

Cause

INTRODUCTION

EXPLANATION is an inveterate human tendency. Even philosophers who think that we cannot attain to knowledge of causes get involved in explaining why that is so. Nor will their disputes about the theory of causes ever remove the word "because" from the vocabulary of common speech. It is as unavoidable as the word "is." "The impulse to seek causes," says Tolstoy, "is innate in the soul of man."

The question "Why?" remains after all other questions are answered. It is sometimes the only unanswerable question—unanswerable either in the very nature of the case or because there are secrets men cannot fathom. Sometimes, as Dante says, man must be "content with the *quia*," the knowledge *that* something is without knowing *why*. "Why?" is the one question which it has been deemed the better part of wisdom not to ask; yet it has also been thought the one question which holds the key to wisdom. As Virgil writes, in one of his most famous lines, *Felix, qui potuit rerum cognoscere causas* (Happy is the man who has been able to know the causes of things).

The question "Why?" takes many forms and can be answered in many ways. Other knowledge may prove useful in providing the answers. A definition, for example, which tells us what a thing is, may explain why it behaves as it does or why it has certain properties. A narrative, which tells us how something happened by describing a succession of events, may also be part of the total explanation of some event in question.

In other circumstances, a demonstration or statement of grounds or reasons may be explanatory. "How do you know?" is often a concealed form of the "Why" question. To answer it we may have to give our reasons for

thinking that something or other is the case; or perhaps give the genesis of our opinion. Things as different as a logical demonstration and a piece of autobiography seem to be relevant in accounting for our convictions; as in accounting for our behavior, we may refer to our purposes and to our past.

THE GREEK WORD for cause, from which our English word "aetiology" is derived, came into the vocabulary of science and philosophy from the language of the law courts. In its legal sense it was used to point out where the responsibility lay. A suit at law is based upon a cause of action; he who demands redress for an injury suffered is expected to place the blame. The charge of responsibility for wrongdoing—the blame or fault which is the cause for legal redress or punishment—naturally calls for excuses, which may include a man's motives.

In the context of these legal considerations, two different meanings of cause begin to appear. One man's act is the cause of injury to another, in the sense of being responsible for its occurrence. If the act was intentional, it probably had a cause in the purpose which motivated it.

These two types of cause appear in the explanations of the historians as well as in trials at law. Herodotus and Thucydides, trying to account for the Persian or the Peloponnesian war, enumerate the incidents which led up to the outbreak of hostilities. They cite certain past events as the causes of war—the factors which predisposed the parties toward conflict, and even precipitated it. The historians do not think they can fully explain why the particular events become the occasions for war except by considering the hopes and ambitions, or,

as Thucydides suggests, the fears of the contestants. For the ancient historians at least, finding the causes includes a search for the motives which underlie other causes and help to explain how other factors get their causal efficacy.

Thucydides explicitly distinguishes these two kinds of causes in the first chapter of his history. After noting that the "immediate cause" of the war was the breaking of a treaty, he adds that the "real cause" was one "which was formally most kept out of sight," namely, the "growth of the power of Athens, and the alarm which this inspired in Lacedaemon."

It is sometimes supposed that Thucydides owes his conception of causes to the early medical tradition. That might very well be the case, for Hippocrates constantly seeks the "natural causes" of disease; and in his analysis of the various factors involved in any particular disease, he tries to distinguish between the predisposing and the exciting causes.

But the classification of causes was not completed in the Athenian law courts, in the Greek interpretation of history, or in the early practice of medicine. Causes were also the preoccupation of the pre-Socratic physicists. Their study of nature was largely devoted to an analysis of the principles, elements, and causes of change. Concerned with the problem of change in general, not merely with human action, or particular phenomena such as crime, war, or disease, Greek scientists or philosophers, from Thales and Anaxagoras to Empedocles, Democritus, Plato, and Aristotle, tried to discover the causes involved in any change. Aristotle carried the analysis furthest and set a pattern for all later discussions of cause.

THE EXPLANATION OF a thing, according to Aristotle, must answer all of the queries "comprehended under the question 'why.'" This question can be answered, he thinks, in at least four different ways, and these four ways of saying why something is the case constitute his famous theory of the four causes.

