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INTRODUCTION: THE REENCHANTMENT OF SCIENCE

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At the root of modernity and its discontents lies what Max Weber called “the disenchantment of the world.” This disenchanted worldview has been both a result and a presupposition of modern science and has almost unanimously been assumed to be a result and a presupposition of science as such. What is distinctive about “modern” philosophy, theology, and art is that they revolve around numerous strategies for maintaining moral, religious, and aesthetic sensitivities while accepting the disenchanted worldview of modernity as adequate for science. These strategies have involved either rejecting modern science, ignoring it, supplementing it with talk of human values, or reducing its status to that of mere appearance. The post-modern approach to disenchantment involves a reenchancement of science itself. The essays herein reflect some of the dimensions that would be involved in a reenchanted science. This introduction positions these essays by showing how they imply a reversal of the modern disenchantment of science and nature and how this reversal fits within the larger contemporary reassessment of natural science.

The first section explains the relationship between the mechanistic philosophy underlying modern science and the process of disenchantment. The second section shows the way a variety of recent developments in the philosophy, sociology, psychology, and history of science, as well as science itself, are converging to undermine the modern basis for disenchantment. The third section explains some of the central ideas of the postmodern organismic philosophy which underlies most of the essays in this volume.

I. MODERN SCIENCE AND THE DISENCHANTMENT OF THE WORLD

In disenchanting nature, the modern science of nature led to its own disenchantment. This happened because the mechanistic, disenchanted philosophy of nature, which was originally part of a dualistic and theistic vision of reality as a whole, eventually led to the disenchantment of the whole world. This first section spells out this development.

What does the “disenchantment of nature” mean? Most fundamentally, it means the denial to nature of all subjectivity, all experience, all feeling. Because of this denial, nature is disqualified—it is denied all qualities that are not thinkable apart from experience.

These qualities are legion. Without experience, no aims or purposes can exist in natural entities, no creativity in the sense of self-determination or final causation. With no final causation toward some ideal possibility, no role exists for ideals, possibilities, norms, or values to play: causation is strictly a matter of efficient causation from the past. With no self-determination aimed at the realization of ideals, no value can be achieved. With no experience, even unconscious feeling, there can be no value received: the causal interactions between natural things or events involve no sharing of values. Hence, no intrinsic value can exist within nature, no value of natural things for themselves. Also, unlike the way our experience is internally affected, even constituted in part, by its relations with its environment, material particles can have no internal relations. Along with no internalization of other natural things, no internalization of divinity can occur. Friedrich Schiller, who spoke of the disenchantment of nature a century before Weber, used the term *Entgotterung*, which literally means the dedivinization of nature. Deity, for the founders of the modern worldview, such as Descartes, Boyle, and Newton, was in no way immanent in the world; it was a being wholly external to the world who imposed motion and laws upon it from without. The laws of nature were, hence, not at all analogous to sociological laws which reflect the habits of the members of human society. A further and in fact central feature of the disenchantment of nature was the denial of action at a distance. Weber’s term for disenchantment was *Entzauberung*, which literally means “taking the magic out.” It was at the heart of the mechanistic vision to deny that natural things had any hidden

(“occult”) powers to attract other things (a denial that made the phenomena of magnetism and gravitation very difficult to explain).¹ In these ways, nature was bereft of all qualities with which the human spirit could feel a sense of kinship and of anything from which it could derive norms. Human life was rendered both alien and autonomous.

Whereas this disenchantment of nature was originally carried out (by Galileo, Descartes, Boyle, and Newton & Company) in the framework of a dualistic supernaturalism in which the soul and a personal deity were assigned explanatory functions and hence causal power, the successes of the objectifying, mechanistic, reductionistic approach in physics soon led to the conviction that it should be applied to all of reality. God was at first stripped of all causal power beyond that of the original creation of the world; later thinkers turned this deism into complete atheism. The human soul or mind was at first said to be “epiphenomenal,” which meant that it was real but only as an effect, not as a cause; later thinkers, believing nature should have no idle wheels, denied that it was a distinct entity at all, declaring it to be simply one of the brain’s emergent properties. In those ways, the “animistic” viewpoint, which attributes causality to personal forces, was completely rejected. All “downward causation” from personal to impersonal processes was eliminated; the reductionistic program of explaining everything in terms of elementary impersonal processes was fully accepted. The world as a whole was thus disenchanted. This disenchanted view means that experience plays no real role not only in “the natural world” but in the world as a whole. Hence, no role exists in the universe for purposes, values, ideals, possibilities, and qualities, and there is no freedom, creativity, temporality, or divinity. There are no norms, not even truth, and everything is ultimately meaningless.

The ironic conclusion is that modern science, in disenchanting nature, began a trajectory that ended by disenchanting science itself. If all human life is meaningless, then science, as one of its activities, must share in this meaninglessness. For some time, many held that science at least gives us the truth, even if a bleak one. Much recent thought, however, has concluded that science does not even give us that. The disenchantment is complete.

The main point to emphasize is that modern thinkers have assumed that this disenchantment of the world is *required by science itself*. A few examples: just as Darwin felt that any “caprice” in the world would make science impossible, so that both divine and free human activity had to be eliminated from our worldview,² so Michael Ghiselin, a contemporary Darwinian, says that to deny the ideal of predictive determinism by affirming teleological causation “is to opt out of science altogether.”³ Jacques Monod says:

The cornerstone of the scientific method is the postulate that nature is objective. In other words, the *systematic* denial that ‘true’ knowledge can be got at by interpreting phenomena in terms of final causes—

that is to say, of 'purpose'. . . . [T]he postulate of objectivity is con-substantial with science. . . . There is no way to be rid of it, even tentatively or in a limited area, without departing from the domain of science itself.⁴

While recognizing that the objectivist view of the world outrages our values and forces us to live in an alien world, Monod nevertheless insists that we must adopt it, because all "animist" views, which make us feel at home in nature by attributing purpose to it, are "fundamentally *hostile* to science."⁵

"So-called purposive behavior," said behaviorist psychologist Clark Hull, is to be regarded as a secondary, epiphenomenal reality, derivative from "more elementary objective primary principles."⁶ Likewise, B. F. Skinner argues that psychology must follow physics and biology in rejecting "personified causes," and that to be "natural" is to be completely determined by one's environment. From the viewpoint of "the science of behavior," says Skinner, the notion of the "autonomous," which "initiates, originates and creates," is the notion of the "miraculous." He adds: "A scientific analysis of behavior dispossesses autonomous man and turns the control he has been said to exert over to the environment."⁷ Whereas this statement suggests that determinism is a *result* of the application of the scientific approach, Skinner had earlier revealed that it is a *presupposition*: "We cannot apply the methods of science to a subject matter which is assumed to move about capriciously. . . . The hypothesis that man is not free is essential to the application of scientific method to the study of human behavior."⁸

While Hull and Skinner come from a previous generation, and advocated a behaviorist psychology which is now widely rejected, William Uttal is a contemporary psychobiologist. He says that reductionism, according to which all the activities of the mind are reducible to the most elementary levels of organization of matter, is "the foundation upon which the entire science of psychobiology is built." To introduce any definition of consciousness that goes beyond the operations used in surgery and the behavioral laboratory would mean "a total collapse into prescientific modes of thought."⁹

