Comment

Between Jerusalem and the Laboratory: A Theologian Looks at Science

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'It is absolutely safe to say that, if you meet somebody who claims not to believe in evolution, that person is ignorant, stupid, or insane.'

Richard Dawkins, Oxford zoologist, in **The Blind Watchmaker.**

We live in but one world. Science and theology are united in that they both seek to understand that one world and to explain it. They do so according to their own respective method (or methods) of knowing. In that sense, both science and theology are a hermeneutic, or a way of interpreting, the world around us. Because we have but one world to interpret, and not a scientific universe alongside a theological universe, only one full and correct answer exists for any well-formed question relating to it. A well-formed question is one that seeks, and helps to make possible, an answer that is both full (that is, comprehensive) and true (that is, accurate). The answer to a well-conceived question, whatever that answer might be, is correct because it comports fully with reality. Answers that do not comport fully with reality are at least partly inadequate, if not flatly wrong. An ill-formed question is one that makes comprehensive and accurate answers not only more difficult to find than they need to be, but might actually make them impossible, as do modern scientific questions, which seek only the material causes to physical phenomena. But as Aristotle observed long ago, the one who would succeed in any intellectual pursuit must ask the right preliminary questions. Questions arising from metaphysical materialism are the right preliminary questions only if matter is all that is, or only if matter is all that matters, two propositions that cannot be demonstrated, indeed that are patently false.

The instances where scientists and theologians agree in their description of that one reality which we all inhabit are many and varied. But they are not my concern. Rather, I intend to focus attention on those places (they too are numerous) where scientists and theologians diverge. I do so in order to offer some guidance on adjudicating between the respective truth claims of science and theology, and in order to reduce the scope of their future disagreement, as well as its attendant animosity. In the process, I intend to direct my criticisms primarily toward the scientists rather than the theologians. I do so precisely because I am not a scientist. That is, if scientists are to be undeceived about their own shortcomings or blindspots, it probably will be because someone who did not share those blindspots was able to point them out. That is my intention: I want to suggest to the scientists that, at least to some outsiders, they sometimes appear narrowly informed, unteachable, and as dogmatic as any ecclesiastical or political inquistion could ever hope to be. I leave it to others to identify for the theologians just what the theologians cannot see and where they fail. Because I do not wish to hold the reader in suspense, much less to be vague or disingenuous, I tell you now that I think much of the adjustment and retrenchment in the sometimes heated dialogue between scientists and theologians needs to be done by the scientists, and that much of the error and unteachability in this dialogue seems to circle around the laboratory and not the seminary. The burden of this essay, therefore, is to explain why I think as I do. I offer but four observations, observations that are, at the same time, both caveats and pleas.

SCIENCE CHANGES OVER TIME

First, the history of both science and theology as intellectual disciplines tends to make me significantly more sceptical about the allegedly secure answers offered by the

scientists than I am about those offered by the theologians. That is, science seems a far more fickle pursuit than theology, especially when viewed over time. While Christian orthodoxy seems to have remained stable over two millennia, and while the constant refinement of Christian tenets in the crucible of hard reality seems not to have required any fundamental reorientation in orthodoxy,[1] the record of science is far different. The constant testing of fundamental scientific beliefs has yielded a long series of significant reorientations, some so far reaching as to topple many, sometimes most, of the supporting pillars of any and every previous (and ardently held) scientific world view. The post-Einsteinian world view is beginning to succeed the Einsteinian, which succeeded the Newtonian, which succeeded the Copernican, which succeeded the Ptolemaic, which succeeded an earlier paradigm. What shall succeed the post-Einsteinian (and what shall succeed **that)** we can only guess. If the history of science is a guide to its future, we can be confident something shall, and that whatever it is, it shall depart quite noticeably from its antecedents both near and far. As Austin Farrer once wryly observed, cosmological theories have a short life nowadays.

