



Michael Tenneson

## Article

# A New Survey Instrument and Its Findings for Relating Science and Theology

*Michael Tenneson, David Bundrick, and Matthew Stanford*



David Bundrick



Matthew Stanford

*We report on the development and application of a survey instrument that measures the patterns of thought used by individuals attempting to relate theology and science. Survey responses of 1,491 people from five populations of science professors, theologians, other educators, students, and church laypersons were evaluated. We suggest a standardized conceptual framework and terminology; summarize science and theology relational approaches used by a broad spectrum of scientists, educators, pastors, and students; and discuss ways that the survey can be used to promote integrative practices. Based on theoretical constructs and empirical analyses, we propose the terms Compartmentalism, Conflict: Science over Theology, Conflict: Theology over Science, Complementarism, and Concordism to describe ways people relate theology and science. Overall, the favored approach of all groups we studied was Complementarism. Three groups with strong religious commitment also used Concordism to a great extent. In some populations, a large number of people did not use any science-theology paradigms to evaluate theology and science propositions. Young earth creationists predominantly used Conflict: Theology over Science and Complementarism. Old earth creationists and evolutionary creationists relied mostly on Complementarism. We end the article with some recommendations to advance the integration of science and theology.*

Can theology and science be integrated in meaningful ways? Scholars have written much about biblical interpretation and methods of science, but less attention has been given to the practical integration of the two. This is a challenging undertaking because the interpretation of God's world (scientific methods) and God's Word (biblical interpretation) often requires different tools and approaches. Consequently, coherent and consistent science-theology paradigms are difficult to achieve, and their practical applications may be even more problematic.

We agree with Alister McGrath when he wrote, "It is increasingly clear that relating Christian faith to the natural sciences is one of the most pressing academic tasks of our day."<sup>1</sup> Not all who are involved in the study of relating theology

and science share McGrath's expertise as both a scientist and a theologian. Can the practicing pastor or lay person productively explore faith and science in ways that do not do damage to valid scientific and theological methods and procedures? Or, is the venture hopelessly complicated and frustrating because of differing theological and scientific presuppositions? Is meaningful integration and application of science and theology practical? We think yes, but it requires theologians to become knowledgeable of basic scientific principles and scientists to develop their skills in theology; and both groups need to pay more attention to the excellent contributions of philosophers to this discussion.

In this article, we present evidence that many scientists, educators, theologians, students, and church attendees make significant effort at such integration.

We describe the theoretical foundations and development of a survey to identify the patterns of thought ("science-theology paradigms") typically used by individuals attempting to relate theology and science. We have analyzed survey responses of 1,491 people from five populations: (1) a diverse group of science professors in the United States (n=312); (2) a group of educators, pastors, and students in the Assemblies of God (AG) (n=117); (3) a group of college undergraduates at a large Christian university in the South (n=551); (4) Protestant pastors, educators, and students who attended a faith and science conference (n=109); and (5) faculty and students from AG higher education institutions in the US (n=402).

The purposes of this article are (a) to provide a conceptual framework and common terminology for theology/science integration that will advance the science-theology dialogue; (b) to report on science and theology relational approaches used by a broad spectrum of scientists, educators, pastors, and students; and (c) to illustrate how the STPS (Science-Theology Paradigm Scale) can be used to promote integrative practices.

## Theoretical Foundations

Most people embrace—consciously or subconsciously—one of several science-theology paradigms. These are mental frameworks (or constructs) for relating scientific understanding and Christian theology. Increased understanding of these science-theology paradigms will lead to more effective and credible communication among an increasingly scientifically literate public.

The relationship between *science* (in the narrow sense of the natural sciences: biology, chemistry, physics, and their subdisciplines)<sup>2</sup> and *religion* (in the narrow sense of biblical theology)<sup>3</sup> in America—and particularly in higher education—changed significantly over the past two centuries as empiricism and naturalism became the characteristic philosophical underpinnings of the university.<sup>4</sup> The new organizing principle in the life sciences, Darwinian evolution, replaced the framework of natural theology in the latter half of the nineteenth century.<sup>5</sup> While some speculate that the gulf is so great between the two that there can be no interplay,<sup>6</sup> recent research into attitudes and beliefs of both

practicing scientists<sup>7</sup> and Christian youth<sup>8</sup> tells us that there is great interest in integrating science and theology. For example, Christian philosophers of science during the last half-century proposed several theoretical patterns for relating science and religion. Following are eight contemporary typologies that provide a broad picture of attempts to develop conceptual frameworks to describe theology and science interactions.