The idea that science requires a reductionistic account, and rules out all downward causation from personal causes and all action at a distance, is illustrated by the treatment of apparent parapsychological phenomena by physicist John Taylor. After studying several people who he had come to believe had the psychokinetic power to bend metal without touching it, he published a book entitled *Superminds*, complete with supporting photographs.¹⁰ However, after deciding later that no explanation was to be found for psychokinetic effects within the scientific worldview, he wrote a second book called *Science and the Supernatural* in which he declared that no such events can occur. Although he still believed that there was good evidence for psychokinetic events, and admitted that he could not explain how the

particular events he had witnessed could have been faked, he concluded that all such reports must be due to hallucination, trickery, credulity, the fear of death, and the like. "Such an explanation is the only one which seems to fit in with a scientific view of the world."¹¹ The reasoning behind this conclusion was as follows: First, scientific explanation can only be in materialistic terms; if anything, such as the human mind, could not be explained in quantitative, materialistic terms, then the scientist would have to choose between silence and irrationality.¹² Second, according to "the scientific viewpoint," all explanation must be in terms of the four forces of physics. Third, none of these forces can explain psychokinesis. Therefore, he says, we must believe that no genuine psychokinesis occurs. Taylor concludes by castigating himself and other scientists for having seriously investigated "phenomena which their scientific education should indicate are impossible."¹³

This idea that the very nature of science rules out the scientific study of anything not understandable in materialistic terms has in our century probably been more prevalent in fields other than physics. James Alcock, a social psychologist, says that a "spiritual science," which parapsychology is sometimes said to be, is a contradiction in terms. "How can a science of the spirit exist, given that science is by its very nature materialistic?"¹⁴

Besides ruling out purpose, freedom, personal causation, and any non-materialistic interactions from the scientific account of nature, the dominant viewpoint has even eliminated temporality. Ilya Prigogine regards the fact that modern science has been nontemporal as the root of the cleavage between the "two cultures" (C. P. Snow) of science and the humanities!¹⁵ This elimination of temporality has been supported by many twentieth-century physicists, including Albert Einstein, who said: "For us believing physicists, the distinction between past, present and future is only an illusion, even if a stubborn one."¹⁶ A contemporary physicist, P. C. W. Davies, spells out the implied dualism between objective nature and subjectivity:

The notion that time flows in a one-way fashion is a property of our consciousness. It is a subjective phenomenon and is a property that simply cannot be demonstrated in the natural world. This is an incontrovertible lesson from modern science. . . . A flowing time belongs to our mind, not to nature.¹⁷

A well-read physician, citing several physicists who endorse this view, says that we must assimilate it, in spite of the fact that it is an affront to common sense, because "we cannot ignore what modern physical science has revealed to us about the nature of time."¹⁸

As stated earlier, the final disenchantment of modern science is its conclusion that its own discoveries prove the meaninglessness of the whole universe, which must include the scientists and their science. Near the end of his popular book, *The First Three Minutes*, physicist Steven Weinberg

says, "The more the universe seems comprehensible, the more it also seems pointless."¹⁹

I momentarily interrupt the recital of evidence to respond to a counter-argument that is probably growing in the mind of many readers. This is the argument that it is not the job of the scientist *qua* scientist to deal with the true nature of time and matter in themselves and with the question whether the universe is meaningful. These are the tasks, it could be argued, for metaphysicians and theologians, or for poets, whom Shelley called the "un-acknowledged legislators of mankind." Hence, according to this argument, no need exists for a postmodern science; it is only necessary to point out the inherent limitations of science so that people will look elsewhere for answers to these larger questions. The problem with this solution is that the ideal of an "inherently limited science" does not work in practice. Science is inherently not only realistic, trying to describe the way things really are, but also imperialistic, bent on providing the only genuine description. The word *science*, after all, means *knowledge*; what is not vouchsafed by "science" is not considered knowledge in our culture. The cultural effect of modern science has been to make scientists the only "acknowledged legislators" of humankind, because its worldview has ruled out the possibility that metaphysics, theology, or poetry would have anything to add. Unless science itself is seen as giving a different answer, the disenchantment of the world will continue. With this brief apologia, I return to the topic.

Not only scientists themselves but also many philosophers have supported the view that science necessarily disenchant the world, proving that experience and those qualities that presuppose it are inoperative. D. M. Armstrong says that we have "general scientific grounds for thinking that man is nothing but a physical mechanism," that "mental states are, in fact, nothing but physical states of the central nervous system," so that we should be able to "give a complete account of man in purely physico-chemical terms."²⁰ In his 1956 preface to *The Modern Temper*, originally published in 1929, Joseph Wood Krutch summarized the book's thesis (with which he had later come to disagree):

The universe revealed by science, especially the sciences of biology and psychology, is one in which the human spirit cannot find a comfortable home. That spirit breathes freely only in a universe where what philosophers call Value Judgements are of supreme importance. It needs to believe, for instance, that right and wrong are real, that Love is more than a biological function, that the human mind is capable of reason rather than merely of rationalization, and that it has the power to will and to choose instead of being compelled merely to react in the fashion predetermined by its conditioning. *Since science has proved that none of these beliefs is more than a delusion*, mankind will be compelled either to surrender what we call its humanity by ad-

justing to the real world or to live some kind of tragic existence in a universe alien to the deepest needs of its nature.’²¹

Better known is the following purple passage from “A Free Man’s Worship,” in which Bertrand Russell summarizes “the world which Science presents for our belief”:

That Man is the product of causes which had no prevision of the end they were achieving; that his origin, his growth, his hopes and fears, his loves and beliefs, are but the outcome of accidental collocations of atoms; . . . that all the labours of the ages, all the devotion, all the inspiration, all the noonday brightness of human genius, are destined to extinction in the vast death of the solar system . . . —all these things, if not quite beyond dispute, are yet so nearly certain, that no philosophy which rejects them can hope to stand.²²

The modern consensus then, as reflected in the preceding quotations, has been that science and disenchantment go hand in hand. On the one hand, it is assumed, science can only be applied to that which has already been disenchanted, which means deanimated.²³ To deanimate is to remove all anima or soul, in Plato’s sense of a self-moving thing which determines itself, at least partly, in terms of its desire to realize particular values. On the other hand, it is assumed that the application of the scientific method to anything confirms the truth of the disenchanted view of it, that it can be adequately understood in purely impersonal terms, as embodying no creativity, no self-determination in terms of values or norms, and nothing that could be considered divine.

The only way to prevent the disenchantment of the universe as a whole, on this view, is to draw a line, usually between the human being as purposive agent and the rest of nature, above which the scientific method is said to be inapplicable. But any such essential dualism is undermined by several things: the fact that human behavior, including human experience, is subject to a great extent to causal analysis; the idea that we, like all other species, are products of the evolutionary process; the difficulty of understanding how a human mind, which operates in terms of reasons, purposes, or final causes, could interact with bodily parts operating strictly in terms of mechanistic causes; and the general pressure toward a unified approach to knowledge. Accordingly, the attempt to prevent total disenchantment by means of an essential dualism—between mind and matter, understanding and explanation, hermeneutics and science—²⁴ is difficult to maintain intellectually. Whereas all people live in terms of the conviction that they are more than behaviorism, sociobiology, and psychobiology allow, and may feel that the totally disenchanted approach to human beings is inappropriate, it has been extremely difficult to state these convictions and feelings in an intellectually defensible way. Besides thereby seeming to leave no alter-

native beyond antihumanitarianism or a humanitarianism based on an arbitrary choice, modern science also seems to alienate us from our bodies and from nature in general. Because it has disenchanted the world, many people have become disenchanted with science.

