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## Scientific Theology

Many think the term scientific theology is an oxymoron. Theology, they say, has to do with God and the supernatural, and science is the study of nature. The two have nothing to do with each other.

The thesis of this book is that science and theology have profound interactions with each other. I have chosen to use the term scientific theology for the synthesis I will describe. Scientific theology gets its name from two important properties. It attempts to fully integrate science into theology, and it views theological theories as analogous to scientific theories.

### Integrating Science

Part of what I mean by scientific theology is a theology that interacts with science. It takes the findings of science into account, and it has something to say to science. Science and theology both approximate truth, and therefore must fit together harmoniously where they overlap. We do not have one truth for science and another for theology. The central tenet of our Judeo-

Christian heritage is stated in Deuteronomy 2:4. "Hear, O Israel: The LORD our God is one LORD."<sup>1</sup> We should not have one god for sociology and another for chemistry and another for history and another for religion, any more than our spiritual forefathers should have had a god for the sky and another for the river and another for the earth. Polytheism is as unsatisfactory now as it was then.

There is a very practical reason why this is so. Suppose that a scientific theory states that it is impossible to resuscitate anyone who has been dead over 1 hour, and that a theological doctrine states not only that one man rose from the dead after being dead over 24 hours, but that all the dead will rise someday. We cannot base our actions on both statements. If a logical conclusion of the scientific theory is "when asked, tell people that this life is all they have, so get the most pleasure out of it", and a logical conclusion of the theological doctrine is "tell others that there is another life and they should prepare for it", then we cannot do both at the same time. We must choose one of the two actions (or a third action) and thus implicitly support one theory or doctrine as being superior to another.

Scientific theology thus parts company with two popular ways of resolving the tension between science and religion, fundamentalist obscurantism and liberal dichotomism.<sup>2</sup> Fundamentalist obscurantism says that we need not pay attention to science; just believe the Bible. This is an easy way of solving the problem, but it starts to break down when it is exposed to modern life. For the same people who say they ignore scientific findings broadcast programs (using the results of physical science) and drive cars (using the results of thermodynamic theory) using gasoline (obtained by applying the results of geological science and chemical science). When they become ill, they visit physicians for the application of medical science. Somewhere they have to draw the line between acceptable and unacceptable science; otherwise they would be accepting what they condemn. Fundamentalist obscurantism is not really a live option.

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<sup>1</sup> RSV. All biblical quotes are from the RSV unless otherwise specified.

<sup>2</sup> That is not to say that all fundamentalists are obscurantists or that all liberals are dichotomists, but that a common way for liberals to approach the problem of the interaction of science and theology is to create a dichotomy, and a common way for fundamentalists to approach the problem is to attempt to ignore it.

This is not to say that all the conclusions of science should be taken at face value. The majority of scientists have been mistaken in the past, and there is no guarantee that the conclusions of today are free from error; good scientists will say as much. A theological conservative who attempts to find places where scientific conclusions need to be modified is not necessarily out of line. But one should not ignore the conflicts between current scientific thought and one's religion and hope they will go away. They will not unless someone works on the problem.

Liberal dichotomism, on the other hand, attempts to make an absolute distinction between science and theology. Science is alleged to deal with questions of fact; theology to deal with questions of meaning and value. The two have no relationship to one another.

Again, this position is not entirely irrational. One cannot get from the physical facts of our universe to a moral duty without adding something else. As it has sometimes been put, you cannot get an "ought" from an "is". Science cannot deal directly with ethics unless some basic principles are added.

But there are problems with this position. First, science does not deal with questions of fact, but only with reproducible events and theories built around them.<sup>3</sup> There remains the possibility that some events are not reproducible without taking factors other than physical ones into account. Science is not incompatible with such events; it merely cannot predict or explain them. A theology

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<sup>3</sup> This is a common definition of the realm of science, and probably the best one. It differentiates science from history, art, and philosophy. It would count physics, chemistry, most of biology, and parts of geology and medicine as sciences, as well as some sociology. The only other common definition of science, that which can be described by mathematics, arrives at a somewhat similar list, although it would include music and mathematics as science and exclude some descriptive parts of biology which are reproducible but not yet mathematically formalized.

Some would say that this definition of science can account for the entire universe (they therefore try to define science as both the study of the reproducible and as the study of everything in the universe). But this concept is not logically necessary. It belongs to the presuppositions of scientism, the belief that all events are reproducible and independent of direct effects of the thoughts of intelligent entities. And it still ignores the problem of history, and that of initial conditions. We will consider scientism in the next chapter. For now I would prefer not to beg the question by including the concept of comprehensiveness in the definition of science.

that incorporates both science and history may do a much better job of explaining and even predicting such events. Thus theology may deal with facts, and may even do it better than science.

