation. There is, he writes, "only a mingling and interchange of what has been mingled." Earth, air, fire, and water, though they are unchangeable particles, mingle together to form objects and thereby make possible what in common experience we see as change.

Empedocles' account of earth, air, fire, and water constitutes only the first part of his theory. The second part is an account of the specific forces that animate the process of change. The Ionians assumed that the stuff of nature simply transformed itself into various objects. Only Anaximenes made any detailed attempt to analyze the process of change with his theory of condensed and expanded air. By contrast, Empedocles assumed that there are in nature two forces, which he called *Love* and *Hate* (alternatively, Harmony and Discord). These are the forces that cause the four elements to intermingle and later to separate. The force of Love causes elements to attract each other and build up into some particular form or person. The force of Hate causes the decomposition of things. The four elements, then, mix together or separate from each other depending on how much Love or Hate are present. In fact, Empedocles believed, there are cycles within nature that manifest Love and Strife in differing degrees at different times. Expressing this never-ending cycle in his poetic style, Empedocles writes that

> this process is clearly to be seen throughout the mass of mortal limbs: sometimes through love all the limbs which the body has as its lot come together into one, in the prime of flourishing life. At another time again, sundered by evil feuds, they wander severally by the breakers of the shore of life. Likewise too with shrub plants and fish in their watery dwelling, and beasts with mountain lairs and diver birds that travel on wings.

There are four stages to the cycle. In the first stage, Love is present and Hate is completely absent. Here the four elements are fully commingled and are held in Harmony by the governing principle of Love. In the second stage the force of Hate, lurking nearby, starts to invade things, but there is still more Love present than Hate. In the third stage Hate begins to predominate, and the particles fall into Discord and begin to separate. In the final stage only Hate is present, and all particles of earth, air, fire, and water separate into their own four groups. There the elements are ready to begin a new cycle as the force of Love returns to attract the elements into harmonious combinations. This process continues without end.

Anaxagoras

Anaxagoras (500–428 BCE) was from Clazomenae, a coastal town in what is now Turkey. He later moved to Athens, where he was in the company of the statesman Pericles. His major philosophical contribution was the concept of *mind* (*nous*), which he distinguished from matter. Anaxagoras agreed with Empedocles that all coming into and going out of being consists merely in the mixture and separation of already existing substances. But he rejected Empedocles' ambiguous and somewhat mythical notions of Love and Hate, by which various objects supposedly form. For Anaxagoras the world and all its objects were well-ordered and intricate structures; there must, then, be some being with knowledge and power that organizes the material world in this fashion. Such a rational principle is what Anaxagoras proposed in his concept of *Mind*, or *nous*.

According to Anaxagoras, the nature of reality is best understood as consisting of *Mind* and *matter*. Before Mind has influenced the shape and behavior of matter, matter exists, as a mixture of various kinds of material substances, all uncreated and imperishable. Even when this original mass of matter is divided into actual objects, each part contains portions of every other elemental "thing" (*spermata*, or seeds). Snow, for example, contains the opposites of black and white and is called white only because white predominates in it. In a sense, then, each part contains what is in the whole of reality, since each has a special "portion" of everything in it.

According to Anaxagoras, *separation* is the process by which this matter formed into various things, and such separation occurs through the power of Mind. Specifically, Mind produced a rotary motion, causing a vortex that spread out to encompass more and more of the original mass of matter. This forces a "separation" of various substances. This rotary motion originally caused a separation of matter into two major divisions—one mass that contained the warm, light, rare, and dry, and a second mass that contained the cold, dark, dense, and moist. This process of separation is continuous, and there is constant progress in the process of separation. Particular objects are always combinations of substances in which some particular substance predominates. For example, water predominates with the elemental stuff moistness but nevertheless has all other elemental things present. Describing this process in one of the preserved fragments of his last book, Anaxagoras writes that

> mind set in order all things that were to be and are now and that will be, and this revolution in which now revolve the stars and the sun and the moon and the air and the aether which are separated off. . . . The revolution itself caused the separating off, and the dense is separated off from the rare, the warm from the cold, the bright from the dark, and the dry from the moist. And there are many portions of many things.

Emphasizing the continued mixture of things, he says that "no thing is altogether separated off from anything else except Mind." Forces set in motion in the vortex account for the appearance of the thick and moist at the center and the thin and warm at the circumference—that is, of the earth and the atmosphere. The forces of rotation also caused red-hot masses of stones to be torn away from

the earth and to be thrown into the ether, and this is the origin of the stars. The earth, originally mud, was dried by the sun and fertilized by germs contained in the air. Everything, even now, is animated by Mind, including life in plants and sense perception in human beings. Mind is everywhere, or as Anaxagoras says, Mind is "there where everything else is, in the surrounding mass."