But not so the Apostles' Creed, which, though it has grown over time, has never required anything resembling a fundamental overhaul, much less several. Liberal theologians of every age (aided by the not inconsiderable efforts of non-Christian thinkers of all sorts) have tried to argue differently and have tried to put orthodoxy under siege. But their dissenting and often idiosyncratic schools of thought themselves have proved transitory and have passed into deserved obscurity. But not the creed. In other words, theological orthodoxy, unlike its several scientific counterparts, has undergone centuries of analysis and assault and survived largely and widely intact. Christian orthodoxy has successfully sustained meticulous scrutiny by both its friends and its enemies and yet has shown itself, and continues to show itself, sufficient to many of the most brilliant minds in history, even over a period of centuries, a claim no scientific explanation of reality can yet make. The scientists in every age, I imagine, suppose they can escape, indeed suppose they have escaped, the fate of their predecessors. They fancy they shall avoid being greatly transcended, though none has yet managed the trick. The face of scientific orthodoxy seems to have a nose of wax.

The transitoriness of scientific speculation and the uniformity and staying power of theological orthodoxy often get hidden behind both the wide diversity of theological beliefs prevalent at any one moment in time, on the one hand, and the absence of many public indications of division within the scientific community, on the other. Widespread theological disagreement seems obvious to the man on the street, who sees the Presbyterian church, the Baptist church, and the Roman Catholic church all standing tall and serene on their respective street corners, their spires rising toward the heavens. What the man on the street does not see is the underlying unity of the Presbyterians, the Baptists, and the Catholics (to name but a few). He does not readily recognise their common belief in — and devotion to — the same God, the same Christ, the same creed, the same salvation. Nor does the man on the street see the various schools of thought in science, which normally do not erect edifices of difference on tree-shaded side streets in every city and village in the free world. He does not see hundreds, indeed thousands, of buildings (or television programmes, for that matter) dedicated to Newtonian or Ptolemaic theories, standing next to the edifices of post-Einsteinianism. Unlike their ecclesiastical counterparts, those Newtonian and Ptolemaic buildings were rarely ever built, and are not now being built, because the scientific world views they represent have been so fully overthrown that they are consigned almost entirely to the dustbin of history. This is not to say that no valuable or enduring elements from within these systems have survived the collapse of the system from which they emerged; it does mean that those systems have been greatly and widely transcended.

Here is my point: while a cross-section of views at any one moment yields more agreement among the scientists of that age than among the theologians, a cross-section taken over time yields the opposite result, and that result, I argue, is more significant because it reveals both the fundamental staying power of the theological interpretation of the world and the (to date) transitory nature of scientific speculation. Science does not speak with one voice, especially over time. That fact notwithstanding, science still seems to me far less likely to take any cues[2] from theology about in which direction to proceed than theology is to take advice from science, which might help explain the transitoriness of the one and the stability of the other. So also might the fact that, unlike nature, God wills to be understood and actively reveals Himself to us.

We apparently are not near the end of scientific intellection, though we are closer now than when Aristotle or Galileo walked among us. We do not know where the next grand turning in the road of scientific learning will lead us, or when it will come, any more than did Ptolemy, Newton, or Einstein. We ought, as a result, to be far more hesitant than we have been to identify scientific results as final. If you contend that scientists do not treat scientific results as final, I simply point to the theory of evolution, which gets treated almost universally not as theory but as established and unassailable fact requiring, at most, not proof, only further nuance. The epigraph by Richard Dawkins, which heads this essay, is a telling case in point, and can be multiplied **many thousands of times,** both in print and in the classroom. It seems to me, Dawkins' arrogance aside, that we ought to be far more wary of Darwin and his hide-bound modern disciples than we now are, because even though those followers of Darwin now admit that Darwin was not entirely right, they too often refuse to admit that Darwin's religious critics are not entirely wrong. Or, to make the point from a different science, one of the positive effects of quantum theory on the dialogue

between theology and science seems to be the increasing awareness we gain from it that virtually no physical or geometrical picture of scientific phenomena is wholly accurate, even though such notions or paradigms were (and still are) widely and enthusiastically set forth, whether as models or as heuristic devices. We need to be more measured in the confidence we place in the scientist and in our estimate of what exactly the scientist has actually accomplished.

SCIENTISTS ARE ALSO DOGMATIC

Second, because scientists are human begins, and because human beings tend to resist the overthrow of their most cherished beliefs, scientific theories, once accepted, are often exceedingly difficult to supersede. The shameful treatment of Pierre Duhem at the hands of his institutional superiors is a well known case in point. All too often, the new, even when it carries great weight of evidence, gets routinely derided as outlandish. That scientists are intellectually conservative, of course, is good. Their conservatism helps protect them from the multiple embarrassments of intellectual trendiness. But that scientists are unduly entrenched, when they are, is lamentable. That entrenchment reveals that scientists sometimes are, like the rest of us, resolutely unteachable.