Second, the inference of meaning or value is often dependent on fact. One can hardly speak of the meaning of the Exodus, or the crucifixion or resurrection of Jesus, or Mohammed's visions, or Joseph Smith's translating the golden plates, if these events did not in fact happen (one may perhaps speak of the meaning of the story, but not of the event itself). Even in the field of ethics, the factual question of whether brain function can be restored, and how much, may determine the value of treating someone who is critically ill. Facts, and even science, can intrude into questions of value.

So the liberal dichotomist distinction will not do. Science may be morally neutral, but good theology must incorporate science, and other systems of fact such as history, into its structure.

### Using the Scientific Method

But I mean more by scientific theology than merely a theology that takes science into account. I also mean a theology that uses the method of science. That is, one makes observations, tries to organize them into coherent theories, or doctrines, and then tests those theories against further observations. When doing this, one always recognizes that the observations, when well established, are of primary importance: If a theory comes in conflict with an established fact, it is the theory that must be modified or rejected.

This is a brief and therefore somewhat simplified description of the scientific method. It may come as a surprise to some that there is not complete agreement in the scientific community as to what constitutes the scientific method. Most scientists actually do not have a well-articulated philosophy of science. They tend to evaluate scientific theories by partly instinctive criteria.

On the other hand, philosophers often do not have the scientific background to develop these instincts. They also have the problem of demarcation. Where is the scientific method best demonstrated? Most people would agree that physics and chemistry are science, as well as large portions of biology and medicine. Many people would add geology. There is more doubt about psychology, economics, and sociology. Few people consider art, his-

tory, and religion scientific. And Marxist theory has, I think, had the last shreds of its scientific façade torn from it in the last few years. Where does one draw the line? And when does a discipline become scientific? In addition, is the scientific method anything scientists do, or are there normative principles that scientist should follow and that will impede progress if not followed? These questions do not have universally obvious answers. To get a better-articulated description of the scientific method, perhaps we should review a thumbnail sketch of the history of the philosophy of science.

Science started in an atmosphere where the only knowledge that counted was that which was absolutely certain. Then came the age of enlightenment, which was heavily influenced by two sets of events. First there was the Protestant Reformation, the uncertainties it engendered in religion, and the horrible persecutions and wars that followed.<sup>4</sup> The conclusions that were often drawn were that religious knowledge was not certain, that using force to coerce religious belief was futile, and that coercing religious practice was wrong. The conclusion was even commonly drawn that religious knowledge was worthless. At the same time Newton produced a theory which stunned the world with its simplicity, scope, and accuracy. These same people believed that scientific knowledge was certain, and they attempted to account for its certainty. But no matter how hard they tried, they were not able to reduce science to absolutely certain principles. Newton himself was unable to explain the nature of his mysterious gravitational attraction from first principles (“*Hypotheses non fingo*”). Thus one could not deduce science. But that left trying to induce science from observations. Thus was born inductivism.

Inductivists believed that no theory should be accepted until it is proved by observations, and that once it is proved it will never have to be discarded. Inductivism initially was optimistic about the ability to produce an absolutely true science from observation. But then Newton’s theory turned out to be wrong, or

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<sup>4</sup> This is not to say that the Reformation caused the uncertainties or the persecutions. It merely underlined the uncertainties and demonstrated that apparently sincere Christians could kill apparently sincere Christians for their beliefs (previously most well-known persecutions by Christians had been of pagans or members of other religions like Islam or Judaism).

at least not absolute truth. Inductivism had failed in practice. And it was noticed that nothing can be absolutely proved by induction alone.

So inductivism degenerated into logical positivism, which took the tack that only sense data, and statements that could be reduced to sense data, were reliable. All other statements were "meaningless". But then it was noticed that scientific hypotheses could not be completely reduced to sense data. This would mean that science was meaningless, which seemed (and seems) absurd. Hypotheses in science generally are attempts to extrapolate from sense experiences to some kind of order behind them. Scientists believe in the sun as a real object behind the light streaming toward us. It seems pointless to deny the reality of such constructs. And it must even be granted that sense experience is not the ultimate arbiter of reality. Witness our reliance on thermometers for temperature evaluations instead of our sense of heat or cold, and our rejection of a blind person's denial of the existence of a rainbow.

Karl Popper advanced beyond the logical positivists when he pointed out that the distinguishing feature of a scientific theory was not the ability to prove it, but the ability to falsify it. This meant for the early Popper that although we could not know truth for certain, we could at least know error.

However, scientists do not spend their time trying to make hypotheses so that they can falsify them; rather they try to find hypotheses that can be falsified but have not been. They then try to predict new events using their hypotheses. The hypothesis that can predict the most events accurately is the preferred one. What actually happens is that a good scientific theory says, "If A or B (or C, etc.) could happen, given these circumstances A will actually happen." The more events ruled out by the theory, the more useful the theory. By the same token, the more events ruled out by the theory, the more falsifiable the theory. So falsifiability and predictive power are two sides of the same coin. But scientists actually want the predictive power side.