"In one sense," he writes, "that out of which a thing comes to be and which persists, is called 'cause'"—the material cause. "In another sense, the form or the archetype" is a

cause—the formal cause. "Again the primary source of the change or coming to rest" is a cause—the efficient cause. "Again the end or 'that for the sake of which' a thing is done" is a cause—the final cause. "This," he concludes, "perhaps exhausts the number of ways in which the term 'cause' is used."

The production of works of art, to which Aristotle himself frequently turns for examples, most readily illustrates these four different kinds of causes. In making a shoe, the material cause is that out of which the shoe is made—the leather or hide. The efficient cause is the shoemaker, or more precisely the shoemaker's acts which transform the raw material into the finished product. The formal cause is the pattern which directs the work; it is, in a sense, the definition or type of the thing to be made, which, beginning as a plan in the artist's mind, appears at the end of the work in the transformed material as its own intrinsic form. The protection of the foot is the final cause or end—that for the sake of which the shoe was made.

Two of the four causes seem to be less discernible in nature than in art. The material and efficient causes remain evident enough. The material cause can usually be identified as that which undergoes the change—the thing which grows, alters in color, or moves from place to place. The efficient cause is always that by which the change is produced. It is the moving cause working on that which is susceptible to change, *e.g.*, the fire heating the water, the rolling stone setting another stone in motion.

But the formal cause is not as apparent in nature as in art. Whereas in art it can be identified by reference to the plan in the maker's mind, it must be discovered in nature in the change itself, as that which completes the process. For example, the redness which the apple takes on in ripening is the formal cause of its alteration in color. The trouble with the final cause is that it so often tends to be inseparable from the formal cause; for unless some extrinsic purpose can be found for a natural change—some end beyond itself which the change serves—the final cause, or that for the sake of which the change took place, is no other than the quality

or form which the matter assumes as a result of its transformation.

THIS SUMMARY of Aristotle's doctrine of the four causes enables us to note some of the basic issues and shifts in the theory of causation.

The attack on final causes does not, at the beginning at least, reject them completely. Francis Bacon, for example, divides natural philosophy into two parts, of which one part, "physics, inquireth and handleth the material and efficient causes; and the other, which is metaphysics, handleth the formal and final causes." The error of his predecessors, of which he complains, is their failure to separate these two types of inquiry. The study of final causes is inappropriate in physics, he thinks.

"This misplacing," Bacon comments, "hath caused a deficiency, or at least a great improficiency in the sciences themselves. For the handling of final causes, mixed with the rest in physical inquiries, hath intercepted the severe and diligent inquiry of all real and physical causes, and given men the occasion to stay upon these satisfactory and specious causes, to the great arrest and prejudice of further discovery." On this score, he charges Plato, Aristotle, and Galen with impeding the development of science, not because "final causes are not true, and worthy to be inquired, being kept within their own province; but because their excursions into the limits of physical causes hath bred a vastness and solitude in that tract."

Such statements as "the hairs of the eyelids are for a quickset and fence about the sight," or that "the leaves of trees are for protecting of the fruit," or that "the clouds are for watering of the earth," are, in Bacon's opinion, "impertinent" in physics. He therefore praises the mechanical philosophy of Democritus. It seems to him to inquire into the "particularities of physical causes" better "than that of Aristotle and Plato, whereof both intermingled final causes, the one as a part of theology, the other as a part of logic."

As Bacon's criticisms indicate, the attack on final causes in nature raises a whole series of questions. Does every natural change serve some purpose, either for the good of the

changing thing or for the order of nature itself? Is there a plan, analogous to that of an artist, which orders the parts of nature, and their activities, to one another as means to ends? A natural teleology, which attributes final causes to everything, seems to imply that every natural thing is governed by an indwelling form working toward a definite end, and that the whole of nature exhibits the working out of a divine plan or desire.

Spinoza answers such questions negatively. "Nature has set no end before herself," he declares, and "all final causes are nothing but human fictions." Furthermore, he insists, "this doctrine concerning an end altogether overturns nature. For that which is in truth the cause it considers as the effect, and *vice versa*." He deplores those who "will not cease from asking the causes of causes, until at last you fly to the will of God, the refuge of ignorance."