The Dawkins epigraph above is but one example of the entrenchment, perhaps even intellectual bigotry, about which I speak. Scientists who think in that fashion seem to me to be what one dictionary defined as proof-proof: the state of mind of one upon whom contrary evidence and argument have no persuasive effect, regardless of their strength. I am not alone in this observation, of course. Many writers, Kuhn and Laudan among them, have shown how dogmatism — yes, dogmatism — characterises the periods of what we might call **normal** science. Whether we want to admit it or not, there is a remarkably comprehensive scientific orthodoxy to which scientists must subscribe if they want to get a job, get a promotion, get a research grant, get tenured, or get published. If they resist, they get forgotten.

Given how changeable previous scientific world views have been, one wonders how chimerical they would have proven without this dogmatism. I am not here debating the relative merits or weaknesses of dogmatism; I simply say that scientists are by no means free from it and should not be treated as if they were, or permitted to speak and act as if dogmatism were a characteristic only, or even primarily, of theologians.

SCIENCE IS NEITHER FULLY EMPIRICAL NOR PHILOSOPHY-FREE

Third, scientists often fail to admit, sometimes even to recognise, that so many of the issues and findings of science are neither purely scientific nor genuinely empirical. Because all empirical endeavours build upon, and proceed according to, various presuppositions, and because those presuppositions and procedures are inescapably philosophical, no scientist and no scientific procedure is truly philosophy-free. Empiricism and the empiricalist procedures that arise from it are philosophy-laden world views and techniques, and not necessarily the best. If ideas have consequences, and if (as some philosophers strongly argue) empiricism and empiricalism are highly suspect, perhaps even greatly flawed, then scientists are likely to be misled if they apply these notions uncritically to their work. To put a point on it, if, as some scientists insist, real science is truly empirical and reduces only to empirical methods and to the conclusions reached by using them, then there is no real science, because the theory-independent observation, analysis, and conclusions needed to establish such empirical premises are simply not possible. Because none of us are presupposition-free, and because (despite much contrary insistence) scientific theories often deal with the unobserved and the unobservable, the laboratory is no philosophy- or theology-free zone. Scientific methods and conclusions cannot be purely empirical because the unavoidable philosophical and theological underpinnings upon which those scientific methods rely are not the result of those allegedly empirical methods.

Put another way, the claim to objectivity and empiricality falls down on both sides — on the side of the scientist and on the side of science. When eating their curry, many people like to build for it a nest of rice. To employ a more American image, people like to mould a bowl in the mashed potatoes in order to hold their gravy. Science, it seems to me, has its nest, its bowl. Science always has its philosophical and theological underpinnings; physics always has its metaphysics — always.[3] To declare science a philosophy-free zone is to have a philosophy; to declare science a procedurally agnostic or atheistic endeavour is to have a theology; to claim that science ought to be value-free is to make a value statement. The question is never whether or not the scientist in a laboratory has a philosophy, a theology, or an ethic when doing scientific work; the question is whether or not the philosophy, the theology, and the ethic the scientist has are any good and are worth having. This problem they cannot escape.

Even in the pursuit of something as fundamental as self-definition, science alone is utterly insufficient. To the question *What is the proper definition of science?* one can give only a philosophical (and, by extension, theological) answer because the question itself presupposes and requires a vantage point from outside science. Because we cannot tell who are the scientists and who are not until we know what science itself is, one cannot answer this question, as scientists too often do, by resorting to the tautology that science is that which is done by the scientist. The question *What is science?* is a question about science, not a question of science. Scientists want, indeed claim, to be empirical. But please note: empirical is a philosophical category.

Without the aid of the humanities, science cannot even identify itself, much less justify, or even invent, its procedures.