Furthermore, certain basic hypotheses, which we might call central theories (a theory is simply a hypothesis that has a certain amount of corroborating data behind it), are exceedingly difficult to falsify. They often make no direct contact with experimental data, and one can always say that the anomaly will be resolved with further data and/or theory. In fact, even the data

are not logically certain. As Popper noted,<sup>5</sup> they are accepted on the basis of a decision, very much like a jury decision and subject to the same biases. "The empirical basis of objective science has thus nothing 'absolute' about it."<sup>6</sup>

Imre Lakatos extends this idea to mathematics, with striking results.<sup>7</sup> Thus even in mathematics, which we have always thought of as absolute, our knowledge is not absolute and incapable of falsehood.<sup>8</sup> Thus there is no absolute certainty of any kind in science. But science still is impressive as a working system.

Lakatos set out to explain this. He postulated scientific research programs (or SRP's), which consist of a "hard core" of unmodifiable theories, and a "protective belt" of modifiable theories surrounding the hard core, which was added to guided by a positive heuristic, or coherent plan for solving problems. He valued SRP's for their ability to predict novel facts. An SRP which was continually producing novel facts was progressive, and one which was not was degenerating.

He defined a novel fact as a fact which was not known at the time the theory was proposed. Nancey Murphy<sup>9</sup> offers this redefinition: "A fact is a novel fact if it is one not used in the construction of the theory T that it is taken to confirm. A fact not used in the construction of the theory is one whose existence, relevance to T, or interpretability in the light of T is first documented after T is proposed." I would only add, with Elie Zahar,<sup>10</sup>

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<sup>5</sup> *The Logic of Scientific Discovery*. New York: Harper and Row, Publishers, 1968, pp 108-111.

<sup>6</sup> Note 5, p. 111.

<sup>7</sup> *Proofs and Refutations: The Logic of Mathematical Discovery*. Cambridge: Cambridge University Press, 1976.

<sup>8</sup> For those who have difficulty believing this, I suggest they read the book. Not counting the appendices, it is short (125 pages) and can be understood by someone with high school geometry and algebra, except for one short section on vector algebra which one does not need to understand to follow the argument.

<sup>9</sup> *Theology in the age of scientific reasoning*. Ithaca, NY: Cornell University Press, 1990, p. 68. Her definition was actually made after Zahar's (see note 10). The reasons for her definition are given in her book.

<sup>10</sup> See "Why did Einstein's Research Programme Supersede Lorentz's?" *The British Journal for the Philosophy of Science* 24:95-123 and 223-62, 1973. Reprinted in Howson C (ed.), *Method and Appraisal in the Physical Sciences*. Cambridge: Cambridge University Press, 1976. Also see Lakatos I: *The Methodology of Scientific Research Projects*. Cambridge: Cambridge University Press, 1978, pp. 184-189.

that even a fact whose existence, relevance, and interpretability in the light of T are documented when T is proposed is of significant positive value if T does not require modification to account for that fact. Thus the explanation of Copernicus for Mercury and Venus never being seen opposite the sun and the retrograde motions of the outer planets always being opposite the sun flows naturally from his theory, whereas the Ptolmaic system (or systems) had to tack that condition onto their theory. This may be taken as one aspect of the simplicity of a theory (one may argue that semantically it is not a “novel fact” but it is certainly significant).

His system should also be modified in the directions suggested by Alan Musgrave.<sup>11</sup> First, “hard cores” develop naturally, and do not need any dogmatic protection. Central theories survive primarily because they are good. Second, heuristics are not all-powerful. They need facts to determine their precise implementation, and they can still get stuck on stubborn facts (or more precisely stubborn combinations of facts). This can appropriately cause what Thomas Kuhn would call a crisis. And some facts are more stubborn than others. If stubborn enough, they may even be closer to “falsifiers” than anomalies. Finally although the later Lakatos backed away from saying so, scientists in general should support what they perceive as progressive research programs more than degenerating ones. This does not mean that a scientific community should coerce someone who does not agree with them about the relative merits of the programs under consideration. After all, he may have more insight than they. But it does mean that they are not obligated to finance him.

I might add that no theory needs to be (or should be) thrown away completely as long as it can serve as an approximation in some area. Since none of our theories are expected to be totally perfect, having a theory with known limitations can be very useful for guiding actions within its domain of relative accuracy. This means that Newton’s theory of gravity was a major advance, even though it was not perfect, and it still should be learned (it is still used for calculating lunar trajectories). In fact, maybe theories should be learned in historical order. It also means that for a

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<sup>11</sup>“Method or Madness?” In Cohen RS *et al.* (eds.): *Essays in Memory of Imre Lakatos*. Dordrecht, Holland: D. Reidel Publishing Company, 1976, pp. 457-504.

theory to be completely true, it must incorporate all the truth in every preceding theory. If we find a theory which adds new knowledge compared to its older predecessor but which fails to account for something which the old theory accounted for well, then the new theory is guaranteed to be incomplete, and in that area. Thus in one sense science is never provably right (and is very probably partly wrong), but in another sense it is always adding more truth as the models get more comprehensive and accurate.