Spinoza denies that God acts for an end and that the universe expresses a divine purpose. He also thinks that final causes are illusory even in the sphere of human action. When we say that "having a house to live in was the final cause of this or that house," we do no more than indicate a "particular desire, which is really an efficient cause, and is considered as primary, because men are usually ignorant of the causes of their desires."

Though Descartes replies to Pierre Gassendi's arguments "on behalf of final causality," by saying that they should "be referred to the efficient cause," his position more closely resembles that of Bacon than of Spinoza. When we behold "the uses of the various parts in plants and animals," we may be led to admire "the God who brings these into existence," but "that does not imply," he adds, "that we can divine the purpose for which He made each thing. And although in Ethics, where it is often allowable to employ conjecture, it is at times pious to consider the end which we may conjecture God set before Himself in ruling the universe, certainly in Physics, where everything should rest upon the securest arguments, it is futile to do so."

The elimination of final causes from natural science leads Descartes to formulate Harvey's discoveries concerning the motion of the heart

and blood in purely mathematical terms. But Harvey himself, as Robert Boyle points out in his *Disquisition About the Final Causes of Natural Things*, interprets organic structures in terms of their functional utility; and Boyle defends the soundness of Harvey's method—employing final causes—against Descartes.

Guided as it is by the principle of utility or function, Harvey's reasoning about the circulation of the blood—especially its venal and arterial flow in relation to the action of the lungs—appeals to final causes. He remarks upon the need of arguing from the final cause in his work on animal generation. "It appears advisable to me," he writes, "to look back from the perfect animal, and to inquire by what process it has arisen and grown to maturity, to retrace our steps, as it were, from the goal to the starting place."

Kant generalizes this type of argument in his "Critique of Teleological Judgement." "No one has ever questioned," he says, "the correctness of the principle that when judging certain things in nature, namely organisms and their possibility, we must look to the conception of final causes. Such a principle is admittedly necessary even where we require no more than a *guiding-thread* for the purpose of becoming acquainted with the character of these things by means of observation." Kant criticizes a mechanism which totally excludes the principle of finality—whether it is based on the doctrine of "blind chance" of Democritus and Epicurus, or the "system of fatality" he attributes to Spinoza. Physical science, he thinks, can be extended by the principle of final causes "without interfering with the principle of the mechanism of physical causality."

THE TENDENCY TO dispense with final causes seems to prevail, however, in the science of mechanics and especially in the domain of inanimate nature. Huygens, for example, defines light as "the motion of some sort of matter." He explicitly insists that conceiving natural things in this way is the only way proper to what he calls the "true Philosophy, in which one conceives the causes of all natural effects in terms of mechanical motions."

Mechanical explanation is distinguished by

the fact that it appeals to no principles except matter and motion. The material and the moving (or efficient) causes suffice. The philosophical thought of the 17th century, influenced by that century's brilliant accomplishments in mechanics, tends to be mechanistic in its theory of causation. Yet, being also influenced by the model and method of mathematics, thinkers like Descartes and Spinoza retain the formal cause as a principle of demonstration, if not of explanation. Spinoza, in fact, claims that the reliance upon final causes "would have been sufficient to keep the human race in darkness to all eternity, if mathematics, which does not deal with ends, but with the essences and properties of forms, had not placed before us another rule of truth."

Nevertheless, the tendency to restrict causality to efficiency—a motion producing a motion—gains headway. By the time Hume questions man's ability to know causes, the term *cause* signifies only *efficiency*, understood as the energy expended in producing an effect. Hume's doubt concerning our ability to know causes presupposes this conception of cause and effect, which asserts that "there is some connection between them, some power in the one by which it infallibly produces the other." The identification of cause with the efficient type of cause becomes a commonly accepted notion, even among those who do not agree with Hume that "we are ignorant . . . of the manner in which bodies operate on each other"; and that "their force and energy is entirely incomprehensible" to us.

The narrowing of causality to efficiency also appears in the doctrine, more prevalent today than ever before, that natural science describes, but does not explain—that it tells us *how* things happen, but not *why*. If it does not require the scientist to avoid all reference to causes, it does limit him to the one type of causality which can be expressed in terms of sequences and correlations. The exclusion of all causes except the efficient tends furthermore to reduce the causal order to nothing but the relation of cause and effect.