To make the point in a different direction, science is not theology-free, and that is so precisely because science intentionally operates according to a procedural agnosticism, if not procedural atheism. That is, science operates as if God cannot be known or else as if He were altogether irrelevant, if not entirely absent. By its means and its conclusions, science implicitly, perhaps even explicitly, denies that Christ is Lord of the universe, an inescapably theological denial. What I, as a theologian, want to tell my scientific colleagues is that, as Lord of the universe and all that is within it, Christ is not something **in addition** to science, He is Someone in relation to it. To operate as if He were utterly irrelevant to the laboratory is to answer, probably without careful analysis and theological acumen, the question raised long ago in the Gospels: What think ye of Christ? Because Christ is foundational to the universe, He is foundational to science. As Thomas Torrance once explained to me,

> *'. . . the countries of the Far East and of the Southern Hemisphere want our science and technology, but they have no doctrine of creation. They do not realize that science and technology rest upon, indeed arise from, Christian foundations. This is true both historically and epistemologically. We must show them that it is the Creator God himself who stands behind everything, and that he provides the rational ground upon which the various sciences rest, as well as the world those sciences unlock and help to tame. Theology and technology come as a pair. We must be quite firm about both this and their function in serving and respecting the integrity of nature.'*[4]

Like it or not, the systematic and procedural denial, not to say the intended destruction, of metaphysics and of theology, is the death of scientific truth, if for no other reason than that it posits a dual or dichotomised universe, which we noted at the outset was untrue. Answers to questions predicated upon that same bifurcated basis, while they are perhaps true as far as they go, do not go all the way, and are not the whole truth.

Perhaps an illustration will serve. No physicist today can reckon with miracles and interventions from outside the material order, or with interventions that break that order open. No theory they devise, no answer they propose, permits such ideas or recognises such data, even though such data and ideas might be absolutely and comprehensively true. That analytical inability reveals the limitations, indeed the wilful blindness, of modern physics. Modern physics does not reveal the limitations of God and His actions, much less God's non-existence or irrelevance, assumptions implicit in scientific method as now understood and practiced. God, if we need to be reminded, works in perfect freedom, and not according to the Kant-Laplace theory of determinedness, or to any of its current or future descendants.

Let me put it more graphically: any intellectual endeavour in which theology is segregated from the other disciplines and relegated to an intellectual ghetto is an instance of Jim Crow come again to the college campus because it explicitly asserts that the best intellectual paradigm is not well-informed academic integration but some framework of separate but equal, which, as we learned in the old South, meant separate but unequal, not because of actual inferiority, but because of bigotry. By acting as if God Himself were irrelevant to the universe He has made and to our understanding of it, scientists, in effect, practise disciplinism, a widespread form of intellectual bigotry whereby the research and discoveries of other scholars are systematically disregarded simply because those scholars are members of another discipline. Theology, the Queen of the Sciences, has been banished to the back of the bus by her own bigoted descendants. The fool has said in his heart that there is no God, and the scientist permits himself to operate as if the fool were right.

Science is not an autonomous set of empirical disciplines. Nothing about science properly, or actually, prevents philosophical or theological concepts from entering into it. Science, like all intellectual disciplines, ought not to conduct its business in an imaginary, air-tight compartment, isolated from all other strivings of the human mind after knowledge. Because too many scientists have cut themselves off from those other strivings, they condemn themselves to discovering all on their own many things already widely known by others. For example, even though such ideas appeared new and revolutionary to some of the unphilosophical practitioners of science, most of Mach's notions were already standard fare in the writings of a number of earlier philosophers. The high price some scientists pay for their intellectual isolationism and prejudice is that they must repeatedly re-invent the intellectual wheel.

But there is more to theology in science than procedural agnosticism and atheism. Our alleged ape ancestors are treated with immense respect, even toadying homage, as the secular Adam and Eve. No attacks upon their status, much less their existence, are tolerated. Read Dawkins' epigraph again. Not to do obeisance to the fossil remains of ancient animals ranks as scientific sacrilege, as scientific heresy. Religion, albeit pagan, has come to the laboratory, and the allegedly secular scientist has become its new high priest.

Furthermore, many of those very scientists who insist on divorcing religion from science seem sometimes especially eager to use their science as a basis for theological (or at least extra-scientific) pronouncements. The literature of science is replete with anti-theistic language and conclusions: The universe was not designed; the universe has no purpose; human beings result from random and mindless natural processes, or so we are repeatedly told.

