Cradled Science: *Examining the Cosmos in the Context of Faith*

Christians must come to grips with science and must develop a responsible worldview perspective—both discerning and appreciative—about the achievements of science, as well as the theories advocated by the scientific community.

Few things have changed human history more profoundly than the rise, growth, and products—both conceptual and practical—of the natural sciences. Yet despite science's important role in modern Western history and culture, the near reverence with which its capabilities are sometimes held, contemporary culture does not completely understand science's theories, its capacities, its limitations, or its basic character. But since science has significant worldview implications, the Christian community—and especially Christian educators—must not be casually unreflective about science. Christians must come to grips with science and must develop a responsible worldview perspective—both discerning and appreciative—about the achievements of science, as well as the theories advocated by the scientific community.

BY DEL RATZSCH

Conceptions of Science

The initial question for this task is: What is science? Most broadly, science is an *epistemological* pursuit—a special approach to reality by which we acquire specific types of understanding regarding the cosmos around us. The earliest influential modern conception of science came from Francis Bacon in the early 17th century. Bacon saw many earlier efforts to understand the cosmos as little more than unconstrained speculation. His corrective proposal, which dominated conceptions of science nearly to the present, was in effect to let *nature* dictate the principles, concepts, and theories of science, while at the same time holding subjective human conceptual intrusions at bay. How did one do that?

Inductivism

According to Bacon, science rested ultimately on pure, objective, dispassionately collected observational data. Scientists then applied special logical procedures to those data in order to produce scientific theories. This set of stringent procedures constituted the "scientific method." Since inductive logic formed the backbone of this method, Bacon's views are generally referred to as "inductivism."

Supposedly, if one followed the above recipe, the results would represent the authoritative voice of nature itself, untainted by human subjectivity. Purity, objectivity, and certainty would be guaranteed. The scientific method would thus (1) enable human beings to discover truths otherwise inaccessible to them and (2) protect

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science from subjectivities that would otherwise cripple it.

This view of science achieved dominance, becoming practically the official cultural conception by the early 20th century, and still underlies many popular ideas about science. But however attractive its promises, Baconian inductivism is in fact irreparably defective, disintegrating at nearly every point. Among its many problems are these: (a) There simply is no form of logic by which theories, laws, and the like can be inferred from empirical data; and (b) Empirical procedures cannot confer certainty upon any scientific theory. As the collapse of the Baconian approach became indisputable (by the mid-20th century), alternative conceptions took its place.

If theories cannot be logically generated from data (See [a] above), how do they originate? The answer is: through leaps of human creativity. But since such leaps apparently do not follow any rules of logic, this meant conceding a key role in science to human creativity, which seemed to re-open the door to subjectivity. Evidently, then, one had to choose among the following options: (1) barring scientific theories from science altogether, (2) construing theories in some non-literal (non-*realist*) way, or (3) finding some way to contain the threat of subjectivity. In the end, the third view prevailed. The most popular such approach asserted that a scientific theory could be thought up or *proposed* for any reason (or for no reason), but that theories had to pass stringent empirical tests before being actually *admitted* into science. Thus, the inescapable subjectivity of theory *invention* could not penetrate science proper because nature itself, via objective empirical results, had the final say in the theory's fate (theory *adjudication*).

The structure of such tests, however, had significant implications for the character of science. The only way to test proposed theories or hypotheses was to *deduce* experimental or other observational predictions from the theory or *hypothesis* (hence the term "hypothetico-deductivism"), then see whether or not the predictions matched observed reality, thereby confirming or contradicting the theory. But correct predictions cannot *rigorously* establish theoretical truth because no matter how many tests a theory successfully passes, it is still possible that some new result—tomorrow, next Friday, or in three centuries—will contradict the theory. Tentativity was thus not the product of laudable modesty—it was forced upon science.

In fact, it is, in principle, possible for a false theory to make *infinitely* many correct predictions. (This fact underlies [b] above.) Worse, multiple *competing* theories may *all* be consistent with any collection of empirical data. (This fact is part of what underlies [a] above.) This cluster of disconcerting results is generally referred to as the *underdetermination* of theory by empirical data. By implication, then, science cannot be *just* rigorous reason applied to objective data—that sort of conceptual purity cannot be attained. Human subjectivity can, at least in principle, seep back in.

