



FOUR DIMENSIONS OF THE SCIENTIFIC TRADITION

Since the Scientific Revolution, claims have been made about science and on behalf of science that include not only scientific but philosophical and theological assertions. When such a wide range of issues is included within the category of scientific knowledge, distinguishing science from a religious-like ideology becomes difficult; and when the authority of science is invoked in support of metaphysical positions, further problems arise. Thus, it is crucial to identify the salient features of distinct aspects of the scientific tradition, namely, science itself, the philosophical view known as scientific realism, the metaphysical ideology of scientific materialism, and the dogmatic form of that ideology known as scientism.

Science

Let me begin by taking note of some of the characteristics of science in its “disembodied” form, that is, divorced from its philosophical and theological underpinnings. Science is a discipline of inquiry entailing rigorous observation and experimentation, followed by rational, often quantitative, analysis; and its theories characteristically make predictions that can be put to the empirical test, in which they may turn out to be wrong, and the theory is thereby invalidated. One of the central ideals of this discipline is that of a disengaged observer, capable of objectifying the surrounding world and suppressing emotions, inclinations, fears, and compulsions in order to pursue research in an unbiased and rational manner.

Another ideal of science is skepticism: one seeks to identify unquestioned assumptions, to question common sense, and to critically examine appear-

ances themselves, for they have often been found to be misleading. The more deeply rooted an assumption or belief is and the more widely it is accepted by one's peers, the more challenging it is to question it, particularly in public. But time and again scientists have risen to this challenge and thereby broadened the scope of human knowledge. On the other hand, if one pushes skepticism to an extreme by excessively doubting one's own and others' beliefs, modes of inquiry, and discoveries, then scientific progress can grind to a halt. Despite the ideal of healthy skepticism in science, there must also be a place for faith, or informed confidence, regarding the advances of earlier generations of scientists and the work of one's contemporaries.

Science frequently involves experimentation, and its theories are aimed at intelligible explanation and predictive ability with respect to those phenomena. Truth in science is determined by the empirical feedback of success in one's predictions, and this pragmatic criterion sets science apart from other disciplines such as philosophy and religion. In this way scientific theories are formulated and tested, with advances in knowledge giving rise to further hypotheses. Scientific hypotheses can be refuted by means of reasoning—for example, if they are found to be internally inconsistent—or by empirical observation or both. However, a hypothesis may also be saved from falsification by modifying surrounding hypotheses or by modifying the interpretation of the empirical data.¹ Although modern science originated with the quest for absolutely certain knowledge of the natural world, scientific knowledge is now usually presented as tentative and subject to change, largely because even some of the most seemingly secure scientific principles have been refuted.

These comments are intentionally very general, so that they pertain to the many disparate branches of science, ranging from theoretical physics to wildlife biology. Given this enormous diversity of fields and methodologies within science, I have chosen to point to an array of salient features of scientific inquiry that provides a basis for recognizing what have been called family resemblances among the sciences. This seems more useful than trying to set down an airtight definition of science as a whole or to identify some “essence” to science that purportedly differentiates it from other modes of inquiry.

While scientific *modes of inquiry* are compatible with many other approaches, including those of philosophy and religion, some aspects of scientific *knowledge* are clearly incompatible with other worldviews, including religious ones. In such cases, the seeker of truth will accept what has clearly been demonstrated to be true by means of rigorous scientific research, while taking care to distinguish such facts from the metaphysically loaded interpretations that scientists may impose upon, and conflate with, those facts. Science has enjoyed enormous successes in explaining objective physical events according to quantitative mathematical laws, but it has been less successful in explaining or predicting subjective mental events. While it has

provided humanity with an unprecedented degree of control over the physical world, it has not shown us how to control our own minds from within. And while it has greatly enhanced the physical well-being and security of much of the world's population, it has made little progress in discovering strategies for finding greater personal happiness, mental health, compassion and altruism, or social harmony.

When giving a general overview of science, it is very easy to exaggerate the unity of this body of knowledge, for over the past four hundred years a wide range of scientific methods and theories has been devised, based on diverse metaphysical principles. The most remarkable point here is that many of these divergent approaches have produced empirically acceptable theories. The assumption of a single worldview embracing all of science, however, is misleading, for there have always been many different scientific maps of the natural world, many of which are drawn from different metaphysical and theological viewpoints.²

Scientific Realism

Scientific realism is not science but a philosophical interpretation of scientific knowledge and its relation to the world. There are many versions of scientific realism as well as antirealism, the latter variously associated with instrumentalism, constructivism, and empiricism. Advocates of scientific realism believe that the formulation of scientific theories aims to give us a literally true story of what the world is like and that the acceptance of a scientific theory involves the belief that it is true.³ It is important to note that advocacy of this view does not necessarily imply the assertion that present scientific theories *are* literally true representations of the world; it implies only that they *aim to be*. Simply put, scientific realism asserts that science is trying to discover what is really going on in nature, beyond the scope of appearances; it is aiming at understanding how nature works and why it is the way it is.

In the preceding description of scientific realism, if “the world” is regarded as the universe as it exists in itself, independent of human concepts and language, scientific realism becomes a form of metaphysical realism. In this context, the objects of scientific inquiry are thought to be describable in principle in and of themselves; and they are believed to exist objectively, independently of any descriptions or interpretations imputed upon them by any subjects.⁴ Although most of the objects within the objective world are not accessible to the unaided human senses, it is believed that they can nevertheless be discovered, investigated, and described with the empirical and rational tools of science. In the words of philosopher Ernan McMullin, science enlarges our world “through retroductive inference to structures, processes and entities postulated to be causally responsible for the regularities established by the experimental scientist, or for the individual ‘traces’

with which historical sciences like geology and evolutionary biology are concerned.”⁵ This retroductive approach has been enormously successful, especially in inferentially discovering causes that are subsequently observed.

Scientific realism has certainly dominated much of scientific thinking throughout history, but it has always had to defend itself against other philosophical perspectives. The scientific realist Galileo, for instance, had to respond to the philosophical arguments of Cardinal Bellarmine, who maintained that scientific theories should be regarded simply as ways of *making appearances intelligible*, without presuming to describe the real nature of the world beyond the veil of appearances.⁶ Isaac Newton (1642–1727), the founder of classical mechanics, and James Clerk Maxwell (1831–79), the founder of the modern theory of electromagnetism, are both known for their internal struggles with realist and antirealist philosophical interpretations of scientific knowledge.