The four causes taken together as the sufficient reason for things or events do not as such stand in relation to an effect, in the sense

in which an effect is something separable from and externally related to its cause. That way of conceiving causation—as a relation of cause to effect—is appropriate to the efficient cause alone. When the efficient cause is regarded as the only cause, having a power proportionate to the reality of its effect, the very meaning of *cause* involves relation to an *effect*.

In the other conception of causation, the causal order relates the four causes to one another. Of the four causes of any change or act, the first, says Aquinas, “is the final cause; the reason of which is that matter does not receive form, save in so far as it is moved by an agent, for nothing reduces itself from potentiality to act. But an agent does not move except from the intention of an end.” Hence in operation the order of the four causes is final, efficient, material, and formal; or, as Aquinas states it, “first comes goodness and the end, moving the agent to act; secondly the action of the agent moving to the form; thirdly, comes the form.”

THE THEORY OF causes, as developed by Aristotle and Aquinas, proposes other distinctions beyond that of the four causes, such as the difference between the essential cause or the cause *per se* and the accidental or coincidental cause. As indicated in the chapter on CHANCE, it is in terms of coincidental causes that Aristotle speaks of chance as a cause.

A given effect may be the result of a number of efficient causes. Sometimes these form a series, as when one body in motion sets another in motion, and that moves a third; or, to take another example, a man is the cause of his grandson only through having begotten a son who later begets a son. In such a succession of causes, the first cause may be indispensable, but it is not by itself sufficient to produce the effect. With respect to the effect which it fails to produce unless other causes intervene, it is an accidental cause. In contrast, an essential cause is one which, by its operation, immediately brings the effect into existence.

Sometimes, however, a number of efficient causes may be involved simultaneously rather than successively in the production of a single effect. They may be related to one another as cause and effect rather than by mere coinci-

dence. One cause may be the essential cause of another which in turn is the essential cause of the effect. When two causes are thus simultaneously related to the same effect, Aquinas calls one the principal, the other the instrumental cause; and he gives as an example the action of a workman sawing wood. The action of the saw causes a shaping of the wood, but it is instrumental to the operation of the principal cause, which is the action of the workman using the saw.

These two distinctions—between essential and accidental causes and between principal and instrumental causes—become of great significance in arguments, metaphysical or theological, concerning the cause of causes—a first or ultimate cause. Aristotle’s proof of a prime mover, for example, depends upon the proposition that there cannot be an infinite number of causes for a given effect. But since Aristotle also holds that the world is without beginning or end and that time is infinite, it may be wondered why the chain of causes cannot stretch back to infinity.

If time is infinite, a temporal sequence of causes reaching back to infinity would seem to present no difficulty. As Descartes points out, you cannot “prove that that regress to infinity is absurd, unless you at the same time show that the world has a definite beginning in time.” Though it is a matter of their Jewish and Christian faith that the world had a beginning in time, theologians like Maimonides and Aquinas do not think the world’s beginning can be proved by reason. They do, however, think that the necessity of a first cause can be demonstrated, and both adopt or perhaps adapt the argument of Aristotle which relies on the impossibility of an infinite regression in causes.

The argument is valid, Aquinas makes clear, only if we distinguish between essential and accidental causes. “It is not impossible,” he says, “to proceed to infinity *accidentally* as regards efficient causes . . . It is not impossible for man to be generated by man to infinity.” But, he holds, “there cannot be an infinite number of causes that are *per se* required for a certain effect; for instance, that a stone be moved by a stick, the stick by the hand, and

so on to infinity." In the latter case, it should be observed, the cooperating causes are simultaneous and so if there were an infinity of them, that would not require an infinite time. The crux of the argument, therefore, lies either in the impossibility of an infinite number of simultaneous causes, or in the impossibility of an infinite number of causes related to one another as instrumental to principal cause.