Although Anaxagoras considered Mind the moving or controlling force in the cosmos and in human bodies, his account of the actual role of Mind was limited. For one thing the Mind was not the *creator* of matter, since he held that matter is eternal. Moreover, he did not see in Mind the source of any purpose to the natural world. Mind's role in the origin of particular things appears to be a mechanical explanation, principally through the process of "separation." Things are the products of material causes, and Mind appears to have no distinctive role apart from starting motion.

Aristotle, who later distinguished between different kinds of causes, offered a mixed evaluation of Anaxagoras's views. He contrasts Anaxagoras with his predecessors, who attributed the origin of things to spontaneity and chance. According to Aristotle, when Anaxagoras said that "reason was present—as in animals, so throughout nature—as the cause of order and of all arrangement, he seemed like a sober man in contrast with the random talk of his predecessors." But, adds Aristotle, Anaxagoras made use of his concept of Mind only "to a small extent." His criticism was that "Anaxagoras uses reason as a divine machine for making the world, and when he is at a loss to tell from what cause something necessarily is, then he drags reason in, but in all other cases ascribes events to anything rather than reason." Anaxagoras seemed to provide an explanation only of how matter acquired its rotary motion, leaving the rest of the order of nature to be a product of that motion.

Still, what Anaxagoras had to say about reason was of great consequence in the history of philosophy because he thereby introduced an abstract principle into the nature of things. He differentiated Mind and matter. While he may not have described Mind as completely immaterial, he nevertheless distinguished Mind from the matter it had to work with. He stated that Mind, unlike matter, "is mixed with nothing, but is alone, itself by itself." What makes Mind different from matter is that it is "the finest of all things and the purest, and it has all knowledge about everything and the greatest power." Thus, while matter is composite, Mind is simple. But Anaxagoras did not distinguish two different worlds—that of Mind and of matter—but saw these two as always interrelated. Thus, he writes, Mind is "there where everything else is." Although he had not worked out all the possibilities of his concept of Mind, this concept was nevertheless destined to have enormous influence in later Greek philosophy.

THE ATOMISTS

Leucippus and Democritus formulated a theory about the nature of things that bears an astonishing resemblance to some contemporary scientific views. However, it is difficult now to disentangle the contributions each individual made to

this atomistic theory. Their writings are lost for the most part, but we at least know that Leucippus was the founder of the atomist school and that Democritus supplied much of the detailed elaboration of it. Leucippus was a contemporary of Empedocles (490–430 BCE), but we know little else of his life beyond that. Democritus, born in Abdera, Thrace, is reputed to have lived 100 years, from 460 to 360 BCE. Through his immense learning and painstaking attempt to state with clarity his abstract theory of atomism, Democritus inevitably overshadowed Leucippus. It is to Leucippus, though, that we must credit the central contention of atomism, namely, that everything is made up of atoms moving in empty space.

Atoms and the Void

According to Aristotle, the philosophy of atomism originated as an attempt to overcome the logical consequences of the Eleatic denial of space. Parmenides denied that there could be many independent things because everywhere there was *being*, in which case the total reality would be One. Specifically, he denied the existence of nonbeing or the void (empty space), because to say that there *is* the void is to say that the void *is something*. It is impossible, he thought, to say that there *is* nothing. Leucippus formulated his new theory precisely to reject this treatment of space or the void.

Leucippus affirmed the reality of space and thereby prepared the way for a coherent theory of motion and change. What had complicated Parmenides' concept of space was his thought that whatever exists must be *material*, and so space, if it existed, must also be material. Leucippus, on the other hand, thought it possible to affirm that space exists without having to say at the same time that it is material. Thus, he described space as something like a receptacle that could be empty in some places and full in others. As a receptacle, space, or the void, could be the place where objects move, and Leucippus apparently saw no reason for denying this characteristic of space. Without this concept of space, it would have been impossible for Leucippus and Democritus to develop their view that all things consist of atoms.

According to Leucippus and Democritus, the nature of things consists of an infinite number of particles or units called 'atoms'. Leucippus and Democritus ascribed to these atoms the two chief characteristics that Parmenides had ascribed to the One, namely, indestructibility and eternity. Whereas Parmenides had said that reality consists of a single One, the atomists now said that there are an infinite number of atoms, each one being completely solid in itself. These atoms contain no empty spaces and therefore are completely hard and indivisible. They exist in space and differ from each other in shape and size, and because of their small size, they are invisible. Since these atoms are eternal, they did not have to be created. Nature consists, therefore, of two things only: *space*, which is a vacuum, and *atoms*. The atoms move about in space, and their motion leads them to form the objects we experience.