Ian G. Barbour, physicist and late professor emeritus of religion at Carleton College, did much to inaugurate the formal study of the relationship between science and religion and, over a longer period of time than anyone to date, worked to classify the various patterns for relating the two.<sup>9</sup> Consequently, we describe three of his typologies below.

### *Barbour's First Typology*

Noting neo-orthodox theologian H. Richard Niebuhr's classification of five strategies which Christians historically had adopted in attempting to relate Christ and culture,<sup>10</sup> Barbour adapted them in 1960 to apply to the relationship between religion and science: (a) religion against science; (b) religion under science; (c) religion above science; (d) religion separate from science; and (e) religion transforming science. The fifth category, Barbour argued, refers to science and religion in dialogue, in a dynamic interaction in which both are subject to reevaluation. Barbour also noted that science and religion provide complementary modes of description since they ask differing types of questions, refer to differing aspects of experience, and serve differing functions in life.<sup>11</sup>

### *Barbour's Second Typology*

By describing how science and religion could be variously in conflict, isolated from one another (compartmentalized), or in dialogue with one another, Barbour in 1968 outlined a threefold classification scheme for relating science and theology: Conflict, Compartmentalization, and Dialogue. Barbour described "Conflict" as including two opposite extremes. On the one hand, there is a scriptural literalism (in which every word of the Bible is accepted as divinely revealed) that places theology in a superior position to science. On the other hand, there is an evolutionary naturalism (in which the Bible is virtually ignored) that places science in a superior position to theology.<sup>12</sup>

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### *Barbour's Third Typology*

In consecutive publications (1990, 1997), Barbour gave final form to his fourfold typology of the relationship between science and religion: Conflict, Independence, Dialogue, and Integration.<sup>13</sup> In perhaps his most mature treatment of the subject, Barbour in 2000 applied the typology to particular scientific disciplines such as astronomy, quantum physics, evolution, genetics, and neuroscience.<sup>14</sup> Summary descriptions of Barbour's four theoretical types of relationships between science and religion are given here.

1. *Conflict*. Science and religion are enemies. Those operating within the Conflict paradigm must choose between science and religion. Two subcategories ("Scientific Materialism" and "Biblical Literalism") represent the opposite extremes of conflict between science and religion. Both posit that science and religion make rival claims about the same domain (the realm of nature) and both engage in warfare rhetoric.<sup>15</sup>

2. *Independence*. Science and religion are viewed as separate domains, mutually exclusive. "They can be distinguished according to the questions they ask, the domains to which they refer, and the methods they employ."<sup>16</sup> Science asks objective "how" questions, while religion asks personal "why" questions about meaning, purpose, and destiny. The Independence model asserts that the primary sphere of religion is God's activity in history, not nature; theology is based on divine revelation, whereas science is based on human observation and reason. Because science and religion are independent aspects of life, the possibilities of both conflict and constructive dialogue between the two are avoided.

3. *Dialogue*. A more constructive relationship between science and religion, the Dialogue pattern emphasizes the similarities (rather than the differences) between science and religion, while preserving the integrity of each field. "Dialogue may arise from considering the *presuppositions* of the scientific enterprise, or from exploring similarities between the *methods* of science and those of religion, or from analyzing *concepts* in one field that are analogous to those in the other."<sup>17</sup> Barbour notes, "Science is not as objective nor religion as subjective as had been assumed."<sup>18</sup>

4. *Integration*. Advocates of the Integration model argue for a greater degree of conceptual unity

between science and religion than do the adherents of the Dialogue model. Barbour suggested three distinct versions of integration, which he called Natural Theology, Theology of Nature, and Systematic Synthesis.