Falsificationism

Hypothetico-deductivists believed that although theories could not be *proved* true, they could at least be empirically *confirmed*—i.e., shown to be probable—to varying degrees. Not everyone agreed. A number of people (claiming to follow Karl Popper) concluded for technical, logical reasons that theories could not even be confirmed (in the usually understood sense), much less proved. But in their view, science could at least prove specific theories to be *false* by uncovering empirical data contrary to predictions of those theories.

Unfortunately, even this modest claim turned out to be too strong. Theories make no predictions at all in isolation, but only in conjunction with a significant cluster of other claims—boundary conditions, auxiliary hypotheses, instrumentation theories, and the like. Thus, the failure of a prediction can be attributed either to the theory in question *or* to any of these other factors, some of which themselves unavoidably lack absolute certainty. The inescapable implication was that observational or experimental failure confronted science with a human *choice* concerning what to abandon and what to keep—a choice never *quite* empirically closed. Thus, the specter of subjectivity had arisen once again. But for the traditional view of science, worse was yet to come.

Post-Empiricism

Historically, it was almost universally believed that perception was neutral, in the sense that genuinely honest and careful observation was unaffected by beliefs, presupposition, philosophical preferences, or similar factors. This neutrality guaranteed the objectivity and utter trustworthiness of empirical data, which constituted the secure foundation of science. But that perceived neutrality came under attack in the mid-20th century. Thomas Kuhn, for example, argued that perception itself was an active—not a passive—process,

deeply colored by the broader conceptual matrices, or *paradigms*, to which one had prior allegiances.

Thus, this view not only destroyed the allegedly rigid, logical structure of science, but also threatened the pure objectivity of its foundation. Furthermore, paradigms influenced not only perception, but also theory evaluation and acceptance, conceptual resources, normative judgments within science, and a host of other consequential matters. And according to Kuhn, paradigms were partially *defined* by, among other things, metaphysical commitments and values. Thus, non-empirical, human-suffused perspectives had seeped into the no-longer-inviolable scientific method at all levels, from empirical bedrock to theoretical pinnacle.

And this problem had no easy cure. Recall that one consequence of underdetermination was that no amount of (even pure) empirical data could point to just *one* theory among competitors. Thus, if one adopted a realist stance toward theories, claiming that some specific scientific theory was actually *true*, rather than merely a useful model, the selection of that specific theory *had* to involve (at least implicitly) factors beyond just the empirical. Kuhn's own list of operative non-empirical principles was relatively tame—simplicity, fruitfulness, measurability, accuracy, and the like. But some postmodernists went much further, claiming, for instance, that the very heart of science contained political agendas, social biases, dominance hierarchies, gender prejudices, and so on.

Current Views

Most people have found postmodernism's claims to be both seriously overblown and themselves driven by underlying sociopolitical agendas. But what can no longer be denied is that a science with utter objectivity, absolute logical rigidity, and purely empirical foundations is not an attainable ideal. Does that mean science can claim no epistemological authority? That in science just anything goes? Not at all. But determining precisely where various lines fall, or what can or cannot legitimately factor into science is extremely problematic. Although they disagree on numerous specifics, most contemporary mainline commentators argue that despite the unavoidable dependence of science upon resources other than just empirical data and reason, scientific results can still claim significant rational justification and epistemic legitimacy. Rigor, objectivity, and warrant may be less than absolute, even less than many fervently hope, but science *can* still get at theoretical truth. A tempered realism still seems defensible.

Of course, realist claims are plausible only if we have grounds for confidence in the human perceptual and cognitive structures that, inescapably, function within science. Beyond that, the principle of underdetermination of theory by data indicates that science requires a conceptual environment extending beyond the merely empirical. Historically, that indispensable confidence and conceptual richness were drawn from religious principles. As just one example among many, according to the doctrine of creation, the Person who had designed the cosmos, shaping it according to structures of His wisdom, was the same Person whose image we humans bore. Because of that likeness, humans could feel confident that they possessed the requisite capacities (both sensory and cognitive) to at least partially understand the creation. This view was explicitly espoused by various early scientists. Indeed, some current historians argue that without the broader Christian conceptual matrix, modern science might never have arisen.