Others, however, have distinguished between *modern science*, which disenchant, and *science as such*, which may be open to reenchancement.

II. REVERSING DISENCHANTMENT: THE CONVERGING REASONS

During the twentieth century, while the disenchanting march of modernity has continued in most areas, a countermovement has been occurring in the philosophy, history, sociology, and psychology of science and in the sciences themselves. This movement, which has acquired great momentum in the latter half of the century, has cut the tie between science and disenchantment, thereby opening the way for the reenchancement of science. (While it might be thought improper to speak of the *reenchantment* of science on the assumption that science has from the beginning been disenchanted, there is now much evidence, some of which is presented in Section B and the works cited in its notes, that the dominant form of science throughout most of the sixteenth and seventeenth centuries *was* enchanted.)

There are four major reasons why the seemingly necessary connection between science and disenchantment is being broken: a new view of the nature of science, a new view of the origin of modern science, new developments within science itself, and reflections on the mind-body problem.

A. A New View of the Nature of Science

The conviction is growing that science is not a value-free enterprise or, to put it more precisely, that values other than the purely intellectual value of truth for its own sake, and that factors other than rational and empirical ones, essentially shape the worldview of the scientific community. Of course, it has long been recognized that the scientific community is composed of human beings, so that the same types of distortion, projection, power plays, and other nonrational factors operate in it as in other communities. But it was assumed, as classically formulated by Robert Merton, that science as a social system, in which these nonrational factors operate, can be separated from science as a cognitive system, which is governed by logic and empirical facts.²⁵ Science as a cognitive system was thought to be essentially value-free, except for those values that are internal to science itself, i.e., its distinctive way of pursuing truth. But now it is widely held that this separation is not possible and that the social factors affect science essentially, not just superficially. Rather than standing as an impartial tribunal of truth, transcendent over the battle field of competing social forces, science is seen as one more interested participant, using its status to legitimate cer-

tain social, political, and economic forces and to delegitimize others. More than that, the scientific community's interest in its own social power relative to other professions and institutions is now seen to condition the picture of the world it sanctions as "scientific."²⁶

As alluded to above, the old view, according to which science seeks truth and nothing but truth and alone gives us truth, has been replaced in some circles by the opposite view, according to which science neither gives nor seeks truth. This extreme view (which is sometimes called *postmodernism* and is briefly discussed in the introduction to the series) is based upon a confluence of several notions. The recognition of the way our interpretations and even perceptions are conditioned by language, by culture in general, by the dominant worldview of the time, by personal (including unconscious) interests, and by interests based on race, gender, and social class—this recognition has led many to the conclusion that a worldview is wholly a construction or a projection, not at all a reflection or discovery of the way things "really" are.²⁷ Even the concern for truth, the very meaning of *truth*, and the criteria for determining truth, are sometimes seen as purely context-dependent.²⁸ These reflections based on language, psychology, and the "sociology of knowledge" are buttressed by philosophical doubts about whether there is a "given" (as opposed to a constructed) element in perception and whether the notion of truth as correspondence between idea and external reality is even meaningful.²⁹ Some or all of these notions, combined with the recognition that modern science has both sought and achieved power over nature, lead easily to the suggestion that this power, not truth, is science's aim and its achievement. The worldview of science is "true" in the sense and only in the sense, according to this view, that it works, i.e., that it is successful in terms of this particular interest.³⁰ Hence, it is not "true" for those who have never had, or who have rejected, this interest; it can accordingly be ignored by them. Other worldviews, based on equally legitimate interests, are equally valid.

However, this extreme view is no more satisfactory than the naive objectivism which it replaced. First, the valid facts upon which this extreme view is based do not require this view. Second, the view is so extreme as to be self-refuting: if we are unable to know the truth about how things are, then the "facts" on which this view is based cannot be true.³¹ Third, this extreme view cannot command consent, because we cannot help but believe that the scientific theories that led (say) to effective immunizations against various diseases correspond in some very strong way to the physiological realities.³²

Rejection of this extreme view does not require a return to the dominant modern view. Recognition that the scientific community seeks truth is fully compatible with the recognition that the truths it seeks are selected according to various interests and prejudices. Recognition that science has discovered a wide range of truths is compatible with the conviction that a wide range of truths it has *not* discovered exists, and that its formulations

of the truths it *has* discovered are one-sided, presenting only abstractions from the full truth. Recognition that there must be some truth to the “modern scientific worldview,” which supports and is supported by the select truths of modern science, is fully compatible with the view that other worldviews exist that, all things considered, correspond equally well or even better to the full nature of reality.³³ Hence, we do not have to deny that science is capable of discovering truths and that it sometimes does so in order to recognize the various ways and enormous degrees to which the worldview, the methods, and the results of the scientific community at any time and place are products of extrascientific interests and prejudices.³⁴ It is this recognition that is the main point. It is freeing many people from the assumption that the modern disenchanted worldview is either proved or presupposed by science as such.

B. A New View of the Origin of Modern Science

The formal points in the previous section have been fleshed out by historians and sociologists who have been reexamining the origins of modern science. Three major conclusions have reversed long-held assumptions. First, the atheistic, materialistic worldview of today does not have behind it the authority of the seventeenth-century founders of modern science, such as Galileo, Mersenne, Descartes, Boyle, and Newton.³⁵ Their mechanistic view of nature was incorporated within a supernaturalistic and dualistic framework that was by no means incidental to them. Second, even this partially mechanistic view, in which (nonhuman) nature was viewed mechanistically, was not the context presupposed by many of the discoveries usually considered to lie at the root of modern science. Harvey was an Aristotelian, and Copernicus, Gilbert, and Newton thought in terms of a “magical” worldview, in which attraction at a distance was central. If good science has been done apart from mechanistic assumptions, they can hardly now be said to be requisite for good science.³⁶ Third, the mechanistic view of nature was adopted less for empirical than for theological, sociological, and political reasons. This third point, about the influence of extrascientific interests upon the modern scientific worldview, is a complex issue; a brief summary of a few of the illustrations provided by historians will have to suffice here.

One theological interest behind mechanism was the conviction, especially by Robert Boyle, that the divine excellency required that God be wholly transcendent, wholly external to nature, and that there be no self-movement in nature which could be taken to be divine.³⁷ The mechanistic view of nature was also used, for example by Boyle and Newton, to argue for the existence of God: if nature was devoid of self-motion, there had to be a supernatural being to have put it into motion and also to have imposed laws of motion upon it. Newton also argued that the mechanistic materialistic conception of matter, according to which it has no hidden powers and acts only by con-

tact, shows the need for a cosmic spiritual being to explain the mutual attraction of bodies (gravitation) and the cohesiveness of atoms in solid bodies.³⁸ The mechanistic picture of the human body was used by Descartes, Boyle, and Locke to support the doctrine of an immortal soul: if the mortal, material body is composed of parts devoid of the power of self-motion, obviously something in us is different in kind from matter.³⁹ The defense of miracles was one of the main motives for mechanism. The Hermetic, Cabalistic, and Neoplatonic philosophies, by allowing influence at a distance as a natural phenomenon, could be used to deny that the miracles reported in the Bible and in the lives of Christian saints were supernaturally caused, meaning that they would therefore not prove the unique truth of Christianity.⁴⁰ Mersenne, Gassendi, Descartes, Boyle, and the Royal Society used the mechanistic philosophy to prove that action at a distance was *not* naturally possible, so that when extraordinary events occurred (which no one doubted) they had to be considered genuinely miraculous.⁴¹

These motives for mechanism were not simply theological but were equally sociological, in that they defended the Church's authority and thereby the State at a time when they were under attack. The Church's authority depended importantly upon the idea of rewards and especially punishments after death, which was thought to require a supernatural God and an immortal soul. This idea was considered essential for the preservation of the sociopolitical order against those who were seeking a wider distribution of material goods and political enfranchisement.⁴² Of particular significance was the authority of the Biblical passage stating that rulers are appointed by God and should be obeyed (not overthrown!).