Other scientist-theologians addressing integration include the late Arthur R. Peacocke (physical biochemist, Anglican priest, and dean of Clare College, Cambridge) and John C. Polkinghorne (theoretical physicist, Anglican priest, and president of Queens' College, Cambridge).<sup>19</sup>

### *Peacocke's Typology*

Peacocke identified eight "possible loci of proposed interactions on this two-dimensional grid" of modern science and Christian theology.<sup>20</sup> The eight models are as follows:

1. *Science and theology are concerned with two distinct realities*. In this model, "reality is conceived of as existing in dual orders, a duality, both existing in our world" (p. xiii). This duality encompasses separately (a) the temporal, the natural, the order of nature, and the physical-biological; and (b) the eternal, the supernatural, the realm of faith, and the mind-spirit. In effect there are two realities, and, because science and theology are concerned with two separate and distinct realms, no interaction is possible.

2. *Science and theology are interacting approaches to the same reality*. There is only one reality, so interaction between science and theology is possible. In this model, science and theology theoretically would have equal opportunity to influence change in the other, but Peacocke noted that this model requires change in one direction: "modifications ... in theological affirmations and ... attitudes to science" (p. xiv).

3. *Science and theology are two distinct noninteracting approaches to the same reality*. Unlike Model #1, in this model there is only one reality, not two, so interaction between science and theology is possible, as it is in Model #2. However, unlike Model #2, in this Model #3, science and theology do not interact because they examine different aspects of their shared reality. In this scenario, for example, science deals with observable qualities such as prediction and control (the question "how"), and theology deals with ultimate goals and meaning (the question "why").



4. *Science and theology constitute two distinct language systems.* Though science and theology may or may not deal with the same reality, they experience little or no intracommunication and, therefore, one can have no bearing on the other.

5. *Science and theology are generated by quite different attitudes by their practitioners.* In this model, scientists are characterized by attitudes of logical neutrality and objectivity; theologians, by subjective involvement and commitment.

6. *Science and theology are both subservient to their distinctive objects and can only be defined in relation to them.* Both include confessional and rational factors: science has “faith” in the intelligibility of nature and in the orderliness of the universe; theology has faith in God. “Both are intellectual disciplines shaped by their object (nature or God) to which they direct their attention” (p. xiv).

7. *Science and theology may be integrated by using scientific concepts in theology.* Many advances in the natural sciences are consonant with theological perspectives. Scientific notions may be utilized to illuminate theological insights.

8. *Science generates a metaphysic in terms of which theology is then formulated.* This metaphysic develops from either the content of science or the philosophy of science.

While Peacocke’s eightfold model certainly identifies issues to consider in the interaction of natural science and Christian theology, it lacks some of the simplicity, logical consistency, and structural symmetry of later science-theology integrative schema.<sup>21</sup>

### *Polkinghorne’s Typology*

Polkinghorne suggested four possible “points of interaction” between science and theology.

1. *Total Absorption.* There is nothing but scientifically discerned reality. All nonscientific levels of meaning, such as theological beliefs, are ultimately subverted by a thoroughgoing scientific reductionism (the philosophy that the whole is nothing more than the sum of the parts). All is physics.<sup>22</sup>

2. *Conflicts.* Conflicts arise when knowledge appears to have discredited the plain meaning of scripture

(e.g., origins, miracles, future life). In this sense, science plays a “surgical” or “antiseptic” role with interpretation of the Bible.<sup>23</sup> Polkinghorne notes that biology academicians often display hostility toward religion in writings that target the general educated public; he, however, rejected the conflict model and the easy, “ill-judged reductionist triumphalism” of some biologists.<sup>24</sup> “Only in the media, and in the popular and polemical scientific writing, does there persist the myth of the light of pure scientific truth confronting the darkness of obscurantist religious error.”<sup>25</sup>

3. *Natural Theology.* Such a position maintains that there must be harmony or consonance between the assertions made by science and theology about the world. The physical world demonstrates certain theological truths, such as the arguments from design that provide support for the doctrine of Divine Origins.<sup>26</sup>

4. *Mutual Influence of Modes of Thought.* Both science and theology seek understanding of the one reality of the world and are capable of mutually influencing each other by analogies of thought. One might learn lessons that might be relevant to the other, such as scientists’ discovery of the wave-particle duality of light in the development of quantum field theory and theologians’ understanding of the God-man duality of Jesus Christ in the development of Christology.<sup>27</sup>

### *Wright’s Typology*

Biologist Richard Wright named four patterns for relating theology and science.<sup>28</sup>

1. *Concordism:* The Bible contains vital information about the natural world that can supplement the information gathered by the direct study of nature, and these two sources of information will harmonize when properly understood. There are gaps in both the biblical and scientific record, and a thorough understanding comes only from study of both sources of data.