The atomists did not think it was necessary to account for how atoms first began moving in space. The original motion of these atoms, they thought, was

similar to the motion of dust particles as they dart off in all directions in a sunbeam, even when there is no wind to impel them. Democritus said that there is no absolute "up" or "down," and since he did not ascribe weight to atoms, he thought that atoms could move in any direction. Things as we know them have their origin in the motion of the atoms. Moving in space, the atoms originally were single individual units. Inevitably, though, they began to collide with each other. In cases in which their shapes were such as to permit them to interlock, they began to form clusters. In this the atomists resembled the Pythagoreans, who said that all things are numbers. Things, like numbers, are made up of combinable units; for the atomists things are simply combinations of various kinds of atoms. Mathematical figures and physical figures are, therefore, similar.

In the beginning, then, there were atoms in space. Each atom is like the Parmenidean One, but though they are indestructible, they are in constant motion. The atomists described earth, air, fire, and water as different clusters of changeless atoms—the product of the movement of originally single atoms. These four elements were not the primeval roots of all other things, as earlier philosophers believed, but were themselves the product of the absolutely original stuff, the atoms.

The atomists produced a mechanical conception of the nature of things. For them everything was the product of the collision of atoms moving in space. Their theory had no place in it for the element of *purpose* or *design*, and their materialistic reduction of all reality to atoms left no place for a creator or designer. They saw no need to account either for the origin of the atoms or for the original motion impelling the atoms. The question of origins could always be asked, even about God; to ascribe eternal existence to the material atoms seemed as satisfactory as any other solution.

The theory of atomism envisioned by Leucippus and Democritus had a long and influential history. So formidable was this theory that, although it went into a decline during the Middle Ages, it was revived during the Renaissance and provided science with its working model for centuries to come. Isaac Newton (1642–1727) still thought in atomistic terms when he wrote his famous *Principia Mathematica*. In this work he deduced the motion of the planets, the comets, the moon, and the sea:

> I wish we could devise the rest of the phenomena of Nature by the same kind of reasoning from mechanical principles, for I am induced by many reasons to suspect that they may all depend upon certain forces by which the particles of bodies, by some causes hitherto unknown, are either mutually impelled towards one another and cohere in regular figures, or are repelled and recede from one another.

Although Newton assumed God had set things in motion, his physical analysis of nature was restricted to the mechanical principles of matter moving in space. After Newton atomism held sway until quantum theory and Einstein gave contemporary science a new conception of matter, which denied the attribute of indestructibility to the atoms.

Theory of Knowledge and Ethics

Besides describing the structure of nature, Democritus was concerned with two other philosophical problems: the problem of knowledge and the problem of human conduct. Being a thorough materialist, Democritus held that *thought* can be explained in the same way that any other phenomenon can, namely, as the movement of atoms. He distinguished between two different kinds of perception, one of the senses and one of the understanding, both of these being physical processes. When our eyes see something, this something is an "effluence" or the shedding of atoms by the object, forming an "image." These atomic images of things enter the eyes, and other organs of sense, and make an impact upon the soul, which is itself made up of atoms.

Democritus further distinguishes between two ways of knowing things: "there are two forms of knowledge, the trueborn and the illegitimate. To the illegitimate belong all these: sight, hearing, smell, taste, touch. The trueborn is quite apart from these." What distinguishes these two types of thought is that, whereas "trueborn" knowledge depends only on the object, "illegitimate" knowledge is affected by the particular conditions of the body of the person involved. For example, two people can agree that what they have tasted is an apple (trueborn). However, they can still disagree about the apple's taste (illegitimate knowledge), with one saying the apple is sweet and the other saying it is bitter. So, according to Democritus, "by the senses we know in truth nothing sure, but only something that changes according to the disposition of the body and of the things that enter into it or resist it." Still, Democritus had to say that both sensation and thought are the same type of mechanical process.

Concerning ethics, Democritus developed a very ambitious set of rules for human behavior. In general, he maintained that the most desirable goal of life is cheerfulness, and we best achieve this through moderation in all things along with the cultivation of culture. With the emergence of ethics as its primary concern, philosophy reached one of its major watersheds, closing out the first era, when the principal question had been about the natural physical order. Now people would ask more searching questions about how they should behave.