Put another way, to the adoration of God and of virtue, some moderns have added the adoration of science (or at

least what goes by that name). But you cannot deify the scientific method without at the same time devaluing or debasing both theology (the human understanding and application of revelation) and philosophy (the human understanding and application of reason). Many scientists, therefore, without meaning to do so, undermine our only sources of morality and freedom: God and reason. They do so by believing, writing and teaching that only those things that are testable under controlled laboratory conditions qualify as hard knowledge; all else is merely opinion. But even a moment's reflection reveals that if every question of morality, of politics, of philosophy, and of theology is a matter of mere untestable opinion, they can be settled only by force, not by reason. In that way (and in others) scientists sometime lead us to tyranny. Fascism and pseudo-liberalism are the not-too-distant offspring of modern man's widespread belief that science alone is trustworthy and that whatever lies beyond its pale is little more and little else than irrational prejudice, unsubstantiatable conjecture, and transitory emotion incapable of reasoned support This vision of life most modern persons learned in the science classroom. Too often scientists teach and write as if the only real options available to us are science or mysticism, empiricism or bias, fact or feeling.

Simply because no test tube yields a should or an ought, should and ought are not thereby banished or made suspect; science is. Moral questions, questions about right and wrong or good and bad cannot be answered (or even raised) by the scientific methods now prevalent in either the natural or the social sciences. That does not mean, however, that they cannot be answered, have not been answered, or have no answers. It means only that with regard to the diagnostic and fundamental questions of life, science is impotent, though dangerous. The one who has not learned to ask, much less to answer, the fundamental questions of life, is indeed no man at all, but still a child, still benighted. To answer such questions, even to raise them, science is powerless. Consequently, while technical schools and scientific laboratories are important and laudable things, to advertise them as colleges or universities, or to say that those who have passed through them are truly educated men and women, is a lie.

To put the point differently, God is the Lord of the entire world of knowledge, including science and technology. Science and technology that are atheistic in both conception and conduct, that are consciously cut loose from all formal considerations about God and morality, are not your dream come true; they are your worst nightmare. To utilise science and technology wisely or else to become their victims, that is the choice before us. But the wisdom that saves us from our science and technology is no commodity derived from either of them or from both. To paraphrase something C. S. Lewis said in another context, science ceases to be a demon only when it ceases to be a god. It can never cease until it figures out a way to let God be God, even in the laboratory.

SCIENTIFIC CONSTRUCTS ARE JUST THAT

Fourth, we ought to be more sceptical than we are both of scientific taxonomy and of the translation of the world outside our heads into numbers. That is, scientists do not simply deal with the world as they find it, they manipulate that world into words of their own choosing, into categories of their own making, into experiments of their own devising, and into numbers. Forcing a creature into one or more categories based upon our intellectual manipulations and speculations regarding its body pattern and parts, or upon our understanding of its physical makeup and upon our conjectures regarding its biological descent, is at least partly arbitrary, partly subjective. Such categories, though helpful and serviceable, are man-made. They unintentionally, and sometimes unwittingly, collapse the distinction between what we discover and what we invent. While the beings that populate such categories most emphatically do exist, the families, orders, classes and phyla into which we have pigeon-holed them do not. Such pigeon-holings are a taxonomist's useful fiction, but **do not exist outside the taxonomist's mind.** That is, while those taxonomical categories are constructs based upon careful observation, they are constructs nevertheless. Of course, I am not saying anything so silly as that there exist no genuine and recognisable differences between a dog and a man, or that dog and man are useless fictions devoid of all external reference or reality. But let us not too quickly or uncritically identify useful as true or as real, categories that in many cases and ways are quite different.

Yet, not only are we required to accept the taxonomist's scheme of classification as both real and true, we are required to accept that the occupants of these various man-made categories are linked by a long series of non-living intermediate creatures (also duly classified and arranged), most of whom are not found to exist anywhere in the fossil record, a radically incomplete record we interpret according to the taxonomical grid provided for us. (The circularity of this procedure seems to go unnoticed and unremarked.) Furthermore, we are also required to believe that all the seemingly discontinuous and taxonomically divisible groups now alive are the descendants of a common ancestor, another phantom of which (or of whom) we have no direct evidence. Please note that ancestor and descendant are part of a taxonomical scheme, and are no less so than is phantom, a word from which my scientist readers would naturally recoil. Their own language, the scientists must remember, is the source of great recoil as well. It rarely seems to occur to some scientists that the rapid evolutionary branchings posited in some theories are but a euphemism for mystical scientific leaps, though they are called by other names, such as Stephen Jay Gould's punctuated equilibrium. Of such leaps I am more than a little sceptical.