2. *Substitutionism:* The Bible contains scientific truth and, because the Bible is understood to be God’s literal and authoritative Word, Bible science is more trustworthy than conventional science. Therefore the science of the Bible (“creation science”) is to be substituted for the naturalistic interpretations of scientists.

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3. *Compartmentalism*: Science and theology deal with entirely separate realms, and they must be kept apart. The Bible is not a handbook of science, and there is no common ground on which the Bible and science can meet. The creation account in Genesis is considered mythological, and evolution presents no problem to Christian compartmentalists unless it is extended into a worldview that excludes the possibility of Christian faith.

4. *Complementarism*: Both biblical truth and scientific knowledge are needed for a balanced view of origins and the natural world. They are not competing views, nor completely separate; they complement each other. They offer different kinds of explanations because they ask different kinds of questions, employ different methodologies, and have different purposes. Complementarists recognize the limitations of both fields (theology and science) and so feel free to generate complementary explanations of the natural world.

### *Bube's Typology*

In a book published as the culmination of his career-long study of the relationship between science and Christian theology, Richard Bube, a physicist and professor of materials science and electrical engineering, proposed seven theoretical patterns.<sup>29</sup>

1. *Science Has Destroyed Christian Theology*: Science and theology tell us the same kind of things about the same realm. When scientific and theological descriptions conflict, one must be right and the other wrong; in this encounter, scientific descriptions always prove to be the winner (similar to Barbour's "Conflict-Scientific Materialism" category).

2. *Christian Theology in Spite of Science*: Science and theology tell us the same kind of things about the same realm. When scientific and theological descriptions conflict, one must be right and the other wrong; in this encounter, theological descriptions always prove to be correct (similar to Wright's "Substitutionism" and Barbour's "Conflict-Biblical Literalism" category).

3. *Science and Christian Theology Are Unrelated*: Science and theology tell us different kinds of things about different realms. There is no common ground. Science has absolutely nothing to say about theology; theology has absolutely nothing to say about

science. Conflict is impossible by definition (similar to Wright's "Compartmentalism" and Barbour's "Independence" category).

4. *Science Demands Christian Theology*: Science and theology tell us the same kind of things about the same realm. An understanding of the scientific descriptions of the world provides such overwhelming evidence of the truths of the Bible and Christian theology that one has no defensible choice but to believe them (similar to Wright's "Concordism" and Barbour's "Integration-Natural Theology" category).

5. *Science Redefines Christian Theology*: Science and theology tell us the same kind of things about the same realm. Traditional biblical theology must be completely redefined to be consistent with the developments of modern science. Since religious beliefs are a product of evolutionary development, theology will continue to be transformed by increasing scientific knowledge (similar to Barbour's "Integration-Theology of Nature" category).

6. *A New Synthesis of Science and Christian Theology*: Science and theology should tell us the same kind of things about the same realm, but the present status of science and theology makes this impossible. Both science and theology need to be transformed radically into new approaches compatible with one another and a new understanding of reality (similar to Barbour's "Integration-Systematic Synthesis" category).

7. *Christian Theology and Science: Complementary Insights*: Science and theology tell us different things about the same realm. Each, when true to its own authentic capabilities, provides us with valid insights into the nature of reality from different perspectives. These two types of insights must be integrated to obtain a coherent and adequate view of reality (similar to Wright's "Complementarism" and Barbour's "Dialogue" categories).