Nowadays, most philosophers of physics, the most mature of the sciences, have distanced themselves from scientific realism, adopting views closer to those of Cardinal Bellarmine than of Galileo. Bas van Fraassen, for example, advocates a form of constructive empiricism whose central theme is that science aims to give us intelligible accounts of empirical evidence. That, he maintains, is all that is necessary to accept a scientific theory.⁷ The debate goes on, however between various versions of scientific realism and anti-realism. Ian Hacking, for instance, mounts a rigorous defense of scientific realism, pointing out that we can be sure of the reality of macro-objects because of what we can do with them and to them, and what they can do to us. Similarly, he argues, if we can measure, manipulate, and understand the causal powers of scientific micro-entities, we have good reason to believe that they are real and theory-independent.⁸ Like Hacking, most contemporary philosophers of neuroscience, among the youngest of sciences, adopt scientific realism.⁹ Some people go so far as to argue that scientific realism is a psychological prerequisite for successful research in science. Others, such as van Fraassen, maintain that the alternative to reifying the contents of science is to equate science not with a dogma but with a quest in which one immerses oneself in a worldview without reifying it, accepting scientific theories as constructs that are more or less successful in making the appearances of the natural world intelligible.

As scientists devise one mathematical structure after another to describe the world, many of them have faith that this process will eventually yield an ultimate “best theory.” Some reify the fundamental laws of physics so far as to attribute qualities to them that are traditionally ascribed only to God, claiming that they are universal, absolute, omnipotent, and eternal, existing independently even of the state of the universe. Mathematical laws of nature, however, while “saving the appearances” with enormous success, do not provide a picture of what the world is like independent of those appearances; and given the wide variety of interpretations of such quantitative laws, it takes a leap of faith to believe that any one of them will prove to be the “right one.” Rather, one’s choice of constructs—for example,

which of the interpretations of quantum mechanics or even Newtonian mechanics one chooses—at any time seems to be largely a matter of temperament; for throughout the history of science multiple theories have commonly accounted equally well for observed phenomena. Scientific realism tends to downplay the role of such subjective influences in scientific research, whereas antirealism tends to isolate the real, objective world from subjectivity, making it unknowable in principle. Throughout this work, the term *subjectivity* refers to all conscious and unconscious *personal* influences, including individual consciousness itself, and all personal, individual goals, attitudes, and points of view. As such, each instance of subjectivity is confined to a specific locality in both time and space.

The tenets of scientific realism, unlike those of science, are not prone to refutation by empirical evidence; however, like other philosophies, they can in principle be refuted by means of rational argument. Scientific realism is compatible with a wide range of religious doctrines, as well as with atheism.

Scientific Materialism

The Essential Principles of Scientific Materialism

According to science, empirical data always have the last word and there is no place for dogmas, sacrosanct theories, or a priori statements. Nevertheless, science has progressed together with the ideology of scientific materialism that does embody a number of sacrosanct theories and a priori statements, namely the principles of objectivism, monism, universalism, reductionism, the closure principle, and physicalism. While these metaphysical principles of scientific materialism are not matters of scientific fact, they are commonly presented in science classrooms, scientific writings, and the popular media as if they were on a par with genuine scientific theories that are subject to empirical verification or refutation. Rarely are these principles taught as a discrete ideology, and many students of science may not be consciously aware of them at all. Scientific knowledge advances in part by a healthy skepticism of long-cherished assumptions, but it is impossible to be skeptical of something of which we are not even conscious.

While scientific materialism actually subsumes science and scientific realism, it is often misleadingly equated with science itself, especially by its advocates. Although the claims of scientific materialism go far beyond the legitimate domains of science, most scientific research is now conducted within the metaphysical framework of this ideology. Thus, it is easy to conflate the two, but in so doing, one overlooks possibilities for scientific research that do not conform to this belief system.

The Scientific Revolution occurred in defiance of the scholastic dogma of its day, and since then, science has advanced by formulating new theories and then revising them or replacing them with better theories as the scope of its empirical knowledge has increased. When old dogmas are challenged,

however, it is difficult, for people to resist the temptation to form new dogmas to replace the old ones, for there is something profoundly unsettling about questioning our deepest assumptions. By the term “dogma” I mean a coherent, universally applied worldview consisting of a collection of beliefs and attitudes that call for a person’s intellectual and emotional allegiance. A dogma, therefore, has a power over individuals and communities that is far greater than the power of mere facts and fact-related theories. Indeed, a dogma may prevail despite the most obvious contrary evidence, and commitment to a dogma may grow all the more zealous when obstacles are met. Thus, dogmatists often appear to be incapable of learning from any kind of experience that is not authorized by the dictates of their creed.¹⁰ The irrationality of dogmatism has been presented as one of the strongest arguments against all forms of religion, but let me now examine the principles of scientific materialism to see whether science, too, has become constrained by its own unique dogma.

Objectivism. As noted earlier, perhaps the most central ideal of science has been the pure objectification of the natural world, and, implicitly, the exclusion of subjective contamination from the pursuit of scientific knowledge. This ideal has so captured the modern mind that *scientific knowledge* is now often simply equated with *objective knowledge*. The principle of objectivism demands that science deals with empirical facts testable by empirical methods and verifiable by third-person means. This principle has proven to be very useful in revealing a wide range of facts that are equally accessible to all competent observers. Such facts must be public rather than private; that is to say, they must be accessible to more than one observer. However, there are many other empirical facts—most obviously, our own subjective mental events—that are accessible only by first-person means and of which the only competent observer is oneself.

Another aspect of this principle is that scientific knowledge must be epistemically objective, that is, observer independent. In its most defensible guise, this ideal demands that scientists strive to be as free as possible of bias and prejudice in their collection and interpretation of empirical data. In its least defensible form, it demands that scientific knowledge must be free of any subjective, nonscientific influences. This, of course, has never been true of science or any other branch of human inquiry, as has been amply demonstrated in Thomas Kuhn’s provocative work *The Structure of Scientific Revolutions*. Even the renowned biologist Jacques Monod, a staunch advocate of scientific materialism, acknowledges that the postulate of objectivity as a condition for true knowledge constitutes what he calls an ethical choice, rather than a matter of fact. This assertion of Monod’s implies that this principle is not the result of research but is rather a premise that guides a certain kind of research, while prohibiting other types of research from being conducted.¹¹

The principle of objectivism, in the sense of the demand for observer independence, simply cannot accommodate the study of subjective phenom-

ena, for it directs one's attention only to those objects that exist independently of one's own subjective awareness. It is no wonder then that science presents us with a view of a world in which our own subjective existence is not acknowledged and the notion of the meaning of our existence cannot even be raised.