One of the subjects that is not commonly dealt with adequately is the value of relative accuracy. Copernicus' theory was only marginally more accurate than Ptolemy's, but was still an advance, primarily because of its simplicity. Kepler's theory was much more accurate, and therefore an advance, even though it was slightly less simple and not completely accurate (and known to be so in Newton's time). Newton derived his gravitational predictions from models using successively fewer simplifying assumptions and becoming more and more accurate. Copernicus' model, Kepler's laws, and Newton's successive approximations got progressively closer to the way planets actually moved, and therefore may be considered progressively more accurate models. It seems unlikely to me that the models are not getting progressively closer to the actual model. This is especially true if one views Newton's model as Newton apparently did (he didn't know why it worked, just that it did) and not as some of his followers did who hypostatized Gravity. I think that Newton himself would have easily accepted Einstein's modification of his theory (and for all the discontinuity, there is a great deal of continuity).

For all the present hype about scientific fashions and contradictions, there is still a great deal of continuity in science. Perhaps the reason why this continuity in science is often missed by philosophers is partly because philosophy tends to concentrate on what is true and can be known to be true, which roughly coincides with pure science, rather than on what one should do, which roughly coincides with applied science or technology. A theory which involves major conceptual changes, like warped space-time fields, can make no noticeable difference for most applications.

Finally, since we do not require certainty, inductive arguments should be allowed back. After all, if something has happened a thousand times in one way, surely the reasonable first approximation is that it will happen the same way the next time. In fact, in one sense, all prediction has to be on the basis of induction. We do not know the future. We can only reason from the past.

This is one reason why the definition of science as the study of the reproducible makes the most sense.<sup>12</sup> If it is reproducible then one might expect a (fallible) principle of induction to be valid. Medical practice would not be possible without at least a partial application of this principle. For a study to be normative for practice, it has to be presumed that unstudied patients will react similarly to studied ones. This stance is in opposition to some Popperians.

This seems to me to be the best currently available theory of the scientific method. One of the things that both Murphy and I<sup>13</sup> are saying is that the web of interdependent theories does not just include science but also extends to theology, and indeed to any worthwhile intellectual endeavor, and some modification of the method of Lakatos should be used to decide between “research programs” in theology as well as science.

Thomas Kuhn does not like the idea of central theories. He prefers to refer to paradigms,<sup>14</sup> or exemplars and the disciplinary matrix.<sup>15</sup> This is because he does not see the central part of a science as expressed theories, but sometimes as less well-defined ways of looking at nature, particularly in their early phases. He notes that these ways of looking at nature are not changed in the scientific community with as much objectivity as you would expect by listening to scientists describe their method. Rather, the changes resemble some religious battles, with conversions and purges, and the new often supersedes the old as the old’s adherents die out rather than everyone seeing the logic of the new position unforced. However, this seems to be a demonstration of the foibles of scientists, rather than a valid prescription for how science should be done. One can readily make the case that science would be farther along if scientists would act more like Lakatos (as modified by Musgrave) says they should (Kuhn

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<sup>12</sup> Another reason is that any position taken in science can be double-checked, thus providing an automatic curb to dishonesty of varying kinds, and also to bias. In many other fields one is relatively helpless against misleading information.

<sup>13</sup> And Lakatos—see note 10, p. 152 (n. 5).

<sup>14</sup> *The Structure of Scientific Revolutions*. Chicago, University of Chicago Press, 1962.

<sup>15</sup> *The Essential Tension*. Chicago, University of Chicago Press, 1977, pp. 293-319.

also sometimes overstates his evidence). It is also true that science advances when the central way of looking at things becomes more well-defined (i. e., a theory).

Kuhn also seems to believe that there is no absolute truth. Rather, he feels that science is aimlessly evolutionary and happens to incorporate more solved puzzles by a kind of survival of the fittest theory.<sup>16</sup> He believes that “there is no standard higher than the assent of the relevant community.”<sup>17</sup> However, in that case the whole meaning and motive for science would seem to disappear. For as he freely acknowledged, normal science is puzzle-solving, which presumes that there is a solution (that is, an absolute truth).<sup>18</sup> And paradigm shifts occur precisely when the old paradigm fails repeatedly to allow such a solution to one or more important puzzles and a new paradigm promises to deliver such a solution.<sup>19</sup> Often the proposer(s) of the new paradigm have to discount the judgment of the “relevant community”, at least initially. There must be some higher standard to which they appeal. Kuhn also has trouble being consistent, noting that “the scientist after a revolution is still looking at the same world.”<sup>20</sup>

It seems to me that many of Kuhn’s observations on the lack of objectivity in science can be explained by the anomalous card experiment.<sup>21</sup> But this experiment was possible precisely because one could make a real card with a black 4 of hearts on it. That was objective reality which anyone who had no psychological reason to deny it would recognize, at least when it was pointed out.