Among causes so related, Descartes, like Aquinas, argues that there must be one first or principal cause. "In the case of causes which are so connected and subordinated to one another, that no action on the part of the lower is possible without the activity of the higher; e.g., in the case where something is moved by a stone, itself impelled by a stick, which the hand moves . . . we must go on until we come to one thing in motion which first moves." But for Descartes, unlike Aquinas, this method of proving God as the first cause of all observable effects has less elegance than the so-called "ontological argument" in which the conception of God as a necessary being, incapable of not existing, immediately implies his existence.

The argument from effect to cause is traditionally called *a posteriori* reasoning, in contrast to *a priori* reasoning from cause to effect. According to Aristotle and Aquinas, the latter mode of reasoning can only demonstrate the nature of a thing, not its existence. Aquinas, furthermore, does not regard the ontological argument as a form of reasoning at all, but rather as the assertion that God's existence is self-evident to us, which he denies.

The various forms which these arguments take and the issue concerning their validity are more fully discussed in the chapters on BEING, GOD, and NECESSITY AND CONTINGENCY. But here it is worth noting that Kant questions whether the *a posteriori* method of proving God's existence really differs from the ontological argument. It is, according to him, not only "illusory and inadequate," but also "possesses the additional blemish of an *ignoratio elenchi*—professing to conduct us by a new road to the desired goal, but bringing us back, after a short circuit, to the old path which we had deserted at its call." Hence the causal proof does not, in Kant's opinion, succeed

in avoiding the fallacies which he, along with Maimonides and Aquinas, finds in the ontological argument.

THE ANALYSIS OF CAUSATION figures critically in the speculation of the theologians concerning creation, providence, and the government of the world.

The dogma of creation, for example, requires the conception of a unique type of cause. Even if the world always existed—a supposition which, as we have seen, is contrary to Jewish and Christian faith but not to reason—the religious belief in a Creator would remain a belief in that unique cause without whose action to preserve its being at every moment the world would cease to be.

On the assumption that God created the world in the beginning, it is, perhaps, easy enough to see with Augustine how "the creating and originating work which gave being to all natures, differs from all other types of causation which cause motions or changes, or even the generation of things, rather than their very existence." It may, however, be more difficult to understand the creative action of God in relation to a world already in existence.

But a theologian like Aquinas explains that "as long as a thing has being, so long must God be present to it" as the cause of its being—a doctrine which Berkeley later reports by saying that this makes "the divine conservation . . . to be a continual creation." Aquinas agrees that "the conservation of things by God is not by a new action, but by the continuation of that action whereby He gives being." But in the conservation of things Aquinas thinks that God acts through natural or created causes, whereas in their initiation, being is the proper effect of God alone.

The dogma of divine providence also requires a theory of the cooperation of the first cause with natural or secondary causes. Dante, in describing the direction which providence gives to the course of nature, uses the image of a bow. "Whatever this bow shoots falls disposed to a foreseen end, even as a shaft directed to its mark." That God governs and cares for all things may be supposed to reduce nature to a puppet show in which every action

takes place in obedience to the divine will alone. Natural causes would thus cease to be causes or to have any genuine efficacy in the production of their own effects.

Some theologians have tended toward this extreme position, but Aquinas argues contrariwise that natural causes retain their efficacy as instrumental causes, subordinate to God's will as the one principal cause. "Since God wills that effects be because of their causes," he writes, "all effects that presuppose some other effect do not depend solely on the will of God"; and, in another place, he says, "whatsoever causes He assigns to certain effects, He gives them the power to produce those effects . . . so that the dignity of causality is imparted even to creatures."

In addition to the role of divine causality in the regular processes of nature, still another kind of divine causation is presupposed by the religious belief in supernatural events, such as the elevation of nature by grace and the deviations from the course of nature which are called "miracles." All these considerations, and especially the matter of God's miraculous intervention in the regular course of nature, have been subjects of dispute among theologians and philosophers (and sometimes physicists and historians). Some of those who do not deny the existence of a Creator, or the divine government of the universe through natural law, nevertheless question the need for divine cooperation with the action of every natural cause, or God's intervention in the order of nature.

Throughout these controversies, the theory of causes defines the issues and determines the lines of opposing argument. But since other basic notions are also involved in the debate of these issues, the further consideration of them is reserved for other chapters, especially GOD, NATURE, and WORLD.