Monism. According to this principle in its scientific guise, there is one unified universe consisting of generally one kind of stuff, which can be described completely by physics. This metaphysical principle is closely conjoined with another belief, known as universalism, which asserts that natural, quantifiable, regular laws govern the course of events in the universe uniformly throughout all of space and time.

For Hellenistic thinkers, phenomena were defined as things, events, and processes that can be seen, in contrast to noumena, which were thought to be things as they are in themselves. According to scientific materialism, however, phenomena have come to be identified as things, events, or processes that occur regularly under definite circumstances. The metaphysical principles that constitute scientific monism have proven to be enormously valuable guidelines for investigating a wide range of phenomena, specifically those that are physical, quantifiable, orderly, and repeatable. On the other hand, they give no account of nonphysical, purely qualitative, sporadic, and unique phenomena. Thus, once again, subjective mental phenomena—which are not demonstrably physical in nature, do not lend themselves directly to quantitative measurement or analysis, frequently appear disorderly, and at times include phenomena that are not evidently repeatable—seem to fall outside the bounds of those principles.

Reductionism. As soon as one accepts the monistic principle that the entire universe consists of only one kind of stuff, namely one that can be described completely by physics, one must identify the nature of this basic stuff. In the twentieth century, many scientists concluded that the world is fundamentally composed of elementary particles of mass/energy. The principle of reductionism augments this view by asserting that macro-phenomena such as the behavior of human cells are the causal results of micro-phenomena (ultimately, the behavior of the elementary particles that constitute the cells). This metaphysical principle is succinctly stated by physicist Earnest Rutherford: “if we knew the constitution of atoms we ought to be able to predict everything that is happening in the universe.”¹² Thus, elementary particle physics is thought to deserve the title of the most fundamental description of the world. In short, the metaphysical principle of reductionism declares that there is nothing that living or nonliving things do that cannot be understood from the point of view that they are made of atoms acting according to the laws of physics.¹³ Some scientists, however, far more cautiously embrace reductionism as a *method*, which has proven highly useful in many areas of research, without adopting it as a *belief* about the actual nature of reality.¹⁴

The principle of reductionism has also been applied to the study of psychology and religious experience. The assumption here is that for the more advanced forms of living organisms, behavior and conscious states can be best understood in terms of the more primitive. For example, the pioneering psychologist Wilhelm Wundt advocated a primitive form of internal perception (*innere Wahrnehmung*) to be used as a tool of scientific psychology for understanding the human mind. Confining his research to the study of perception and sensation, he excluded the observation of thought processes, feelings, their complex connections, and the affects and processes of volition. Another trend in late nineteenth-century psychology was the attempt, inspired by the successes of chemistry, to devise a “periodic chart” of the basic elements of mental activity, understood in terms of very brief, primitive events.

Upon the demise of the introspectionist movement in modern psychology in the early years of the twentieth century, behaviorism also adopted the principle of reductionism by studying the behavior of animals as a means to understanding human behavior. Moreover, with the perceived failure of introspection as a means of scientific inquiry, many behaviorists simply reduced all mental activity, including consciousness itself, to objective behavior. That is, subjective, internal mental events were reduced to objective, external events, which science was well accustomed to studying. This was a “lateral” reduction of an anomalous-class of phenomena to a more familiar type of processes.

By the 1960s, when the limitations of behaviorism became increasingly apparent in terms of understanding the mind, much of the emphasis shifted to neuroscientific research, which also laterally reduces subjective mental events to objective brain activity. Despite the vast differences in methodologies and theories within the cognitive sciences over the past century, the principle of reductionism has run through all these disciplines, as if they were all conforming to a pre-established creed. Likewise, when modern scholars have sought to understand various forms of religious experience, including mystical experience, this same trend has been very prevalent.

Reductionism, like the other tenets of scientific materialism, has guided scientists in shedding light on those types of phenomena that can be best understood by examining their elementary components. However, the universality of this assumption is increasingly coming into question in science, for example in the context of chaos theory.¹⁵ In the life sciences, too, close attention to the behavior of elementary particles or even individual cells frequently yields *less* understanding than attention to the more global interactions among systems of cells. Moreover, when it comes to scientifically inquiring into the nature and origins of consciousness and other mental events, the principle of reductionism may actually obscure the phenomena one is trying to investigate.

The Closure Principle. The adoption of the principle of reductionism *as it was formulated in twentieth-century scientific materialism* implies another of

the principles of this metaphysical dogma: what has come to be known as the closure principle. According to this belief, the physical world is “causally closed”—that is, there are no causal influences on physical events besides other physical events.

The closure principle has proved to be a useful hypothesis for the investigation of a wide range of interactions among physical phenomena; but if there are any nonphysical influences on physical events, unquestioning acceptance of this belief will ensure that those influences will not be recognized. Some scientific materialists have misleadingly argued that the closure principle must be a universal truth because scientific research has found no evidence of any nonphysical influences in the natural world.¹⁶ The distinguished biologist Edward O. Wilson, for instance, declares that the religious belief in a God who directs organic evolution and intervenes in human affairs “is increasingly contravened by biology and the brain sciences.”¹⁷

Natural philosophy, as it was envisioned by Descartes and other participants in the Scientific Revolution, had only the physical world as its proper domain, and this has been largely true of science ever since. Moreover, never in the history of modern science have instruments or methods been devised to detect the presence of nonphysical influences of any kind. Research in modern biology and the brain sciences is conducted with the assumption, hardly ever questioned, that there are no nonphysical influences in organic evolution or in human affairs. So the fact that scientists have not discovered any such influences should hardly come as a surprise. And at this point in history, it is certainly premature to declare that scientific knowledge of organic evolution and brain activity is so complete that nonphysical influences can be absolutely ruled out on purely empirical grounds.

Particularly with regard to the human mind, the closure principle seems to be incompatible with experience, for our conscious mental processes, which have not been demonstrated to be composed of configurations of mass and energy, certainly do appear to influence human behavior. Advocates of the closure principle assume that the *apparent* influence of our desires, beliefs, and intentions on our behavior is actually an illusion—all behavior is in fact determined solely by the interaction of the nervous system with the rest of the body and the physical environment. However, contemporary neuroscience does not even remotely possess sufficient understanding of the brain to verify this assumption on the grounds of empirical evidence. If for no other reason, the fact that modern science does not know how or why consciousness first appeared in terms of the evolution of life on our planet or in the development of a human embryo should make it abundantly clear that the closure principle is a metaphysical belief and not a scientific fact.