Further, not only is taxonomical classification significantly theory-laden, it is context-dependent and subtly subjective. That which we classify as the observed in one

case fails to be so classified in another, even though the thing itself is the same. That is, what is foreground and what is background vary according to the judgment of the observer, an observer who is never context-free or presuppositionless. Thus, scientists are driven back, whether they acknowledge it or not, upon the problem ***What is context and what is content?,*** the answer to which seems to vary from situation to situation depending upon the experimenter and the experiment, even though the aggregation of things involved might be basically the same. Nor are the experiments themselves pristinely empirical and objective, for experiments are highly stylised sets of phenomena, sets from which as many variables as possible have been artificially eliminated by the will and work of the experimenter, however well or however poorly. Of course, I am not saying that the data yielded by such experimentation are therefore untrue, only that they are not pristine. In other words, some scientists need frequently to be reminded of the significantly non-literal and pragmatic nature of their experiments, of their theories, and of the language in which those experiments and theories are conceived and articulated.

Like taxonomy, quantification might itself be a movement away from the world around us, not into it. The translation of things into numbers is, after all, a translation. Neither the words nor the numbers in scientific theories are complete and exact representations of the constitution and behaviour of the universe, much less are they the things themselves which they are intended to describe in words or embody in numbers and formulae. Newton had his numbers; Einstein had his; post-Einsteinians have theirs. Newton's and Einstein's formulae worked (so to speak) and were the basis for considerable correct prediction regarding natural phenomena. Nevertheless, on many important points, Newton and Einstein were also quite wrong, something from which their seemingly correct numbers did not and could not save them. I am not reluctant to think that the same fate awaits many of their scientific descendants.

The classification of physical phenomena as suitable and useable scientific data, the arrangement of that data into groups, the translation of that data into numbers, the manipulation of those numbers via computation, and the transformation of the results of that computation into more data and new conclusions are all guided by philosophical deliberations that are prior to and apart from science's alleged empirical nature and militate against it, all of which ought to cause us to hold science's supposedly assured results with less assurance. Judging from the philosophical and theological naivete of most of the scientists with whom I have ever spoken, those intellectual deliberations might not have been deliberations at all, but merely the unexamined and unacknowledged *a priori* assumptions of a mind utterly untrained in a number of difficult but acutely relevant fields throughout the humanities.

The related assertion that science is measurement is, of course, a philosophical assertion, an assertion that is flatly unprovable. Indeed, as even a moment's reflection will demonstrate, because it is not itself measurable, this assertion is unscientific on its own terms. It is, in fact, autophagic — it eats itself up. Nor can we prove this assertion by invoking the principle of prediction and thereby assert that a scientific hypothesis is true if it can be shown accurately and successfully to predict the action of physical phenomena. The principle of prediction, while clearly important and serviceable, is at least as closely related to pragmatism as to truth. That is, to be able to predict more accurately than all other theories means only that one's theory is pragmatically preferable, not that it is necessarily true. We must remember that false, or partly false, theories have demonstrated impressive powers of prediction in the past. The ancient Babylonian astronomers, for example, by no means shabby forecasters, were working from premises and principles quite off the mark. In other words, while prediction seems to be a necessary attribute of a true scientific theory, it must not be considered a sufficient attribute. Prediction is not proof, no matter how impressive it seems. Too many scientists, nevertheless, still think, write, argue and teach as if accurate prediction demonstrated truth. How many times this has been done, is being done, and shall continue to be done, only God knows. But it seems not at all likely to stop. Or, to make the case in a different direction, if prediction were really the reliable indicator of truth that some think it to be, then physics itself, which has an abysmal record of prediction with regard to some individual entities, would be radically undermined. Furthermore, as clear thinking philosophers and theologians understand, pragmatic preference is an utterly insufficient basis for determining the virtue of an action. If pragmatic preference is an exploded mode of justification in ethics, I am inclined to regard it as such in scientific epistemology. Its epistemological failures are not magically eradicated simply because we now concern ourselves with a laboratory.