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<sup>16</sup> Note 14, pp. 169-173; compare p. 117.

<sup>17</sup> Note 14, p. 93.

<sup>18</sup> See Note 14, pp. 36-37

<sup>19</sup> Note 14, pp. 151-8

<sup>20</sup> Note 14, p. 128; compare p. 149. See also Shimony, A. “Comment on Two Epistemological Theses of Thomas Kuhn.” In Cohen RS et al. (eds.), see note 11, pp. 569-88.

<sup>21</sup> Briefly described in note 12 pp. 62-64 and alluded to on pp. 111-4, quoting Brunner JS, Postman L: “On the perception of incongruity: a paradigm.” *J Personality* 1949;18:206-23. People familiar with playing cards were shown cards with the color and suit mismatched. They at first forced the cards into the usual pigeonholes, sometimes without effort, then became confused by them, and finally some of them (but not all) figured out the mismatch. But the confusion could be quite profound and long-lasting. Kuhn does not mention that many subjects, rather than becoming confused, saw gradually more black in the black cards and more red in the red cards.

Perhaps our greatest problem with paradigms is that we tend to hold on to them by blind faith, instead of allowing faith to grow as the evidence for them accumulates, and always bearing in mind that our paradigms are not necessarily or even usually, the ultimate reality.

I have even more trouble with Feyerabend's position that any rules for doing science are too restrictive. First, there is the logical problem. "There are no rules" is itself a rule, and thus self-contradictory. I can even use any rules I want under this program, as who is to say that my rules are any worse than someone else's rules or lack thereof? The argument seems to cut off the trunk of the tree where it is sitting. Second, there is the practical problem. It seems, if the history of science has anything to teach us, that there are rules that are helpful. One of them is, regardless of how attractive your theory is, you must make sure it is grounded in experience. That is the basis for science, and partly accounts for the rapid advance of science now as compared with the Middle Ages.<sup>22</sup> To say that sometimes people have lucked out breaking the rules is not the same as saying that it is a good idea to break them on a routine basis.

Science, in the end, is an attempt to align our philosophy to objective reality, so that our philosophy is, as much as possible, in accord with the way the universe actually runs. That is why science puts so much emphasis on experiment. However, it is also true that science has provided nearly coercive evidence that there is an underlying order to the universe, which is at least partly comprehensible by us. It is thus reasonable to expect and search for further evidence of that order. And systematic search may very well be the best way to find that evidence.

Perhaps my own philosophy of science might be summed up as follows: I believe that there is an absolute truth, and that we can approximate it. I also believe that everything we do, and even that we perceive, is more or less fallible. That includes our application of methodological rules. Therefore there is no method that can give an ironclad guarantee of success. Perhaps we should

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<sup>22</sup>To see how different the outlook was then, note the Aristotelians' phrase "saving the phenomena", used for justifying the complications in the Ptolemaic system of astronomy, as if the phenomena needed to be saved rather than the theory (this is unbelievable to the modern scientist who hasn't run across it before).

call our rules principles. I do not call them values unless they are distinguished from Kuhn's values, as they are not intended to be our own arbitrary creation but rather a (partial) recognition of an external reality.

Some of these principles are as follows: (A.) In general, the most obvious interpretation of sense experience is to be preferred. (B.) Observations are the court of final appeal. They are actually our only windows into the objective universe to see if our theories match reality (C.) Inductive arguments, although not probative, are suggestive. (D.) Anomalies (or falsifications) should have more attention than most corroborating evidence. (E.) Novel facts should have more attention than anomalies, and in a psychologically charged environment novel facts that are collected in a blinded manner have the most corroborating value. (F.) One should always work with the best known version of a theory, especially an opposing one. (G.) Theories should either be logically connected and evaluated together, or else not be connected and be evaluated separately. (H.) Since all our theories (as well as our factual knowledge) are likely to be at least partially imperfect, the presence of anomalies should not cause us to immediately abandon a theory. A theory should not be abandoned completely until a better one can take its place. (I.) If two or more principles are more or less evenly balanced on opposite sides of an argument, withhold judgement unless you are forced to act (or the risks are minimal), then make your best guess and act accordingly.<sup>23</sup> In the meantime, try to see if you can resolve the dispute by collecting more data (in this case, it is a good idea to work in both research programs, and it can usually be done easily, contrary to Kuhn).

What I am proposing and attempting to explore partially is a theological research program, or paradigm, or central theory. I will thus pay particular attention to anomalies and crucial experiments, to continuity with previous theory and to the prediction of novel facts by a given theory.

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<sup>23</sup> One of the striking things I have noticed about the history of science is that the truly great scientists seem to have an uncanny ability to sense which theories are more sound long before the evidence coerces everyone else. Some of this is due to selection bias (great scientists are those who worked on the right theories) but some seems to be due to a sense that is partly natural and partly developed.