Physicalism. With the widespread adoption of reductionism and the closure principle in the nineteenth century, due in part to the widespread acceptance of the principle of the conservation of energy,¹⁸ scientific materialism abandoned its Judeo-Christian origins. No longer could this metaphysical dogma

conform to the Judeo-Christian belief in a nonphysical, personal God who intervenes in the course of nature and human history and who responds to the prayers of individuals. By the nineteenth century, the only religion with which scientific materialism remained compatible was Deism, a religion contrived in part by the proponents of scientific materialism itself.

Albert Einstein was among the most eminent scientists educated in the nineteenth century to declare that the concept of a personal God is utterly incompatible with science and that it is the major source of conflict between religion and science. This theological stance, however, did not prevent him from believing in a universal Superior Mind that reveals itself in the world of experience. This Deist view retains the Christian belief that God possesses an absolute perspective on reality, but it denies that God influences natural events in any way.¹⁹ In other words, God is conceived of as an ideal scientist, a purely objective observer who sees reality as it is without any personal, subjective intervention.

Twentieth-century scientific materialism abandoned belief in any form of theism by adopting the principle of physicalism, which states that in reality only physical objects and processes exist. In other words, only configurations of space and of mass/energy and its functions, properties, and emergent epiphenomena are real. A closely related principle maintains that everything that exists is quantifiable, including the individual elements of physical reality, as well as the laws that govern their interactions. At this point scientific materialism becomes compatible only with some of the more primitive nature religions. The “God’s-eye view” of reality that was the earlier ideal of scientific materialism has been replaced by the ideal of the “view from nowhere.”²⁰ That is, the ideal of pure objectivity has been retained, but it has been divorced from the theological underpinnings that originally gave it credibility, meaning, and value. Thus, the quasimystical quest of earlier scientists to view God’s creation from God’s own perspective has been replaced by the ideal of viewing a mindless, meaningless universe from a nonhuman, purely objective perspective.

There are many scientists and philosophers, of course, who deny that physicalism is simply a metaphysical principle. Philosopher Patricia Churchland, for instance, claims that the rejection of consciousness (or any other “spooky stuff” such as a soul or spirit) existing apart from the brain “is a highly probable hypothesis, based on the evidence currently available from physics, chemistry, neuroscience and evolutionary biology.”²¹ She declares that the assertion of physicalism is an empirical matter, not a question of conceptual analysis, a priori insight, or religious faith. Philosopher Güven Güzeldere asserts in a similar vein that “. . . contemporary science tells us that the world is made up of nothing over and above ‘physical’ elements, whatever their nature (waves, particles, etc.).”²²

Let us assume for the moment that these physicalists are right in asserting that scientists have empirically demonstrated that only physical things and events exist. This would imply that this assertion belongs together with a wide range of other scientific facts—such as the convertibility of mass and

energy, the atomic weight of hydrogen, and the nature of photosynthesis—about which there is a very high degree of consensus among the scientific community. Churchland acknowledges that not all philosophers agree with her physicalist belief, but it must also be acknowledged that a very sizable proportion of the scientific community doesn't either. Given that 40 percent of American scientists today believe in a personal God to whom they can pray and that this figure has not changed significantly over the past century, it would seem that if the physicalist hypothesis has been proven empirically during the twentieth century, virtually half of the scientific community in the United States still refuses to acknowledge it. If this is the case, are they prevented from seeing this empirical truth as a result of their commitment to a theistic ideology? If so, this raises a profound qualm about the reliability of the scientific community as a whole to distinguish empirical facts from ideological commitments. One might just as well ask the same question of those scientists who believe that the empirical evidence does confirm the hypothesis of physicalism: Are they overinterpreting scientific evidence to make it conform to their metaphysical beliefs? If we are to trust the scientific community to give unbiased reports of its research, then physicalism *must* be regarded as a matter of conceptual analysis, a priori insight, or religious faith. For there is clearly no scientific consensus on this matter, or even a historical convergence toward such a consensus among scientists.

The Marginalization of the Mind

While the nineteenth-century adoption of the closure principle denied causal efficacy to anything that is nonphysical, the twentieth-century version of physicalism denies that anything nonphysical even exists in reality. This shift has major implications for the relation between the mind and the physical universe. It is noteworthy that, while physical science was well established by the late seventeenth century, a science of the mind was not initiated until a full two centuries later. And even then, particularly in the Anglo-American world, the focus of academic psychology swiftly shifted away from the mind and toward behavior, and then to neuroscience. Only in the latter half of the twentieth century did cognitive psychology, for example, begin to reconsider the functions of the mind as it is experienced firsthand. In the historical development of modern science, the study of the mind occurs only as an afterthought, subsequent to the elaborate development of physics, chemistry, and biology; so it is no coincidence that in the world as conceived by science, the role of the mind in nature has been marginalized. According to this view, the universe is conceived as a giant computer, and the emergence of consciousness during the course of cosmic evolution is attributed solely to the laws of physics, which over the immensity of time give rise to a nearly infinite complexity that is purportedly sufficient to give rise to consciousness. This “explanation” places an enormously heavy explanatory burden on the term “complexity,” which in fact explains nothing.

Since the Scientific Revolution, subjectively experienced mental events have gradually lost their status as real entities. Advocates of scientific materialism now variously regard them as mere epiphenomena, as propensities for behavior, as being equivalent to brain activity, or as bearing no existence whatsoever. As one indicator of this phenomenon, it is worth noting the types of discoveries for which Nobel awards have been granted in the fields of physiology and medicine. While it is well known that many mental phenomena—including hope and fear, happiness and depression, trust and suspicion, and belief and disbelief—have profound influences on the human body and state of health, since Nobel awards were first granted in 1901 for discoveries in physiology or medicine, *not a single one has been given for discoveries about the nature of the mind*. One could rationalize this fact by claiming that research into the nature of the mind and its possible influences on the body is not included in the domain of “hard science” and is therefore unworthy of such a distinguished award. But “hard science” in this context means nothing more than science that rigidly conforms to the metaphysical dictates of scientific materialism, even at the cost of ignoring significant aspects of health and disease.