There were yet other sociological motives for advocating the "new mechanical philosophy" as part of an extreme dualism between the soul and nature and between God and the world. In opposing pantheistic or panentheistic worldviews in which God was immediately present to and in all things, the Royal Society distinguished itself clearly from those other philosophies which, also based on "natural magic" (i.e., mathematics), had been used to support "leveling" social movements which had opposed hierarchical views of society and of the Church.⁴³ It also, by eliminating all feeling as well as divinity and creativity from nature, was intended (e.g., by Descartes and Boyle) to sanction the uninhibited exploitation of nature for human ends, such as mining and vivisection.⁴⁴

Another extrascientific influence, whether it be considered sociological or psychodynamic, was the desire to develop a "masculine" science of nature in contrast with the "feminine" or "hermaphrodite" science of the alchemists and other Hermeticists. In this masculine science, domination over nature replaced harmonious cooperation as the goal; dispassionate objectivity replaced the union of head and heart as the proper stance of the scientist, who therefore needed no personal transformation; and nature, understood as feminine, was emptied of all spirit and feeling, and especially all divinity.⁴⁵

This complete dualism between God and the human soul as subjects, on the one hand, and nature as a realm of pure objectivity, with no inherent values, on the other, also provided a neat division of territory between theology and politics on the one hand, and natural science on the other. The implicit pledge by science to be value-neutral and not to deal with theological matters (except perhaps to give indirect support) removed any reason for the State and the Church to take offense at science's conclusions and hence any reason for it to interfere in its activities.⁴⁶

Later, when secularization had proceeded to the point where there was little reason to fear ecclesiastical censure and when the leading members of the scientific community were no longer committed to supernatural Christianity and the Church's social authority, dualism could be turned into materialism, with the result that the scientific community would no longer have to share authority to establish truth with any other community.⁴⁷ It would be reductionistic to follow some sociologists in explaining the materialistic worldview entirely in terms of a bid for social power and prestige; after all, there *were* genuine intellectual problems, such as the problem of evil and the mind-body problem. But it would be falsely idealistic to ignore or discount this motive altogether.⁴⁸

Because of studies revealing these influences, a conviction is growing that good science does not presuppose mechanism and that the mechanistic view of nature was adopted more for theological and sociological than for empirical reasons. A representative statement is provided by Jerome Ravetz:

The 'scientific revolution' itself becomes comprehensible if we see it as a campaign for a reform of ideas *about* science, introduced quite suddenly, injected into a continuous process of technical progress *within* science . . . [S]cientific revolution was primarily and essentially about metaphysics; and the various technical studies were largely conceived and received as corroborating statements of a challenging world-view. This consisted essentially of two Great Denials: the restriction of ordinary faculties such as sympathy and intelligence to humans and to a remote Deity; and the relegation of extra-ordinary faculties to the realms of the nonexistent or insignificant. . . . The great historical myth of this philosophy is that it was the necessary and sufficient cause of the great scientific progress of the seventeenth century. This was a central point in its propaganda, for itself at the time and in histories ever since. Yet the results of historical enquiry, some old and some new, contradict this claim.⁴⁹

This new view has done much to undermine the modern conviction that a necessary connection exists between science and disenchantment (referred to in the above quotation as the "two Great Denials").

It should perhaps be stressed that an *enchanted science* is a wholly different thing from a *sacred science*; in fact, the decline of the latter is

necessary for the reemergence of the former. A *sacred science*, as described in Sandra Harding's helpful discussion, is one whose method, worldview, and central facts are thought to be immune from social influences so that science itself is not to be understood in the same terms as it recommends that all other social activities are understood. That is, while science promotes the view that all (other) social practices are best understood in terms of influences from the environment, it maintains that the "development of science alone is to be understood through the stories scientists and a scientific culture tell about themselves." She asks rhetorically: "To what other 'community of natives' would we give the final word about the causes, consequences, and social meanings of their own beliefs and institutions?" We must, she says, be "willing to try to see the favored intellectual structures and practices of science as cultural artifacts rather than as sacred commandments handed down to humanity at the birth of modern science."⁵⁰ Since modern science has disenchanting the world and thereby itself, this desacralization of science, the progress of which we have traced in this and the previous sections, is a necessary condition for the reenchantment of the world and of science itself.

C. Recent Developments in Science

The move away from the mechanistic, deterministic, reductionistic worldview associated with modern science has been based not only on formal reflections upon the nature of modern science but also on substantive developments within science itself.

Many discussions of this topic focus primarily, if not exclusively, upon quantum physics, seeing it as not only destroying the Cartesian-Newtonian worldview but as also suggesting a new worldview—or a return to an old one, usually a mystical worldview, perhaps Taoist or Buddhist. However, the dominant interpretation of quantum physics, the Copenhagen interpretation, is limited to rules of calculation to predict the content of observations.⁵¹ In other words, it is a nonrealist, phenomenalist interpretation, in which the attempt to describe what is really going on in the world of subatomic entities, independently of human measurement, is eschewed. Most popular accounts of the implications of quantum physics for our worldview neglect this fundamental point. The phenomenalist descriptions are presented as if they tell us something deep about the nature of reality.

A recent interpretation of the significance of quantum physics for the worldview of the founders of quantum theory themselves presents a more sophisticated account. Rejecting the notion that a direct connection exists between quantum theory and mysticism, Ken Wilber argues that quantum theory did nevertheless promote mysticism, but only indirectly. That is, as these physicists became aware that physical theory gave them only shadows and symbols of reality, rather than reality itself, they became freed from the materialistic worldview and hence open to taking their own conscious experience as real and revelatory.⁵²

But, regardless of the way the dominant interpretation of quantum physics did in fact loosen the grip of the mechanistic worldview, it does not provide us with the basis for a new worldview. The question remains whether quantum physics, under a different interpretation, might say something more directly helpful about the nature of reality.

There are some physicists, such as David Bohm and Henry Stapp, who have sought to develop a realistic (nonphenomenalist) account of the quantum realm. Bohm has thereby been led to distinguish between the “explicate” order, upon which physics thus far has focused, and the “implicate” order, which a more complete physics would describe.⁵³ In this implicate order, enduring things are not separate from each other, as they appear to be in the explicate order, but are mutually enfolded in each other. Each electron, for example, in some sense enfolds in itself the universe as a whole and hence all its other parts. Accordingly, internal relatedness to other things which we directly experience in our conscious experience is generalized analogically all the way down to the simplest individuals. As Bohm points out in his essay in this volume, in overcoming the dualism between mind and matter this view implies the transcendence of the modern separation between facts and values, truth and virtue. Henry Stapp likewise regards each event as a process of enfoldment: each event enfolds previous events within itself.⁵⁴

This view, that the events of nature are internally constituted by their appropriations from other things, is the central theme of those who are suggesting that the mechanistic paradigm in science be replaced by an ecological one—a view represented in this volume by Charles Birch, John Cobb, and Frederick Ferré. The term *ecological* most readily suggests biology. But it is important to all of these thinkers that internal relations are characteristic not only of living beings but also of the most elementary physical units. For one thing, only when this view prevails will the current drive to make mechanistic explanations ultimate even in the science of ecology be overcome.