I should make explicit something that has hopefully been implicit before. Science requires strict honesty. Fudging the data is the most heinous crime a professional scientist can commit. Ignoring evidence, particularly contrary evidence, is a close second. One is always expected to be objective. It is true that scientists often do not exemplify this virtue. But when they are caught they are severely punished, and rightly so. The standard is still absolute honesty.<sup>24</sup>

I should justify to some my omission of a possible role of the Holy Spirit at this point. It is not permissible to discuss this role unless we have established His existence and discussed some of His properties. This may make the discussion incomplete at this time. However, it does not necessarily make it fatally flawed because if He exists, and if He is impartial, then He will speak to anyone who will listen, even if the listener does not know all the details of Holy Spirit theology. Therefore it is fair to concentrate on the proper receptive attitude (open and honest) for now.

One possible misconception should be cleared up. It is a half-truth that one may believe whatever one likes as long as one is sincere. Like all half-truths, it is dangerous. Honesty may indeed be the only important virtue. But honesty is not merely believing what one says, or even saying what one believes. Honesty is trying one's best to recognize external reality and to make one's statements correspond with that reality. So if one is honest one has to try one's best to perceive truth and believe that truth, and then to say what one believes. One's likes and dislikes should not have a determining influence on one's belief if one is trying to be honest (unless one is being honest about one's feelings). In fact, one should attempt to guard against possible bias introduced by one's feelings.

### **Properties of a Good Theory**

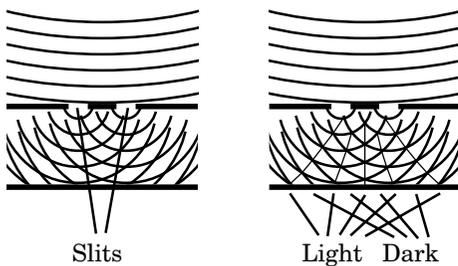
The above is a largely abstract review of scientific methodology. At this point it may help to review some of the most salient properties of a good theory, with the help of some illustrations.

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<sup>24</sup> In point of fact complete honesty is very difficult. Very probably none of us is completely honest about everything all the time. That does not change the fact that there are times at which we have the choice between being more honest or less honest. Good scientific method demands that at those times we choose the more honest alternative.

First, the primary purpose of any theory is to account for the facts. This applies to all theories, even ones suggested by Biblical writers. Theories are only useful for explaining or predicting facts.<sup>25</sup> To the extent that they succeed, they are good. To the extent that they fail, they are bad. It is not a requirement that a theory be easy to visualize. The only requirement is that the theory is logically consistent, that is, that one can make unambiguous predictions (and post-dictions) from it.

An illustration may help. The particle theory of light was popularized by Newton. This theory held that light was emitted like tiny bullets by an object like a candle or the Sun. It might be absorbed by or bounce off of, other objects, and was sensed when it hit the eye. It predicted a finite speed for light, which proved to be correct. It explained reflection well, refraction not quite as well, and was superseded by the wave theory of light with the realization of the implications of interference. It was noted that light, upon going through two slits a short distance apart, would form bands of light and dark on a screen at certain intervals. These bands corresponded to areas where the wave theory predicted that light waves should reinforce or cancel each other (see illustration).



The illustrated slits are 3 wave-lengths apart. Areas where the waves reinforce each other have lines drawn through them in the second illustration.

There was no plausible explanation for interference from the standpoint of the particle theory of light, and it was thus abandoned. The wave theory reigned supreme, explaining reflection,

<sup>25</sup> This is true on both a theoretical and a practical level. On a theoretical level, a scientific theory is primarily concerned with explaining the universe. But it must be the universe we live in, and therefore agreement with fact becomes critical. On a practical level, a scientific theory is primarily concerned with usefulness, that is, with being able to predict facts. But then it must predict the right facts (notice that we are specifically not saying that theories are merely collections of organized facts, but simply that their ultimate judge is facts).

refraction, and interference, until the discovery of the photoelectric effect,<sup>26</sup> which showed that light had some properties of particles which could not be explained by the wave theory. Thus the quantum theory of light was born. Quantum theory is very difficult to visualize; it is really a mathematical model. Explanations such as “wave packets” or “particles guided by waves” for quanta do not give a completely accurate picture. Quantum theory reigns in physics today not because it is easy to visualize (quite the contrary!), but because it gives unambiguous predictions that have proven to be accurate. In order for another theory to supplant it, that theory must explain more facts.

In like manner, theories of, for example, the atonement are under obligation to explain facts. The Bible states, for example, that God is love, that sins can be forgiven, and that Jesus’ death was not only necessary but planned. Any theory of the atonement must take such statements into account. The more such statements are adequately explained, the better such a theory is.