How did the mind, which exerts such a powerful influence in our daily lives and which makes science possible, become so marginalized? In his classic work *The Principles of Psychology*, the American psychologist and philosopher William James (1842–1910) presents a thesis that sheds brilliant light on this issue:

The subjects adhered to become real subjects, attributes adhered to real attributes, the existence adhered to real existence; whilst the subjects disregarded become imaginary subjects, the attributes disregarded erroneous attributes, and the existence disregarded an existence in no man’s land, in the limbo “where footless fancies dwell.” . . . Habitually and practically we do not *count* these disregarded things as existents at all . . . they are not even treated as appearances; they are treated as if they were mere waste, equivalent to nothing at all.²³

James sums up this idea with the assertion that “our *belief and attention are the same fact. For the moment, what we attend to is reality . . .*”²⁴ A historical illustration of this theme is to be found in the history of behaviorism. In 1913, the American behaviorist John B. Watson wrote that “the time has come when psychology must discard all reference to consciousness,”²⁵ and he attributed belief in the existence of consciousness to ancient superstitions and magic.²⁶ Fifteen years later, he expanded this principle by declaring that behaviorists must exclude from their scientific vocabulary “all subjective terms such as sensation, perception, image, desire, purpose, and even thinking and emotion as they are subjectively defined.”²⁷ Behaviorism duly followed this dictum, with the result that in 1953, B. F. Skinner concluded that *mind* and *ideas* are nonexistent entities “invented for the sole purpose of providing spurious explanations. . . . Since mental or psychic events are asserted to lack the dimensions of physical science, we have an

additional reason for rejecting them.”²⁸ Assertions concerning subjective experience were similarly denied by certain philosophers of the same period who argued against the very existence of subjective statements.²⁹

A similar denial of mental phenomena (Skinner eventually retracted his)³⁰ is to be found nowadays in a contemporary philosophical school known as eliminative materialism. Proponents of this view, for example, Paul Churchland and Stephen Stich, argue that subjectively experienced mental states should be regarded as nonexistent, on the grounds that the descriptions of such states are irreducible to the language of neuroscience.³¹

Since the time of Galileo, scientific materialism has been absorbed in extraspection: it has focused its attention even beyond the external world of human experience to the objective reality that purportedly lies behind the veil of appearances. This, it deems, is the world of science, and it alone is real; whereas mental phenomena, which are purportedly accessible to introspection, have come to be treated by the advocates of scientific materialism as “mere waste, equivalent to nothing at all.”

The central aim of science is to understand and control the objective, physical world; yet the subjective mind, with its powers of observation and reasoning, is, awkwardly, the fundamental instrument of scientific inquiry. With their ideal of absolute objectivity, in which all subjective influences are excluded, the advocates of scientific materialism have sought to exclude the subjective elements of even the human mind. According to this ideal, scientific research is to be conducted in an utterly dispassionate manner, free of all personal biases; and even scientific thinking is portrayed as an impersonal activity. Moreover, instead of human logic and language, scientists are to employ as much as possible the laws of mathematics, which are thought by many to be purely objective rules.

The disdain of scientific materialism for subjectivity has also shaped the very concept of scientific observation. While nonscientific kinds of observation also detect phenomena—such as our joys and sorrows, hopes and fears, ideas and inspirations—they are thought to be tainted by human subjectivity and are therefore suspect. From the perspective of scientific materialism, human sensory perception may be deemed not only unreliable but irrelevant. For a scientific observation to take place, all that is required is a detector, or receptor. The human eye is one type of receptor, which detects a certain range of electromagnetic frequencies, but other instruments also measure this and other types of information, and they are regarded as more reliable.

In common parlance, for an observation to take place, the received information must be transformed into humanly accessible information that is, sooner or later, perceived and understood by a human being. But according to scientific materialism, *observation* is assimilated into the general category of *interactions*, thereby freeing it from the subjectivity of its normal associations. This interpretation is said to be central to grasping what is involved in scientific objectivity in the search for knowledge and the justification of belief.³²

If we were to accept the assertion of scientific materialism that observation and measurement occur without any relation to consciousness, there would be no valid reason to exclude *any* physical interaction from this category. Not only instruments of artificial intelligence but all phenomena with spatial dimension would always be detecting—that is, observing and measuring—all the phenomena with which they come in contact. Likewise, not only clocks but all physical phenomena that endure in time would be observing the duration of the phenomena with which they come in contact. In other words, every animate and inanimate phenomenon in the entire universe would constantly be observing its spatial and temporal environment.

However, arriving at panpsychism by such a route blurs any real distinction between the statements that everything is conscious and that nothing is conscious. Moreover, from this vantage point it becomes impossible to ascertain the real difference between conscious and unconscious measurements. Thus, the assertion of unconscious observation and measurement has the effect of obscuring the unique, experienced nature of consciousness, which has been ignored by scientific materialism all along.

The Religious Status of Scientific Materialism

The sheer fact that scientific materialism as it was formulated in the twentieth century is incompatible with all the traditional world religions is enough to provoke the question of whether this doctrine has itself become a kind of modern religion. If the only thing that can displace or substitute for one religion is another religion, scientific materialism would appear to fill that role; and there is no question that this dogma has won many converts from traditional religions.

For the advocates of scientific materialism, traditional religions no longer make sense of the world and human existence in light of modern scientific knowledge. In this light, science, for scientific materialists, becomes an indispensable quest for intelligibility, without which the world and human existence become meaningless. But science alone is incapable of grappling with normative and intrinsic values; it cannot point to the purpose of human existence; and the shifting sands of scientific theories do not provide a firm ground from which to view the world. In short, science itself is not a religion, and it cannot serve the functions in human life that a religion must fulfill.

The metaphysical doctrine of scientific materialism, on the other hand, does fulfill these needs for its proponents. Not only does it present a framework within which to live, it provides its followers with a sense of meaning and thereby connects their lives with a greater reality. This meaning and greater reality are included in the concept of development of science and technology aimed at a complete scientific understanding and technological conquest of nature.

Scientific materialists might disagree with this thesis on the grounds that rational, empirical *truths* may refute religious creeds. It is certainly true that scientific research has revealed truths about the natural world that are incompatible with the descriptions of nature found in many prescientific religious doctrines. However, the notion that the principles of scientific materialism, unlike traditional religious beliefs, are evidently true to all open-minded, intelligent people is nothing more than propaganda. To many people who accept these principles, they do indeed seem self-evident and irrefutable, just as the fundamental premises of the world's traditional religions seem self-evident to their most devoted followers. But to the outsider the "truths" of all these creeds may seem nothing more than articles of faith.

To illustrate the dogma-to-dogma confrontation between traditional religions and scientific materialism, let us examine Edward O. Wilson's account of the sources of religion. Wilson's central claim is that religion is instinctive, meaning "only that its sources run deeper than ordinary habit and are in fact hereditary, urged into existence through biases in mental development that are encoded in the genes."³³ He elaborates on this point by drawing a radical distinction between the origins of religion and biology.