CONCLUSION

Those, at any rate, are my observations and caveats. That is how the laboratory looks from the seminary, or at least to this member of it. Having watched many of them in action, I think the scientists would be better served (and would serve better) if they were more humble and more eclectic in pursuit of their worthy enterprise. I should hope that when they do their work the scientists would listen at least as much to those outside the laboratory as they would like those outside the laboratory to listen to them. This, after all, is the golden rule of scholarship.

Finally, though it is clearly beyond both my intention and my competence to dictate to the scientists exactly how their jobs ought to be conducted and in what specific direction they ought to proceed, let me offer but one outsider's opinion, an opinion motivated by sincere goodwill for my laboratory colleagues. I believe that what we need

now is not something akin to an aimless collection of more data, but research (of every sort) directed by principles, illumined by ideas. Those guiding principles and those illuminating ideas must, by their very nature, come to science from outside science, at least until we figure out how science ought to be restructured and redefined in order to avoid its current myopia. Science, to be kept serviceable and humane, must be kept humble and teachable. And it must acknowledge its debts, debts it always has.

To the question *Is science **enough?*** the answer is emphatically ***No.***

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FOOTNOTES

1. Creeds are not imposed by simple ecclesiastical fiat. Instead, like scientific definitions in other branches of knowledge, creeds typically undergo what might roughly be described as a five stage development: observation, reflection, articulation, testing, and confirmation or rejection. In the first stage, Christian thinkers examine carefully the text of Scripture (that is, the content of revelation) and the course of their own and others' experience of living in agreement with Scripture, at least as they understand it. Second, they reflect deeply and carefully upon what they have observed, in order to grasp its true significance. Because they must not be content with an inarticulate devotion to this perceived significance and to their conclusions concerning it, they naturally try to give thoughtful and precise expression. Their newly formulated ideas are then submitted to testing in the twin crucibles of life and thought to see if those ideas can withstand the rough and tumble of genuine human experience and the rigours of systematic intellectual scrutiny. If they cannot, they are rejected, or else modified and tried again. In this informal but effective way, the Church has invested decades, even centuries, in capturing in precise creedal form the tremendous truths revealed in the historical events connected with Jesus of Nazareth. Of course, this is not to say that creeds have nothing to do with the pronouncements of bishops and councils; they often do. But creeds typically find their roots elsewhere, in revelation and in the life and thought of the church. This is especially true of the Apostles' Creed, which though at some points is still controverted, has been tested by long experience and careful, repeated reflection upon that experience in the light of Scripture and reason. Furthermore, because the Apostles' Creed grew out of centuries of biblical exegesis, human experience and reflection, it continues to be both relevant and reliable. It continues to ring true because, like all good theology, it is deeply rooted in divine revelation, on the one hand, and human reason and reality, on the other.
2. What might be the precise nature and content of such cues I cannot now say. How philosophy and theology ought ideally to be introduced into the sciences is a question, the answering of which might require a radically new way of doing science. That I myself am currently unable to supply this new paradigm is neither an embarrassment to me nor a refutation of my claim that it might be needed. I offer only an analogy, drawn from criminology. When a detective attempts to solve a crime, he not only searches for clues, he invents hypotheses. In this search and invention, the detective has this great advantage: he knows he is deciphering not some random occurrence, but tracking the work of a mind. Knowing this, the detective suitably modifies the character of his hypotheses and alters both the nature and focus of his search for clues, as well as his definition of what might or might not be relevant data. Human criminals, for example, unlike mindless and lifeless matter, have discernible motives and sometimes concoct false alibis in order to cover their tracks. In short, they leave clues of a very distinctive sort. The scientist, by the same token, if he were to entertain the God factor in his laboratory and decide to trace the workings of Infinite Mind rather than of mindless matter, might need to alter what he considers the boundaries of acceptable hypothesis, what he admits as relevant data, how he forms and executes his experiments, how he draws and articulates his conclusions, and what he imagines constitutes a convincing proof or refutation.
3. I am not saying that all physicists must or do have the same metaphysic, only that while they are doing their work they cannot avoid having one and applying it.
4. Bauman, M., 1990. **Roundtable: Conversations with European Theologians,** Baker Book House, Grand Rapids, Michigan, p. 115.

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