THE DISCUSSION OF CAUSE takes a new turn in modern times. The new issues arise, not from different interpretations of the principle of causality, but from the skeptic's doubts concerning our ability to know the causes of things, and from the tendency of the physical sciences to limit or even to abandon the inves-

tigation of causes. A 20th-century geneticist, Dobzhansky, calls our attention to the fact that we use the word "spontaneous," as in the phrase "spontaneous generation" or "spontaneous mutation," to cover up a "thinly veiled admission of the ignorance of the real causes of the phenomena in question."

According to the ancient conception of science, knowledge, to be scientific, must state the causes of things. The essence of scientific method, according to the *Posterior Analytics* of Aristotle, consists in using causes both to define and to demonstrate. Sometimes genus and differentia are translated into material and formal cause; sometimes a thing is defined genetically by reference to its efficient cause, and sometimes teleologically by reference to its final cause.

The degree to which this conception of science is realized in particular fields may be questioned. The treatises of the astronomers, for example, do not seem to exemplify it as much as do Aristotle's own physical treatises or Harvey's work on the circulation of the blood. Yet until modern developments in mathematical physics, the ascertainment of causes seems to be the dominant conception of the scientific task; and until the separation widens between the experimental and the philosophical sciences, the possibility of knowing causes is not generally doubted.

Galileo's exposition of the new mechanics explicitly announces a departure from the traditional interest of the natural philosopher in the discovery of causes. The aim, he says, in his *Concerning Two New Sciences*, is not "to investigate the cause of the acceleration of natural motion, concerning which various opinions have been expressed by various philosophers"; but rather "to investigate and to demonstrate some of the properties of accelerated motion." The "various opinions" about causes are referred to as "fantasies" which it is "not really worth while" for the scientist to examine.

This attitude toward causes, especially efficient causes, characterizes the aim of mathematical physics, both in astronomy and mechanics. For Newton it is enough—in fact, he says, it "would be a very great step in philosophy"—"to derive two or three general prin-

ciples of motion from phenomena . . . though the causes of those principles were not yet discovered. And, therefore, I scruple not to propose the principles of motion . . . and leave their causes to be found out." In other passages, Newton disparages the search for "hidden or occult causes" as no part of the business of science.

When we pass from classical mechanics to quantum mechanics, causal predictions give way to probability calculations. "The discovery of the quantum of action," Bohr tells us, makes "a detailed causal tracing of atomic processes . . . impossible," because "any attempt to acquire knowledge of such processes involves a fundamentally uncontrollable interference with their course." Quantum mechanics involves a renunciation of "the causal space-time co-ordination of atomic processes."

Hume goes further. He insists that *all* causes are hidden, even in the phenomena studied by classical physics or Newtonian mechanics. By the very nature of what causes are supposed to be and because of the manner in which the human mind knows, man can have no knowledge of how causes really produce their effects. "We never can, by our utmost scrutiny," he says, "discover anything but one event following another, without being able to comprehend any force or power by which the cause operates, or any connexion between it and its supposed effect."

All that men can be referring to when they use the words "cause" and "effect," Hume thinks, is the customary sequence of "one object followed by another, and where all objects similar to the first are followed by objects similar to the second." So far as any knowledge based upon reason or experience can go, the relation of cause and effect is simply one of succession, impressed upon the mind "by a customary transition." That one event leads to another becomes more and more probable—but never more than probable—as the sequence recurs more and more frequently in experience.

Hume's skepticism about causes, and his reinterpretation of the meaning of cause, gains wide acceptance in subsequent thought, especially among natural scientists. William James,

for example, considering "the principle that 'nothing can happen without a cause,'" declares that "we have no definite idea of what we mean by cause, or of what causality consists in. But the principle expresses a demand for *some* deeper sort of inward connection between phenomena than their merely habitual time-sequence seems to be. The word 'cause' is, in short, an altar to an unknown god; an empty pedestal still marking the place for a hoped-for statue. Any really inward belonging-together of the sequent terms," he continues, "if discovered, would be accepted as what the word cause was meant to stand for."