The human mind evolved to believe in gods. It did not evolve to believe in biology. Acceptance of the supernatural conveyed a great advantage throughout prehistory, when the brain was evolving. Thus it is in sharp contrast to the science of biology, which was developed as a product of the modern age and is not underwritten by genetic algorithms. The uncomfortable truth is that the two beliefs are not factually compatible. As a result, those who hunger for both intellectual and religious truth face disquieting choices.³⁴

This theory of the origins of religion is a direct product not of any universally compelling scientific evidence but of the principles of scientific materialism. While advocates of this dogma will probably find his explanation plausible and comforting, to believers of more traditional religions it may seem unsubstantiated and offensive. From their perspective, Wilson's speculations may sound more like an evangelical tract condemning the unholy origins of other faiths rather than an unbiased, scientific theory supported by compelling evidence.

Wilson throws to the winds any notion of reconciliation between science and religion, claiming that "[s]cience has always defeated religious dogma point by point when differences between the two were meticulously assessed."³⁵ When surveying the history of scientific discoveries in the face of religious dogmas, one finds much to support his position. On the other hand, when it comes to ostensibly scientific responses to a wide array of human experiences that do not conform to the metaphysical principles of scientific materialism, one finds them classified as "anomalies" and "mere coincidences." To scientific materialists, such responses may be satisfactory,

but to those not of their faith such “explanations” appear inadequate and at times even irrational.

To draw a further parallel between the origins of traditional religions and of scientific materialism, I return to Wilson’s own account.

Successful religions typically begin as cults, which then increase in power and inclusiveness until they achieve tolerance outside the circle of believers. At the core of each religion is a creation myth, which explains how the world began and how the chosen people—those subscribing to the belief system—arrived at its center. Often the mystery, a set of secret instructions and formulas, is available to members who have worked their way to a higher state of enlightenment.³⁶

As I will show in the next chapter, the articles of faith of scientific materialism are largely rooted in the philosophical and religious beliefs of ancient Greece and of Judaism and Christianity. During the rise of modern science, the percentage of scientists and their followers who advocated the principles of this new creed were a small minority, or “cult,” to use Wilson’s term, but by the twentieth century, they had increased in power and inclusiveness until they achieved a tolerance outside their circle of believers. At the core of this creed is an account of cosmogony and evolution, which is based on scientific research that is conducted in conformity with the principles of scientific materialism. Traditional nature religions posit that the nature of our existence in the world is determined by forces and agents that only the priests have access to and can manipulate. In scientific materialism, scientists and engineers have assumed the earlier role of the priests and sorcerers who know and control the mysterious forces of nature.

Scientific materialists are committed to the tradition of science and characteristically display considerable confidence in the authority of science and in its future progress. The noble ideal of this doctrine is that the march of science will proceed to an increasingly complete and flawless understanding of the universe and through the resultant control of the natural world will provide solutions to humanity’s problems. The most optimistic of these proponents go so far as to suggest that scientific knowledge of the physical world will be essentially complete in the near future.³⁷

Modern science was originally conceived of as the pursuit of absolute, certain knowledge of the natural world, as this ideal is expressed in the writings of Galileo and Newton. However, as science matured, many scientists have relinquished their claims to absolute, certain truth, as old scientific “truths” have been successively modified or abandoned and replaced by new theories. In this regard, a religious creed may be said to differ from a scientific theory in claiming to embody eternal and absolutely certain truth, while science is always tentative and open to eventual modifications in its present theories. Astute scientists are aware that their methods are incapable of arriving at a complete and final demonstration. Scientific materialists, in contrast, tend to hold onto their metaphysical principles with

all the tenacity of religious believers. Just as medieval theology took the most general principles as its starting point, so did scientific materialism begin with large metaphysical assumptions and not simply with particular facts discovered by observation or experiment.

The origins of scientific materialism are permeated with theological beliefs; this doctrine was founded with ideals that were largely religious in nature; and it has traditionally been defended on theological grounds. In addition, this creed has drawn converts from other religions, and it attempts to fulfill the religious needs of its followers; furthermore, like many other religions, it demands exclusive allegiance. It is therefore misleading for its devotees to present it as an antithesis of religion, when in reality it is a modern kind of nature religion.

The Central Totem and Taboo of Scientific Materialism

In this consideration of scientific materialism, in contrast to science, as a religious creed, let us examine the theory of religion presented by the French sociologist Emile Durkheim (1858–1917). According to this pioneer in the sociology of religion, religious beliefs are representations that express the nature of sacred things and the relations they sustain, either with each other or with profane things.³⁸ Although it was far from his intent to apply this concept to scientific materialism—indeed, he sought to replace religion with science—I shall argue that scientific materialism meets the criteria of a religion according to Durkheim’s theory.

In Durkheim’s view, in religious belief sacred things constitute an ideal world that makes intelligible the profane world of the senses, while bearing a greater significance and reality than mundane things. Of crucial importance is the fact that the sacred influences the profane, but the profane should never touch—and thereby contaminate—the sacred.³⁹ This separation of the sacred from the profane gives rise to the formulation of taboos, or interdictions. While it may be ontologically impossible for the mundane to touch the sacred, on a practical level it is certainly possible to contaminate one’s *experience of the sacred* due to influences of the profane. And this must be avoided at all costs.

According to Durkheim, “[t]here is no religion where there are no interdictions and where they do not play a considerable part.”⁴⁰ Moreover, the most important and extended type of religious taboo is

the one which separates . . . all that is sacred from all that is profane. So it is derived immediately from the notion of sacredness itself, and it limits itself to expressing and realizing this. Thus it furnishes the material for a veritable cult, and even of a cult which is at the basis of all the others; for the attitude which it prescribes is one from which the worshipper must never depart in all his relations with the sacred. It is what we call the negative cult. We may say that its interdicts are the religious interdicts *par excellence*.⁴¹

Violation of such taboos is not only thought to result in misfortune for the guilty person due to the natural order of things but also calls for punishment by humans, for it offends public opinion, which retaliates against it.