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Of course, that was then. What of now?

Science and Religion

Ideally, a worldview should be a unified, integrated whole. (There is, however, no guarantee that humans can achieve such integration.) But for much of the 20th century, many people thought that religion and science were (perhaps by definition) simply irrelevant to each other—that any worldview attempting to incorporate both would lack internal cohesion or even face fracture and fragmentation. At worst, religion was seen as fighting a (probably doomed) rearguard action against the seemingly inexorable advance of a sci-

ence destined to conceptually engulf everything it touched. But in a sense, things have come at least partway around the circle again. Science is now recognized as (1) at least partially embedded in a wider conceptual context and (2) unavoidably drawing resources from that wider context. And no one really knows exactly how to construct the boundaries that define what sorts of resources science can legitimately absorb.

"Science" can thus be locked into place within a number of different worldviews, with advocates of each claiming that it confirms their particular view. Marxists, secular humanists, and other *philosophical* naturalists have done exactly that. Still, there are many who insist on some version of *methodological* naturalism—that whatever the ultimate metaphysical reality, genuine science *as science* must

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(either definitionally or practically) be completely detached from everything other than the purely natural. But rigid cases for such prohibitions are increasingly difficult to construct, and even some secular thinkers now admit that there are no compelling reasons why Christian thought cannot contribute to a legitimate conceptual context for science.

Perhaps this direction should not be surprising. If we do live in a deliberately created *cosmos*, we would expect truth to exhibit a unity and interconnectedness. (This should perhaps make us a bit uneasy with both compartmental and complementarist views.) That interconnectedness can, of course, have potentially unsettling consequences. Christian themes that constitute structural elements of science could themselves be affected as the contours of the science within which they are incorporated shift in response to new discoveries. That has, after all, happened before, as when the Church learned—from science—that scriptural passages concerning the immobility of the Earth were no longer to be taken literally. (Some Christians believe that evolutionary theory teaches similar lessons.) On the other hand, a science embedded—cradled—in a Christian worldview might find itself having to flex around doctrinal pillars that can be bent only so far. This is the position defended by many creationists.

Finding a Balance

Finding the right balance—discovering when, where, and how to let theology inform science, and discovering when, where and how to let science inform theology—is no easy thing. Indeed, there is likely no *a priori* way of doing it. One of the reasons conceptions of science (including science's non-empirical components) have repeatedly changed over time is that such conceptions are themselves indirectly affected by the course of science. We have learned things not only about nature, but also about the character and methods of science itself from nature's reactions to our scientific efforts. Since there have been no immutable, *a priori* "rules of science," there may well have been no other way such things *could* have been learned. It may similarly become clear that the only means of discovering the right balance-points in a science-respecting Christian worldview will also be in the actual pursuit of a faithful science. In that process, we may just have to remain teachable, doing the best we can in the light of all the insights we gain—both from the natural world and from revelation.

In any case, the voice that speaks to us through Scripture and through creation is ultimately one voice, and we must strive to discover and share the unity and wholeness of the picture revealed. There must be an interpenetration of our reading of God's creation and our reading of God's Word—something perhaps like the often-described reciprocal interplay within science between theory and data. And we may well get the content of *neither* part of the dialogue right if we ignore the other part. John Calvin once remarked that we need the spectacles of Scripture to rightly construe nature. Perhaps similarly, correctly listening to Scripture may require the hearing aid of nature.

There will doubtless always be tensions between science and religion, with no purely mechanical rules for resolving them. We may have to learn to live with such tensions, unable to reconcile all the claims demanding our assent. Perhaps that should not surprise us. As finite humans, we live with similar tensions in many realms of everyday life, in scientific inquiry, and in our spiritual lives as well—as, for example, when we try to put together mercy and justice, free will and election, power and frailty.

Refusing to function within tensions leads to paralysis. Of course, as we try—and sometimes fail—to balance such tensions, we must use great discernment and care. But that is nothing new in the Christian life, either.

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