Because internal relatedness is a necessary feature of subjects, the attribution of internal relations to individuals at all levels is one condition for overcoming an ultimate dualism between subjects and objects; *completely* overcoming dualism would involve the attribution of other essential features of subjects, such as feeling, memory, and aim or decision, at least in embryonic form, all the way down. Birch refers to Donald Griffin, who is one of several scientists calling for the scientific study of animals to go beyond behaviorism by speaking of subjective experience. Although “thinking” may occur only in the higher animals, Griffin suggests, the notions of memory and internal imaging seem necessary to understand the behavior of bats and even bees.⁵⁵ Whereas bats and bees are very complex, highly evolved organisms, bacteria are unicellular microorganisms, the simplest form of life, which evidently emerged about four billion years ago, according to the most recent discoveries. Daniel Koshland and his colleagues have

provided evidence of rudimentary forms of both “memory” and “decision” in bacteria.⁵⁶ Going even further down, there is reason now to believe that DNA and RNA macromolecules are not simply passive entities which change as their parts are changed, but that they are active organisms which actively transpose their parts.⁵⁷ Going even further, it has been suggested that the Pauli Principle provides reason to think of an atom as a self-regulating whole.⁵⁸

Against the ontological reductionism of the materialistic worldview, according to which all causation runs sideways and upward, from parts to parts and from parts to the whole (with all apparent wholes really being aggregates), there are now developments in science stressing “downward causation,” from the whole to the parts. One of the most striking developments is evidence that the genes, which neo-Darwinism considers necessarily impervious to influence from the organism as a purposive whole, are in fact influenced by the organism.⁵⁹

This recognition of downward causation from mind to body is aided if materialism and dualism are transcended. Those positions made it inconceivable that subjective purposes, feelings, decisions, and the like could influence the body. But if bodily cells and their components themselves have subjective experience, then downward causation from mind to body is no longer counterintuitive and the recognition of downward as well as upward causation between other levels will be easier. Willis Harman’s essay in this volume⁶⁰ speaks to this issue especially with regard to “psychosomatic effects,” as does my own.

More inclusive forms of downward causation would be involved in assertions of the influence of the planet as a living organism, and of the universe as a whole, on their parts. Something like the former could be suggested by the “Gaia hypotheses” of J. E. Lovelock and Lynn Margulis.⁶¹ The latter is involved in David Bohm’s view that every natural unit, as an act of enfoldment, in some sense enfolds the activity of the universe as a whole within it. Because the universe as an active whole can be regarded as divine,⁶² Bohm in effect is suggesting that postmodern science, in speaking of the implicate order, would include reference to divine activity. He is thus reversing the dedivinization of nature bemoaned by Schiller.

The organismic view also overcomes the modern (and premodern) view that, for the world at its most fundamental level, temporality, in the sense of an irreversible distinction between past and future, is unreal. The notion that each electronic or protonic event enfolds past events within itself makes reversibility no more conceivable at the subatomic than at the human level.⁶³ According to Brian Swimme in this volume, we should, instead of regarding the historical evolution of the cosmos as an epiphenomenal development on the surface of the immutable laws of physics, see these laws themselves as products of a temporal development. Accordingly, physics no longer disenchant our stories; physics itself provides us with a new story which can become a common, unifying story underneath our more par-

ticular stories. Rupert Sheldrake in this volume, agreeing with Swimme that the laws of physics should not be considered changeless, suggests further that they be conceived as habits that have evolved and that continue to evolve. The laws of nature hence become sociological laws, an idea that reduces further the modern dualism between humanity and nature. Rather than seeing mechanisms as fundamental and organisms as derivative phenomena to be explained mechanistically, Sheldrake suggests the opposite: mechanistic phenomena represent the extreme possibility of habit formation on the part of organisms. Sheldrake here restates a major theme of organismic scientists, represented in the essays by Bohm, Birch, and Ferré as well, that while a mechanistic starting point cannot account for genuine organisms, an organismic starting point can account for all the mechanistic phenomena evident in the world

Sheldrake's original contribution is his hypothesis about the way such habits could be formed. This hypothesis of morphic resonance, which attributes a cumulative power to the repetition of a similar form, depends not only upon the irreversibility of time, but also upon influence at a distance, that is, over both temporal and spatial gaps. He is thereby bringing back, in a postmodern form, one of the notions that early modern thought most vigorously opposed (see Note 1 and the above-cited quotation from Jerome Ravetz). That Sheldrake's proposal was condemned by a representative of the modern scientific establishment even prior to its testing is no surprise.⁶⁴

The issue of action at a distance is, of course, central to the controversies about parapsychology. Numerous treatments show that the main difficulty with parapsychological claims, probably even more fundamental than the problem of repeatability, is the fact that "paranormal claims seem to clash with our twentieth-century presuppositions about reality."⁶⁵ And, as concluded by a recent reexamination of C. D. Broad's "basic limiting principles" which paranormal claims seem to violate, the crucial principle is that "any event that is said to cause another event (the second event being referred to as an 'effect') must be related to the effect through some causal chain."⁶⁶ This principle is violated by telepathy, clairvoyance, and psychokinesis (and precognition, which also violates the principle that the cause must precede the effect temporally). The author concluded that "the absence of a specifiable and recognizably causal chain seems to constitute a difficult, if not insurmountable, objection to our giving a coherent account of what it means to make such a claim."⁶⁷ C. D. Broad himself had suggested that, if there are any well-established facts that are exceptions to these principles, the good thinker "will want to revise his fundamental concepts and basic limiting principles in such a way as to include the old and new facts in a single coherent system."⁶⁸ As we saw earlier, the notion that a "causal chain" of contiguous events or things must exist between a cause and an effect at a distance is part and parcel of the mechanistic worldview and is based on the assumption that the constituents of the world are bits of matter, analogous to billiard balls or parts of a machine, which can only affect each

other by contact. But if the basic units of the world are less like cogs or billiard balls than like moments of experience, which enfold influences from previous moments of experience into themselves, that all influence must come from contiguous events is no longer intuitively self-evident. Hence, in line with their nonmechanistic, organismic views of nature, Bohm and Stapp in physics and Sheldrake in biology point to evidence of nonlocal effects.⁶⁹ In this context, the claims of parapsychologists, such as those reported by Stanley Krippner herein, need not be rejected *a priori*, on the grounds that they clash with the rest of our worldview. In fact, Bohm, Sheldrake, and Stapp (as did Whitehead before them) all suggest that events exert two forms of influence on the future, one form on contiguous events, another on noncontiguous ones.⁷⁰ They use this nonlocal causation, in which what is normally called *physical energy* is not involved, to explain phenomena that seem inexplicable in terms of causation through chains of contiguous events alone.

These recent developments in the scientific community, some of which are reflected herein, are reversing the disenchantment of science and its worldview. They are carrying forward what Floyd Matson described in 1964 as “the affirmative countermovement in postmodern science.”⁷¹

D. Reflections on the Relation between Mind and Matter

The main philosophical reason for rejecting the mechanistic, nonanimistic view of nature is that that view makes the relation between mind and matter problematic. Four aspects of this problem can be distinguished: the traditional mind-body problem, the problem of mind as the Great Exception, the problem of emergence, and the problem of where to draw the line.