An important corollary to this way of looking at theories is this: Two theories (or doctrines) which predict the same set of facts are for practical purposes the same theory. If one cannot find, at least in principle, a situation in which the two theories make divergent predictions, then there is no meaningful difference between them. Thus, for example, for low speeds and masses there is no practical difference between Newtonian physics and the theory of relativity. For this reason, the theory of gravitation is commonly used to calculate the paths of objects in free fall, since the formulas are easier to use and they come up with, to within measurable error, the same values as those derived from the general theory of relativity. It is only when masses and speeds become large that noticeable differences arise and the theory of relativity shows its superiority.<sup>27</sup> The same should hold true for theological theories.

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<sup>26</sup>This was preceded by Planck’s solution of the spectrum of emitted light, which assumed that light behaved like it was emitted in packets. However, Planck apparently thought his solution was just a mathematical trick, and it was left to Einstein to make the proper generalization.

<sup>27</sup>A better (and at this point theoretically perfect) example is the difference between the subjective (Bohr) and objective (Bohm) interpretations of quantum mechanics. Both interpretations predict precisely the same phenomena, and are usually called interpretations rather than theories for this reason.

I once heard two people argue for weeks over whether justification and sanctification were two separate aspects of the same experience, or whether they were two different events which always happened simultaneously. On talking with the two people separately it became evident that one was worried about the possibility of the other separating justification and sanctification temporally, while the other was worried about the first confusing the two, while each denied the other's charges. There would not appear to be any difference in the predicted results from these theories, and in that case, scientific theology would not recognize any essential difference between them.

Another important corollary is this: A theory which does not make unambiguous predictions which can be falsified is valueless. A useful theory in the final analysis, is a way of saying, "Nature is put together in such a way that in a given situation where A or B could conceivably happen, in point of fact, you will find A happening." If there is no such situation, then the theory is not testable, and it doesn't matter whether the theory is true or not. It cannot be used, which makes it useless. Scientific theology has little patience with arguments about how many angels can dance on the head of a pin.

In fact, other things being equal, the value of a theory is in direct proportion to its willingness to stick out its neck in testable ways. A theory which says that there is a certain kind of order in a part of the Bible, or the Qur'an, or human experience, is to be preferred to that which says that they are random, unless and until the theory of order has been shown not to match the facts.

So a good theory (or doctrine) should make unambiguous, falsifiable, and yet accurate predictions. But there is one other property a good theory should have. In science it is called elegance. This property is hard to describe, but one way to try is to say that elegance is the ability to describe many varied facts with just a few simple basic assumptions. The theory of gravity and Newton's laws of motion, for example, explained at one stroke the falling of objects to earth, the path of projectiles, the orbit of the moon, the earth, and the other planets, and ocean tides—quite a diverse array of natural events. But there is more to elegance than that. Maxwell, in 1909, was working on the interaction of magnetic and electrical forces in free space, and came up with 4 sets of equations. The fourth set contained zero on the right side, which

## Maxwell's Equations:

$$\begin{array}{ll}
 \text{I.} & \frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z} = 0 \\
 \text{II.} & \frac{\partial H_x}{\partial x} + \frac{\partial H_y}{\partial y} + \frac{\partial H_z}{\partial z} = 0 \\
 \\ 
 \text{III.} & \frac{\partial E_z}{\partial y} - \frac{\partial E_y}{\partial z} = K_H \frac{\partial H_x}{\partial t} \\
 & \frac{\partial E_x}{\partial z} - \frac{\partial E_z}{\partial x} = K_H \frac{\partial H_y}{\partial t} \\
 & \frac{\partial E_y}{\partial x} - \frac{\partial E_x}{\partial y} = K_H \frac{\partial H_z}{\partial t} \\
 \text{IV.} & \frac{\partial H_z}{\partial y} - \frac{\partial H_y}{\partial z} = 0 \quad (= K_E \frac{\partial E_x}{\partial t}) \\
 & \frac{\partial H_x}{\partial z} - \frac{\partial H_z}{\partial x} = 0 \quad (= K_E \frac{\partial E_y}{\partial t}) \\
 & \frac{\partial H_y}{\partial x} - \frac{\partial H_x}{\partial y} = 0 \quad (= K_E \frac{\partial E_z}{\partial t})
 \end{array}$$

looked asymmetric compared to the other 3, so he invented a term to complete the symmetry.<sup>28</sup> This set of symmetrical equations led directly to the discovery of radio waves within a few decades and implied that they were related to light. The fact that elegance has turned out to be a useful property in scientific theory implies that the basic nature of the universe is built upon harmony. This has interesting implications for science and for theology.