Though Hume holds that we cannot penetrate beyond experience to the operation of real causes imbedded in the nature of things, he does not deny the reality of causation as a principle of nature. On the contrary, he denies that anything happens by chance or that any natural occurrence can be uncaused. "It is universally allowed," Hume says with approval, "that nothing exists without a cause of its existence, and that chance, when strictly examined, is a mere negative word, and means not any real power which has anywhere a being in nature." But "though there is no such thing as *chance* in the world, our ignorance of the real cause of any event has the same influence on the understanding, and begets a like species of belief or opinion."

In other words, Hume's position seems to be that man's ignorance of real causes, and the mere probability of his opinions about customary sequences of "cause" and "effect," indicate human limitations, not limits to causal determination in the order of nature itself. Adversaries of Hume, coming before as well as after him in the tradition of the great books, take issue with him on both points. Nietzsche sides with him: causes are fictions we ourselves invent. "It is *we* alone who have fabricated causes . . . We once more behave as we have always behaved, namely *mythologically*."

Against Hume's determinism, which is no less complete than Spinoza's, Aristotle, for example, affirms the existence of chance or real contingency in the happenings of nature. Against Hume's reduction of statements about causes to probable opinion, Kant insists

that, in the metaphysics of nature, such judgments can be made with absolute certainty. These related issues are discussed in the chapters on CHANCE, FATE, and NECESSITY AND CONTINGENCY.

In the development of the natural sciences since Hume's day, his translation of cause and effect into observed sequences or correlations reinforces the tendency, which first appears with Galileo and Newton, to *describe* rather than to *explain* natural phenomena. Yet to the extent that the findings of science bear fruit in technology, man's control over nature seems to confirm Bacon's view of science rather than Hume's—at least to the extent that the application of scientific knowledge to the production of effects implies a knowledge of their causes.

According to Planck, "the law of causality is neither true nor false. It is rather a heuristic principle, a signpost . . . to help us find our bearings in a bewildering maze of occurrences, and to show us the direction in which scientific research must advance in order to achieve fertile results." Concern with causality "impresses the awakening soul of the child and plants the untiring question 'Why?' into his mouth." This "remains a lifelong companion of the scientist and confronts him incessantly with new problems."

THE PRINCIPLE OF CAUSALITY—that nothing happens without a cause or sufficient reason, or, as Spinoza puts it, "nothing exists from whose nature an effect does not follow"—has been made the basis for denials of human freedom as well as of chance or contingency in the order of nature. The problem of man's free will is discussed in the chapters on FATE, LIBERTY, and WILL, but we can here observe how the problem is stated in terms of cause, with respect to both divine providence and natural causation.

If God's will is the cause of everything which happens, if nothing can happen contrary to His will or escape the foresight of

His providence, then how is man free from God's foreordination when he chooses between good and evil? If, as the theologians say, "the very act of free choice is traced to God as to a cause," in what sense can the act be called "free"? Is it not necessarily determined to conform to God's will and to His plan? But, on the other hand, if "everything happening from the exercise of free choice must be subject to divine providence," must not the evil that men do be attributed to God as cause?

The problem takes another form for the scientist who thinks only in terms of natural causes, especially if he affirms a reign of causality in nature from which nothing is exempt—just as, for the theologian, nothing is exempt from God's will. Since the realm of nature includes human nature, must not human acts be caused as are all other natural events? Are some human acts free in the sense of being totally uncaused, or only in the sense of being caused differently from the motions of matter? Are causality and freedom opposed principles within the order of nature, appropriate to physical and psychological action; or do they constitute distinct realms—as for Kant, the realms of phenomena and noumena, the sensible and the supra-sensible; or as for Hegel, the realms of nature and history?

The different answers which the great books give to these questions have profound consequences for man's view of himself, the universe, and his place in it. As the issue of necessity and chance is central in physics or the philosophy of nature, so the issue of determinism and freedom is central in psychology and ethics, in political theory and the philosophy of history, and above all in theology. It makes opponents of James and Freud, of Hegel and Marx, of Hume and Kant, of Spinoza and Descartes, of Lucretius and Marcus Aurelius. It raises one of the most perplexing of all theological questions for Augustine, Aquinas, Pascal, and for the two great poets of God's will and man's freedom—Dante and Milton.