This mind-body problem is due to the conjunction of a directly known fact, an apparent fact, and an inference. The *directly known fact* is that we have, or are, a mind, in the sense of a stream of experiences. As Descartes stressed, if there is one thing I cannot doubt, it is that I am experiencing. The *apparent fact* is that the mind and the body seem to interact; that is, the mind seems to be affected by the body and seems to affect it in return. The *inference* is that the human body is composed of things that are devoid of experience. The resulting problem is: How is it understandable that these two totally unlike things appear to interact? The problem is intensified once we realize that the dualism between nonexperiencing and experiencing things entails a *set* of absolute contrasts, so that the question becomes: How can the impenetrably spatial relate to the nonspatial, the nontemporal to the temporal, the mechanistically caused to the purposively acting, the idealess to the idea-filled, the purely factual to the value-laden, the externally locomotive to the internally becoming?

Because the founders and early defenders of the dualistic⁷² worldview were supernaturalistic theists, they did not find the problem insurmountable. Although they differed in details (with Descartes speaking of an

ethereal pineal gland, Malebranche of occasionalism, Leibniz of preestablished harmony or parallelism), they all agreed in essence with Thomas Reid, who simply said that God, being omnipotent, can cause mind and matter to interact, even if such interaction is inconceivable to us.⁷³ These thinkers thereby illustrated Whitehead's complaint about supernaturalists: having a God who can rise superior to metaphysical difficulties, they did not rethink their metaphysical principles but simply invoked God to prevent those principles from collapsing.⁷⁴

However, as this appeal to God has become unacceptable, dualists are left with no answer. They either ignore the problem or regard it as a mystery we simply must accept. For example, at one time Karl Popper said: "What we want is to understand how such nonphysical things as *purposes, deliberations, plans, decisions, theories, tensions, and values* can play a part in bringing about physical changes in the physical world?"⁷⁵ At a later time, however, he evidently decided that no such understanding was possible. He still confessed to belief in a "ghost in a machine," but dismissed the question of their interacting with the lame comment that "complete understanding, like complete knowledge, is unlikely to be achieved."⁷⁶ Materialists use this admitted unintelligibility of dualistic interaction as the basis for equating mind and brain.

The second problem raised against dualism by some materialists is the implausibility of the idea that everything in the universe except human experience can be understood in physicalistic terms. This is the problem of the human mind as the Great Exception. J. C. C. Smart says: "That everything should be explicable in terms of physics . . . except the occurrence of sensations seems to me to be frankly unbelievable."⁷⁷ This problem is lessened somewhat when dualists extend experience to all animals having central nervous systems, as do many dualists; it is lessened even more if experience is attributed all the way down to the lowest forms of life.

However, this solution simply raises the problem of interaction in a new form, resulting in a third problem, the problem of emergence. Whether the ontological gap is located between the human mind and its body or between an experiencing cell and its insentient atoms, the communication across the gap is equally unintelligible. As Smart states: "How could a non-physical property or entity suddenly arise in the course of animal evolution? . . . What sort of chemical process could lead to the springing into existence of something nonphysical? No enzyme can catalyze the production of a spook!"⁷⁸

A fourth problem for dualists, if they try to solve the first two by extending experience below the human mind, is just *where* to draw the absolute line between sentient and insentient things. Drawing the line with Descartes between the human soul and the rest of nature, so that dogs are simply barking machines, was never very plausible, and it became less so with the theory of evolution. But drawing an absolute line anywhere else seems arbitrary, especially in an evolutionary context. Some vitalists have

drawn an absolute line between living and nonliving matter, but the once-clear line between living and nonliving has become vague. Is the cell living and sentient, while its remarkable DNA and RNA macromolecules are insentient mechanisms? Is the bacterium a sentient organism, while the virus is not? Any such line seems arbitrary. For example, while agreeing that crystals and DNA molecules show signs of memory, and that even atoms and elementary particles have "propensities," Karl Popper refuses to attribute experience any further down than to single-celled animals.⁷⁹ The reason Popper cannot attribute experience to atoms and electrons is clear; it is that he, being a modern man, shares "with old-fashioned materialists the view that . . . solid material bodies are the paradigms of reality."⁸⁰

Given that modern starting point, the only way to avoid the insoluble problems of dualism is to affirm total materialism. Materialists avoid the problem of mind-body dualism by affirming identism, the doctrine that mind and brain are identical. J. C. C. Smart, not being able to believe that experience is "made of ghost stuff," says that it is "composed of brain stuff." In other words: "Sensations are nothing over and above brain processes."⁸¹ In D. M. Armstrong's words, "mental states are in fact nothing but physical states of the central nervous system."⁸²

Materialism has even more problems than does dualism, because it shares most of the problems of dualism and then adds some of its own. To begin with the problems it shares with dualism: First, it has not really escaped the problem of emergence which it levels against dualism. The identist's claim is that conscious experience is a quality that has "emerged" in the evolutionary process analogously to the way in which other properties have emerged, such as saltiness, wetness, and furriness. Just as saltiness emerged out of a particular configuration of things none of which were by themselves salty, so experience has arisen out of a particular configuration of things (neurons) none of which by themselves had experience. In spite of the initial analogical plausibility of this argument, it hinges on a "category mistake." All the other emergent properties (saltiness, etc.) are properties of things *as they appear* to us from without, i.e., to our conscious sensory perception. *But conscious experience itself is not a property of things as they appear to us from without; it is what we are in and for ourselves.* The suggestion that an analogy exists between the other examples of emergent properties and the alleged emergence of sentience out of insentient things confuses two entirely different matters under a single category.⁸³ All the other examples involve the emergence of one more characteristic of things as they appear to others; *only* in the case of experience is the alleged new property a feature of what the thing is for itself. Surely the question of whether an individual is something for itself is categorically different from the question of what it is for others. Once this is seen, that materialism has the same problem of unintelligibility as does dualism is evident. It equally involves the claim that a thing that is something for itself emerged out of things that are mere objects for others. The fact that the thing in question is called a

distinct mind by dualists and a brain by materialists is a secondary matter; an absolutely unique type of causal relation is still being posited. Things that are nothing for themselves are said to causally produce a thing (a brain) that is metaphysically unique in being not only an object for others, but a subject for itself.

Most materialistic identists also share with dualists the implausible idea that experiencing things constitute a Great Exception. For example, after suggesting that mind is strictly identical with matter, so that there is "only one reality which is represented in two different conceptual systems," i.e., physics and phenomenological psychology, Herbert Feigl makes clear that he does not intend panpsychism: "nothing in the least like a psyche is ascribed to lifeless matter." Rather, whereas the language of physics applies everywhere, the language of psychology is applicable "only to an extremely small part of the world."⁴⁴

The materialist identist also shares the dualist's problem of where to draw the line between things that can be described in physical terms alone, and those to which psychological terms are appropriate. Drawing a line is equally arbitrary whether or not the things with experience are thought to be distinct actualities.

Some identists seek to overcome these problems by denying that psychological language need be used at all, even for our own experience. All language about pains, colors, intentions, emotions and the like would be eliminated. One would talk entirely in physicalistic terms, for example, by talking in terms of certain neuron firings instead of anger, in terms of other neuron firings instead of pain, etc.⁴⁵ This so-called eliminative materialism shows the desperate straights to which the mechanistic view of nature can lead.