Traditionally, human communities gain access to the sacred, or ideal, world by means of religious beliefs and practices. As Durkheim develops the main theme of his classic work *The Elementary Forms of the Religious Life*, he addresses the issue of *mana*, a transpersonal, universal force that is central to all religions. This alone is the real object of any religious cult, and its chief representation is the totem. “The totem is the means by which an individual is put into relations with this source of energy”⁴² and is the source of the moral life of the clan. Finally, it is the totem that provides a clan with its unique sense of identity. Concerning the relations among diverse totemic groups, Durkheim writes:

each totemic group is only a chapel of the tribal Church; but it is a chapel enjoying a large independence. The cult celebrated there, though not a self-sufficing whole, has only external relations with the others; they are juxtaposed without interpenetrating; the totem of a clan is only fully sacred for that clan. . . . The idea of a single and universal *mana* could be born only at the moment when a tribal religion developed over and above the clan cults and absorbed them more or less completely. It is with the sense of tribal unity that there awakens the sense of the substantial unity of the world.⁴³

During the formative years of the Scientific Revolution, a number of eminent scientists, for example, Robert Boyle (1627–91), regarded scientific inquiry as a form of worship performed by scientists in the temple of nature. The activity of science was sacred because it sought to understand God’s Creation and, thereby, to draw closer to the mind of God. But as science progressed, first God’s role as ruler of creation and then his role as creator and sustainer of nature came to be challenged. In the eventual absence of the divine, only the temple of nature remained, under the watchful eyes of its scientist-priests. In this way the objective world of nature has come to take the place of the sacred. This is not to say that many scientists actually regard nature as a sacred realm; rather, *the objective world is all that is left to take its place*. According to scientific materialism, it is the objective world and not God that makes intelligible the profane world of a sense appearances, which is thoroughly tainted by subjectivity.

Numerous scientists of the seventeenth century, from Galileo to Newton, affirmed the Cartesian dualism of the primary properties of the physical world versus the secondary properties associated with human perception. The goal of science was to see beyond the veil of these secondary properties to the true nature of the physical world. This is not to say that many scientists were not of two (or more) minds on this matter. Newton, for example, declared in his *Mathematical Principles* that he refused to make any hypotheses about the underlying mechanism of gravity as it exists apart

from phenomena. However, in his *Opticks* he did succumb to the powerful urge to theorize about the inherent nature of gravity.

The scientists of this era were also deeply intent on transcending the theological disputes that gave rise to sectarian rivalry; and these disputes they attributed to the fallibility of human, subjective interpretations. Galileo argued that the truths of nature are inexorable and immutable and no truths that the physical world sets before us ought to be called into question.⁴⁴ Reasoning, in his view, was certainly necessary; but the type that was needed was based on mathematics, which God placed in nature, rather than mere human reasoning, which led to multiple interpretations and disputes. Einstein embraced the same theme when he commented that nature, in its own right, can be captured not in any human language but with pure mathematical thought alone, whose propositions are absolutely certain and indisputable.⁴⁵

Thus, within the context of scientific materialism, the subjective realm of human perception, reasoning, and language are set in opposition to the objective realm of the physical world, its inexorable laws, and mathematics. While the objective realm has taken the place of the sacred, the subjective realm has taken the place of the profane.

According to this view, objective reality thoroughly conditions subjective processes. Thus, the brain, one's genetic constitution, and other external, objective stimuli determine mental, emotional, and sensory functions; but apart from those objective influences, no subjectively experienced events, as such, exert any causal influence in the real world. Scientific materialism maintains that brain functions, to which subjective experience is reduced, interact extensively with the external environment. However, this reduction of conscious experience to brain states simply reinforces the preceding point: subjective experience can be allowed to influence the objective world only insofar as such experience is reduced to objective processes.

Durkheim asserts that the concept of mana is the precursor of the scientific concept of energy that was developed during the nineteenth century. Its essential characteristic is that it is located nowhere definitely yet is everywhere present, manifesting in a myriad of diverse forms. According to Durkheim, mana is seen as the objective reality that underlies, empowers, and regulates all physical phenomena. It is altogether distinct from physical power and is in a way supernatural, but it shows itself in physical force or any kind of power or excellence a person possesses. In short, "[a]ll forms of life and all the effects of the action, either of men or of living beings or of simple minerals, are attributed to its influence."⁴⁶ In primitive religions the notion of mana served to explain "the world of experienced realities,"⁴⁷ which, for Durkheim, were social realities.

One chief distinction between religious notions of mana and the scientific concept of mass/energy is that the latter is regarded as purely physical, whereas the former is not. Note, however, that according to physicist Richard Feynman, a staunch scientific materialist, the conservation of energy is

a mathematical principle, not a description of a mechanism or anything concrete. “It is important to realize that in physics today,” he writes, “we have no knowledge of what energy *is*.”⁴⁸ There is certainly no consensus among physicists that energy is some physical stuff existing in the objective world, but if it is not, it is even less clear exactly what it is.⁴⁹ Nevertheless, like mana, it is still thought to underlie, empower, and regulate all physical phenomena, and it manifests in physical force.

If the sole preoccupation of science is understanding and controlling forms of mass/energy, what means does science employ to gain access to this objective reality? Science’s totem, I suggest, is the scientific method, “the means by which an individual is put into relations with this source of energy.” The term *scientific method* is every bit as multifaceted as is *totem* in the context of primitive religions. For each “clan” within the scientific community—from elementary particle physicists to ecologists—the totem of the scientific method appears under different guises. The scientific method in the abstract is associated with careful observation and experimentation, inductive reasoning, and quantitative analysis. But for specific clans of scientists, certain of these characteristics are marginal, while others are dominant.

Mathematical physicists, for example, may hardly concern themselves with observation or experimentation; and wildlife biologists may at times neglect quantitative analysis. Despite the profound differences in the scientific method for diverse branches of science, the *ideal* of this means of inquiry is the source of ideals and the very identity of the scientific community as a whole. Specific versions of the scientific method further distinguish different branches of science and stand out as the totem for each one in the event of interscientific disputes. Yet despite the element of discord within the scientific community, there is widespread unity in the sense that all scientists seek to comprehend phenomena in terms of the objective world. Finally, and perhaps most important, the scientist’s methodology must itself be *objective*, that is, as free as possible from all subjective influences.

Prior to the nineteenth century, diverse sciences each enjoyed a large degree of independence. For example, atomic theories were developed quite autonomously in the fields of chemistry and physics. As in Durkheim’s description of totemic groups, the sciences were juxtaposed without extensive interpenetration. However, with the development of the principle of energy conservation in the nineteenth century, a single and universal concept of energy was conceived, and it exerted a powerful unifying influence on the sciences.⁵⁰ Thus, as in Durkheim’s account, with this sense of “tribal unity” there awakened a sense of the substantial unity of the world.⁵¹

These applications to modern science of Durkheim’s thoughts on the sacred versus the profane, mana, and the totem conform closely to his claim that science pursues the same end as religion and is better fitted to it. In his view, scientific thought, which he claims is “only a more perfect form of religious thought,”⁵² properly supplants the cognitive authority of religion altogether.