Another important property of theories is their coherence with other, more well-established theories. In fact, one of the fundamental assumptions in science has been that all truth is interrelated. This is one reason one cannot train in chemistry without

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<sup>28</sup> The forms in the illustration are slightly modernized. The original equations can be found in Niven WD (ed): *The scientific papers of James Clerk Maxwell*. New York: Dover Publications, Inc., N. D. Equation 1 can be derived from equations 17 and 19 of *On Physical Lines of Force* (published in 1861) on p. 464, and also equation 115 on p. 497. Equation 2 can be derived from equations 57 and 58 on p. 476. The third set of equations are equivalent to equations 54 on p. 475. The fourth set of equations are equivalent to equations 15 on p. 464. The need to account for electric displacement "currents" is noted on pp. 496-7 (Prop. XIV), and formalized by the time *A Dynamical Theory of the Electromagnetic Field* appeared in 1864 (see equations C, A, and E on pp. 557, 554, and 560). The existence of waves whose speed equaled that of light was realized in the earlier paper (pp 499-500). This is particularly striking when it is realized that this theory required space to have a dielectric property, and seemed to require a material in a vacuum which was very stiff but allowed matter to pass without resistance (the famous "ether"), and which has since been discredited in the eyes of most scientists without destroying the validity of Maxwell's equations or his conclusions regarding the electromagnetic character of light.

knowing something about physics and vice versa. It is why too narrow subspecialization in science, while understood, is deplored. And it is why physicists are trying so hard to create a grand unified theory of the universe.

All of the above is not intended to say that there is no such thing as absolute theological truth. We will probably find in theology, as we have found in science, that the concept of absolute truth is a useful one. I personally believe in that concept (if I did not, I would not have written this book). The major reason for this tentative way of doing theology is that our perception of absolute truth is so often faulty, both from random error and from personal bias. The above method is an attempt to build self-correction into the theological process (for this reason I reserve the right to change my position if the evidence warrants).

There are Christians who say that such self-correction is insufficient, and that the human mind is so depraved that we can only accept God's word at face value. This position may be a nearly impregnable defensive one for a Christian. But Christianity is not intended to be primarily defensive: It is to take the offensive. In the words of Christ, "Go ye therefore and teach all nations, baptizing them.. ." (KJV) And when a Christian approaches someone who does not believe as he does, the unbeliever must first be convinced that the Bible is God's word, instead of the Vedas or the Qur'an or simply nothing at all outside of nature. Claims will not do. Joseph Smith also makes claims, which are contradictory to the Bible taken at face value, and they both can't be right. We have to have a way to choose between conflicting claims. What I am suggesting is that the claims which best fit in with what we otherwise know about the universe are the most credible.

Obviously, determining what best fits in with what we know about the universe is a big task. There will always be those who suggest shortcuts. But, as in science, the certainty of the conclusions is only as strong as the evidence behind them, and in the end, no shortcut will do the job as well as the proper way of investigation. I agree that our thought processes are far from perfect. But we must start from where we are. We cannot start with God's word unless we have good reason to believe that it is indeed God's word, and if that is the question, we must satisfy ourselves regarding the answer before we can proceed.

There is one more property of scientific theology that should be restated. It does not require one to have absolute certainty

before one can act. It follows the ethical guidelines long used in medical science: Choose the action which seems most likely to do the most good with the least risk of substantial harm. Sometimes, particularly in ambiguous situations, the best course is to collect and correlate more data in an effort to make the situation less ambiguous. But if the situation requires action, you must use your best judgment and then act.

This allows us to acknowledge strong points in an opposing argument, while not paralyzing us until all opposing arguments are answered. It will also leave us more open to the possibility that an opposing theory is actually better than our own. It thus encourages ethical activity without encouraging bigotry

Because of this, in what follows I will not try to philosophically prove all the positions I take on various subjects. I believe theology, even more than science, is a subject too broad for any one mind, or even combination of minds, to fully encompass. It is impossible for anyone without the omniscience of God to write (or even understand) a truly comprehensive systematic theology. I will merely try to find the most reasonable models I can to explain the phenomena. You will then be able to make the judgment for yourself as to whether and how far I have succeeded. As Romans 14:5 says, "Let every man be fully persuaded in his own mind."<sup>29</sup>

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<sup>29</sup> Strictly speaking, I do not view this chapter as advocating the use of the scientific method in theology so much as advocating the use of a method honed on the study of reproducible events in the study of non-reproducible (by us) events. The method got its name from where it was developed, but what I am saying is that it is actually the method of knowledge and not just the method of science, and I am merely restoring it to its proper sphere.

Many theologians will recognize that this approach is not entirely new. In fact, they may even feel that they believe in most, if not all, of its basic tenets. Hopefully they are right. If it is good theology, someone before me may have seen it. The reasons for my presenting it are a) I haven't seen it put quite this overtly before, b) most conservatives (and because of my treatment of the data I consider myself a conservative) shy away from saying that theological statements in the Bible can be treated as models, and c) most theologians do not have the grasp of science necessary to treat the relationship between science and theology as carefully as I believe will be done here. They either tend to be overwhelmed by science, or to ignore it.

Some may also note that the term "scientific theology" has been used for a theology which has come to entirely different conclusions than I have. I believe that most of those theologians started from a philosophical base that refused to allow for any non-reproducible events, or even any events which could be caused by forces outside of nature. As we shall see in the next chapter, this is an unwarranted assumption given our present knowledge.