Besides the problems that identism shares with dualism, it has several of its own. One is that, while claiming to be empirical, it denies the full reality of the directly known in the name of the inferred. That is, the one thing we know from inside, so that we know what it is *in itself*, is our own conscious experience. As almost all modern philosophers have insisted, we do not directly know what objects of sensory perception are in themselves, but only how they appear to us. The idea that these objects are *mere* objects, mere matter, can only be the result of metaphysical speculation. And yet materialists, on the basis of the speculative inference that the human body is composed of "matter" which is *in itself devoid of experience*, deny that our directly known conscious experience can be a distinct actual thing on the grounds that that hypothesis requires interaction between experiencing and nonexperiencing things.

A second problem unique to materialism is that, in denying the distinction between the mind and the brain, it gives up the hypothesis that had provided the materialistic or mechanistic view of nature its *prima facie* plausibility in the first place. That is, the mechanistic view entailed a distinction

between so-called *primary* qualities, which were really attributes of physical things, and *secondary* and *tertiary* qualities, which were only in the mind, although they might falsely appear to be in nature. Hence, nature consisted solely of quantitative factors, locomotion, and mechanistic causation; all color and smells, all pain and pleasure, all good and evil, and all purposes and self-motion, resided solely in the mind. By having two types of actual things, dualism could deny that these nonphysical qualities exist in nature without making the counterintuitive assertion that they are wholly unreal. But in materialistic identism the modern worldview has lost its mind and must thereby deny that most of the qualities that are immediately experienced are real. They are illusions created by an illusion.

The materialistic denial that experience plays a causal role in the world also creates a problem of understanding how experience, and then conscious experience, ever emerged. Within an evolutionary framework, especially the neo-Darwinian one presupposed by materialists, the emergence and stabilization of a new property only can be explained in terms of its enhancement of the chances for survival. But the point of materialistic identism is to deny that experience exerts causal power on the physical world; experience is a concomitant of some physical processes that would by hypothesis interact with the rest of the world in the same way if they were devoid of experience.⁸⁶ Hence, by this view, experience cannot enhance an organism's chances of survival. The materialist therefore has no evolutionary explanation as to why any of the things in the world should have experience of any sort, let alone conscious and self-conscious experience.

Adding further to the difficulties of materialistic identism is the fact that, in rejecting the dualism between mind and body, it necessitates a dualism between theory and practice. Whereas dualism said that the mind was the one thing with the power of self-motion, a large part of the motivation for the materialistic denial of nonmaterial mind is to deny that there is any part of the world that is not subject to the deterministic, reductionistic method of modern science. But we all, including the avowed materialists among us, live in practice as if we and other people were partly free from total determination from beyond ourselves. The resulting dualism between theory and practice is at least as vicious as that between mind and matter.

In summary, both dualism and materialism are unintelligible. But if the modern premise that the elementary units of nature are insentient is accepted, dualism and materialism are the only options. This fact suggests that the premise that lies behind the modern disenchantment of the world is false.

Accordingly, a strong philosophical argument converges with recent developments in the philosophy, sociology, and history of science, and in science itself, to undermine the basis for the modern disenchantment of the world.

III. POSTMODERN ORGANICISM AND THE UNITY OF SCIENCE

The postmodern organicism represented in this series has been inspired primarily by the scientist-turned-philosopher Alfred North Whitehead. Various features of this viewpoint are explained or employed in the essays herein (those by Birch, Cobb, Ferré, and me, and to some extent Bohm, Sheldrake, and Swimme),⁸⁷ and in future volumes. However, it is necessary here, without trying to summarize the whole position, to indicate briefly how it relates to the question of the unity of science, with a focus on the question of causation. I will do this in terms of a contrast of "paradigms," understood as the basic worldviews presupposed by communities of scientists.

This postmodern organicism can be considered a synthesis of the Aristotelian, Galilean (both forms), and Hermetic paradigms. Aristotelian organicism had a unified science by attributing purposive or final causation to everything, most notoriously saying that a falling stone seeks a state of rest. The Galilean paradigm, in its first form, distinguished absolutely between two types of primary beings: (1) those that exercised purposive or final causation; and (2) those that did not and could consequently be understood completely in terms of receiving and transmitting efficient causation. At first, limiting the beings in the first category to human minds was customary, but that limitation is neither necessary to the dualistic paradigm nor very credible. Many Galilean dualists have accordingly, as mentioned in the previous section, extended final causation further down the animal kingdom: those who are termed *vitalists* see it as arising with the first form of life. Wherever the line was drawn, the drawing of a line between two ontologically different types of primary beings split science into two parts. One science spoke only of efficient causes; the other science (psychology) spoke in terms of final causes or purposes. The second form of the Galilean paradigm tried to restore unity to science by abolishing an internalistic psychology of final causes. Psychology, under the name of *behaviorism*, was transformed into an attempt to describe and explain human and other animal behavior solely in terms of efficient causes and other externalistic terms. *Eliminative materialism*, mentioned earlier, is the extreme version of this way to achieve unity.

Postmodern organicism holds that all primary individuals are organisms who exercise at least some iota of purposive causation. But it does not hold that all visible objects, such as stones and planets, are primary individuals or even analogous to primary individuals. Rather, it distinguishes between two ways in which primary organisms can be organized: (1) as a compound individual,⁸⁸ in which an all-inclusive subject emerges; and (2) as a nonindividuated object, in which no unifying subjectivity is found. Animals belong to the first class; stones to the second. In other words, there is no ontological dualism, but there is an organizational duality which takes account of the important and obvious distinction that the dualists rightly re-

fused to relinquish. Hence, there are (1) things whose behavior can only be understood in terms of both efficient causes and their own purposive response to these causes, and (2) things whose behavior can be understood, for most purposes, without any reference to purposive or final causation. In this sense, there is a duality within science.

However, the qualification *for most purposes* is important. Whereas the Galilean paradigm maintained that a nonteleological explanation of material things could be adequate for all purposes, including a complete understanding, at least in principle, the postmodern paradigm contends that any explanation devoid of purposive causation will necessarily abstract from concrete facts. *Fully* to understand even the interaction between two billiard balls requires reference to purposive reactions—not indeed of the balls as aggregates, but of their constituents. Because the study of nonindividual objects as well as that of primary individuals and compound individuals requires, at least ultimately, reference to final as well as efficient causes, there is a unity of science.

The relation between final and efficient causation in Whiteheadian postmodern organicism is different from their relation in any previous form of thought, even from other forms of panexperientialism (often called panpsychism), although it was anticipated in Buddhist thought. Other forms of thought that have attributed experience to all individuals, such as that of Gottfried Leibniz and Teilhard de Chardin, have assumed the ultimate constituents of the world to be enduring individuals. An individual was physical from without to others, but was conscious or mental from within, for itself. From without, it interacted with other enduring individuals in terms of efficient causation; from within, it lived in terms of purposes or final causation. Given this picture, relating efficient and final causation to each other was difficult. The common view has been that they do not relate, but simply run along parallel to each other. However, as discussed above in relation to materialistic identism, this parallelism raises serious problems. If experience or mentality makes no difference to an individual's interactions with its environment, how can we explain why the higher forms of experience have evolved? And without appeal to a supernatural coordinator, how can we explain the parallelism between inner and outer; e.g., why should my brain's signal to my hand to lift a glass follow right after my mental decision to have a drink, if my decision in no way *causes* the appropriate neurons in the brain to fire?