From a traditional religious perspective it may seem that science has banished the sacred and left us with a world that is bleakly and utterly profane. From the perspective of many scientists, however, a religious orientation is not at all alien to science. A religious status has been attributed to science at least since the seventeenth century, as we find in the writings of Galileo, Boyle, and Newton. Moreover, beginning in the late eighteenth century, scientific materialists began to speak of their scientific awakening in terms that might be used of a religious conversion. To take but one example, Lyon Playfair, one of the most energetic evangelists of scientific materialism in nineteenth-century Britain, declared in 1853 that “science is a religion and its philosophers are the priests of nature.”⁵³ A century later Albert Einstein was to claim that “you will hardly find one among the profounder sort of scientific minds without a religious feeling of his own” and that “in this materialistic age of ours the serious scientific workers are the only profoundly religious people.”⁵⁴

Einstein’s own conversion to this new faith is an interesting case in point. Despite the fact that he was the son of entirely irreligious Jewish parents, as a child he was deeply drawn to the faith of his forefathers. This shifted, however, at the age of twelve, when his encounter with popular scientific books led him to the conclusion that many of the biblical accounts could not be true. This resulted in his conversion from Judaism to scientific materialism.⁵⁵ Einstein did not apparently draw any clear distinction between science and scientific materialism but, like Durkheim, conflated the two. Whether or not it is legitimate to distinguish them as sharply as I have argued here, religious attitudes within the scientific tradition are neither new nor uncommon; indeed, they appear to run throughout most of the history of modern science.

Scientism

Although signs of scientism can be found in writings as early as the seventeenth century, they have become far more prevalent since the nineteenth century with the rise of scientific positivism, a view that originated with Auguste Comte. Its three central assertions are that (1) science is our only source of genuine knowledge about the world, (2) science is the only way to understand humanity’s place in the world, and (3) science provides the only credible view of the world as a whole. Scientism subsumes scientific materialism (and, thus, scientific realism and science), but it is normally equated by its proponents with science itself. The term “scientism” is invariably used in a pejorative sense, so even those who accept the above three tenets of this doctrine do not call themselves advocates of scientism. They simply say they believe wholeheartedly in science.

Scientism has been depicted in various ways by its detractors. It has been described as the doctrine that science knows or will soon know all the answers and has been said to judge disbelief in its own assertions as a sign

of ignorance or stupidity. Scientism unjustifiably extends the authority of science beyond its proper limits, and it assumes that science can solve all of humanity's problems. Expressions of scientism appear in science textbooks, the popular scientific press, and professional scientific literature. It has made deep inroads into the humanities, and its unexamined assumptions have a hold within nearly every field of scholarship.⁵⁶

In short, scientism adopts an absolutist perspective on reality and denies the value of all other avenues of inquiry and knowledge. Much as the fundamentalists of traditional religions regard the revealed message of their scriptures as self-evident, requiring little or no interpretation on the part of humanity, so do advocates of scientism regard the Book of Nature as revealing its own truths to objective, impersonal observation and reasoning. According to this view, there are no significant philosophical problems in the scientific acquisition of knowledge, and the subjective cogitations on this subject by philosophers are largely useless.

Scientism presents the body of scientific knowledge as a unified whole, just as nature is a unified whole, for the former is regarded as a steadily improving representation of the latter. Thus, the notion of relativity of perspective and methodology in the investigation of nature is seen as wholly spurious. Much as religious fundamentalism presents only an idealized caricature of the history of its own beliefs, so does scientism present the history of science as a unswerving march toward Truth, in which earlier errors are systematically replaced with facts. As theistic fundamentalists view the history of their tradition as being guided by the hand of God, so do the proponents of scientism see the history of science as being led by the hand of Nature. In both cases, human influences in the form of personal biases, social values, economic considerations, accidents, and so on are consciously or unconsciously concealed.

Taking into account the role of human subjectivity appears to be equally taboo in both religious and scientific fundamentalism. According to many schools of religious fundamentalism, the subjective minds of humans are seen as insignificant in relation to the supreme mind of God; and the deeds of humans pale in contrast to the works of the Almighty. Moreover, religious fundamentalists throughout the world tend to overlook the human role in the selection and transmission of their sacred writings, preferring instead to view their scriptures as being the direct expression of the divine. From this utterly objective, transcendent source, devout believers think of themselves as receiving and conveying to others this divinely inspired knowledge, without contamination by their own human subjectivity. In this way, the role of diverse, mutually incompatible human interpretations is minimalized, and the religious doctrine is treated as being a complete, integrated, internally consistent whole, whose divine origin transcends human subjectivity. Thus, the doctrine is presented as being the only viable source of solutions to all the major problems of humanity, and the appropriate response on the part of true believers is to accept its assertions without question and to follow its dictates in a spirit of submission and obedience.

Similarly, according to the dictates of scientism, with regard to scientific observation and quantitative analysis, humans are best replaced by mechanical instruments of detection and computation; and in terms of participation in the act of experimentation, the more passive the human role, the better. Advocates of scientism commonly overlook the subjective, human role of choosing which natural phenomena to investigate, the means of investigating them, and the diversity of human interpretations of research data. Science is presented, like a religious doctrine, as being essentially a complete, integrated, internally consistent whole whose origin in nature transcends human subjectivity. While science provides all genuine knowledge of existence, technology holds all the keys to solving the problems of humanity: environmental, economic, medical, psychological, and social. The appropriate response on the part of the lay public is to be supportive of the scientific community and gratefully receive its technological blessings.

Religious fundamentalists regard those who reject their dogma as being victims of their own sin, especially the sin of pride. Similarly, champions of scientism condemn dissenters from their view as having abandoned reason, for it is inconceivable to them that anyone could be rational and knowledgeable of science yet deny their most cherished scientific beliefs. In short, scientism is to scientific materialism what fundamentalism is to all traditional religions.

In this chapter I have tried to identify the salient characteristics of scientific materialism and its taboos within the fourfold typology of science, scientific realism, scientific materialism, and scientism. The mingling of religious beliefs and scientific knowledge is not new to the twentieth century; rather, it has characterized the development of modern science all along. To understand this trend more clearly, let us turn now to the history of the interaction between theology and science in the West.