However, if the ultimate individuals of the world are momentary events, rather than enduring individuals, a positive relation can exist between efficient and final causation. Efficient causation still applies to the exterior of an individual and final causation to the interior. But because an enduring individual, such as a proton, neuron, or human psyche, is a temporal *society* of momentary events, exterior and interior oscillate and feed into each other rather than running parallel. Each momentary event in an enduring individual originates through the inrush of efficient causa-

tion from the past world, i.e., from previous events, including the previous events that were members of the same enduring individual. The momentary subject then makes a self-determining response to these causal influences; this is the moment of final causation, as the event aims at achieving a synthesis for itself and for influencing the future. This final causation is in no way unrelated to efficient causation; it is a purposive response to the efficient causes on the event. When this moment of subjective final causation is over, the event becomes an object which exerts efficient causation on future events. Exactly what efficient causation it exerts is a function both of the efficient causes upon it *and* of its own final causation. Hence, the efficient causes of the world do not run along as if there were no mentality with its final causation. An event does not necessarily simply transmit to others what it received; it may do this, but it also may deflect and transform the energy it receives to some degree or another, before passing it on. (*We* do this to the greatest degree when we return good for evil.)

To say that the categories of both final and efficient causation must be employed for the study of all actual beings does *not* imply that the two categories will be *equally* relevant for all beings. Indeed, as already indicated, an appeal to final causation is irrelevant for almost all purposes when studying nonindividuated objects, such as rocks, stars, and computers.⁸⁹ Even with regard to individuals, the importance of final or purposive causation will vary enormously. In primary individuals, such as photons and electrons (or quarks, if such there be), final causation is minimal. For the most part, the behavior of these individuals is understandable in terms of efficient causes alone. They mainly just conform to what they have received and pass it on to the future in a predictable way. But not completely: behind the epistemic “indeterminacy” of quantum physics lies a germ of ontic self-determinacy. The importance of self-determination or final causation increases in compound individuals, especially in those normally called *living*. It becomes increasingly important as the study focuses upon more complex, highly evolved animals; all the evidence suggests that final causation is the most important, on our planet, in determining the experience and behavior of human beings. The importance of efficient causes, i.e., of influence from the past, does not diminish as one moves toward the higher individuals; indeed, in a sense higher beings are influenced by *more* past events than are lower ones. But the totality of efficient causes from the past becomes less and less explanatory of experience and behavior, and the individual’s own present self-determination in terms of desired ends becomes more explanatory.

From this perspective we can understand why a mechanistic, reductionistic approach has been so spectacularly successful in certain areas and so unsuccessful in others. The modern Galilean paradigm was based on the study of nonindividuated objects, such as stellar masses and steel balls, which exercise *no final causation* either in determining their own behavior or that of their elementary parts. Absolute predictability and reduction is

possible in principle. This paradigm was next applied to very low-grade individuals, in which the final causation is *negligible* for most purposes except to the most refined observation. With this refinement, the absolute predictability of behavior broke down with the most elementary individuals; the ideal of predictability could be salvaged only by making it statistical and applying it to large numbers of individuals. With low-grade forms of life, and in particular with their inherited characteristics and certain abstract features of their behavior, Galilean science has still been very successful, but not completely. Certain features of even low-grade life seemed intractable to this approach, just those features which led to the rise of vitalism. This paradigm has been even less successful with rats than with bacteria. At this level, various problems are virtually ignored, because little chance of success is apparent, and scientists are interested in applying their method where the chances for success are most promising. Finally, the method has been less successful yet with humans than with rats. The record of success at this level is so miserable that many scientists and philosophers of science refuse to think of the so-called social or human sciences, such as psychology, sociology, economics, and political science, as sciences at all. This pattern of success and failure of the Galilean paradigm fits exactly what the post-modern paradigm predicts. As one leaves nonindividuated objects for individuals, and as one deals with increasingly higher individuals, final causation becomes increasingly important, and regularity and hence predictability become increasingly less possible. Hence, nothing but confusion and unrealistic expectations can result from continuing to regard physics as the paradigmatic science.⁹⁰

This framework can explain why it has been even less possible to discover regularities and attain repeatability in parapsychology than in certain aspects of ordinary psychology. Although every event (by hypothesis) exerts influence directly upon remote as well as spatially and temporally contiguous events, its influence on contiguous events is much more powerful. Hence, the effects of the kind of influence that is exerted upon remote events indirectly *via* a chain of contiguous events will be much more regular and hence predictable than the effects of the kind of influence that is exerted on remote events directly, without the intervening chain. Accordingly, because sensory perception arises from a chain of contiguous events (photons and neuron firings in vision) connecting the remote object with the psyche, the sensory perception of external objects is much more regular and reliable, hence predictable, than any extrasensory perception of them. Likewise, because effects produced in the external world by the psyche by means of the body are mediated by a chain of contiguous causes, whose reliability, like that of the sensory system, has been perfected over billions of years of evolution, such effects are much more reliable than any psychokinetic effects produced by the direct influence of the psyche upon outer objects without the body's mediation. Additionally, although *unconscious* extrasensory perception and *subtle* and *diffused* psychokinetic action occur continually (by hypo-

thesis), the power to produce *conscious* extrasensory perception and *conspicuous* psychokinetic effects *on specific objects* is—at least for the majority of human beings most of the time—evidently lodged in an unconscious level of experience, which by definition is not under conscious control. Given these assumptions, the fact that parapsychology has attained little repeatability with conspicuous psychokinetic effects and conscious extrasensory perception is what should be expected.⁹¹ In this way, the element of truth in the Hermetic paradigm is coordinated with the elements of truth from the Aristotelian and Galilean paradigms.

What then is science—what constitutes its unity? The anarchistic or relativistic view that “anything goes,” that there is no such thing as a scientific method, is surely too strong. But it serves a useful function, as indeed it was intended,⁹² to shake us free from parochial limitations on what counts as science. A description of science for a postmodern world must be much looser than the modern descriptions (which were really *prescriptions*).

Any activity properly called *science* and any conclusions properly called *scientific* must, first, be based on an overriding concern to discover truth.⁹³ Other concerns will of course play a role, but the concern for truth must be overriding, or the activity and its results would better called by another name, such as *ideology*, or *propaganda*, or *politics*.⁹⁴ Second, science involves demonstration. More particularly, it involves testing hypotheses through data or experiences that are in some sense repeatable and hence open to confirmation or refutation by peers. In sum, science involves the attempt to establish truth through demonstrations open to experiential replication. What is left out of this account of science are limitations (1) to any particular domain, (2) any particular type of repeatability and demonstration, or (3) any particular contingent beliefs.

(1) Science is not restricted to the domain of things assumed to be wholly physical, operating in terms of efficient causes alone, or even to the physical aspects of things, understood as the aspects knowable to sensory perception or instruments designed to magnify the senses.⁹⁵ As the impossibility of behaviorism in human and even animal psychology has shown, science must refer to experience and purposes to comprehend (and even to predict) animal behavior. Although we cannot *see* the purposes motivating our fellow humans or other animals, assuming that such purposes play a causal role is not unscientific, if this hypothesis can be publically demonstrated to account for the observable behavior better than the opposite hypothesis. And, once it is explicitly recognized that science *can* deal with subjectivity, there is no reason in principle for it to limit itself to the objective or physical side of other things, if there is good reason to suspect that an experiencing side exercising final causation exists. At the very least, even if we cannot imagine very concretely what the experience of a bacterium or a DNA molecule would be like, we need not try to account for its observable behavior on the metaphysical assumption that it has no experience and hence no purposes.