### *Carlson's Typology*

With the assistance of six contributors to the volume he edited, physicist Richard F. Carlson identified five patterns for relating science and theology, arguing that "there is no single distinctly Christian viewpoint on matters of the relationship of natural science and Christian faith."<sup>30</sup> Quickly dismissing the first pattern, Scientism, since it makes no room at

all for theology, he presented four principal, distinct viewpoints held by Christians, especially in the US. Carlson's fivefold schema follows:

1. *Scientism (or Scientific Materialism)*: Science is the only avenue to truth. When science and religion are in conflict, science is always preeminent. This is the position of "scientific imperialism" (similar to Bube's "Science Has Destroyed Christian Theology" and Barbour's "Conflict-Scientific Materialism" categories).
2. *Creationism*: When Christian belief and science are in conflict, Christianity is preeminent. In any conflict between scientific and theological conclusions, the science is considered to be defective, incomplete, or inadequate (similar to Bube's "Christian Theology in Spite of Science," Barbour's "Conflict-Biblical Literalism," and Wright's "Substitutionism").
3. *Independence*: Both science and theology are valued in themselves, but each is seen as parallel to the other and thus not interacting. Since there is no common ground shared by science and Christianity, there is no possibility for conflict (similar to Bube's "Science and Christian Theology Are Unrelated," Barbour's "Independence," and Wright's "Compartmentalism").
4. *Qualified Agreement*: Science and theology overlap, and many of the findings of science are acceptable (except for contemporary Darwinism and theories of chemical evolution) to Christian theology. When science and theology are in conflict, the best way to explain the scientific data is to extend science beyond a purely naturalistic methodology and posit an intelligent designer (similar to Bube's "Science Demands Christian Theology" and Barbour's "Integration-Natural Theology" and somewhat similar to Wright's "Concordism").
5. *Partnership*: A full integration of science and theology in which they work together as partners in theorizing about important matters. The two enterprises dialogue and influence each other, and the contributions of both are valued. Science and theology are not seen as threats to each other, but science can enhance theology and theology can inform science (similar to Bube's "Christian Theology and Science: Complementary Insights," and Wright's "Complementarism," and somewhat similar to Barbour's "Dialogue" category).

## Synthesis of the Theoretical Science-Theology Paradigms

Employing the criteria of *parsimony* (economy of explanation), *symmetry* (balance of opposing paradigms), and *salience* (inclusion of only the most important and relevant paradigms), we synthesized the above-mentioned schemes into a fivefold model. This model is theoretically grounded and has been empirically tested. Content validity was established by a panel of experts, construct validity was confirmed via principal components analysis, and reliability testing showed that it is internally consistent. These five paradigms are not mutually exclusive. People often utilize more than one of them simultaneously.

1. *Conflict: Theology over Science* or "Theologians Know Best" is that pattern of relating theology and science in which theology and science fundamentally conflict with each other. When such conflicts arise, theological explanations should be accepted as correct. Kurt Wise (paleontologist and student of Stephen Jay Gould)<sup>31</sup> and Ken Ham (director of the young earth creationist ministry, "Answers in Genesis")<sup>32</sup> embrace this model.
2. *Conflict: Science over Theology* or "Scientists Know Best" is the paradigm in which theology and science fundamentally conflict with each other in describing reality, and scientific explanations naturally should be accepted as correct. This model is utilized by many atheists such as Richard Dawkins, Daniel Dennett, Sam Harris, and Christopher Hitchens.
3. In *Compartmentalism*, theology and science describe completely separate realities, and because of this separation neither conflict nor agreement between scientific and theological descriptions of reality can exist. In other words, "they share no common ground." Agnostics Stephen Jay Gould, who coined the terminology "non-overlapping magisteria" (or NOMA),<sup>33</sup> and Neil deGrasse Tyson<sup>34</sup> exemplify the use of this paradigm.
4. *Complementarism* posits that both theology and science are incomplete. Theology and science describe different aspects of reality but, taken together, an accurate scientific description and an accurate theological description should provide a more complete understanding of reality. This paradigm is utilized by Denis Lamoureux<sup>35</sup> and



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Francis Collins<sup>36</sup> and was the overarching framework for a five-year “Science and Religion” series conducted by philosophers and scientists speaking at various Chinese universities.<sup>37</sup>

5. The moniker “*Concordism*” that we have chosen to use for our fifth category carries with it much historical and philological baggage. We summarize its varied use in the following paragraphs. For our research purposes, we define Concordism in the following way. Concordists assume, with respect to the relationship between theology and science, agreement or harmony. Concordism is not the expectation of a one-to-one relationship between biblical and scientific propositions. Rather, as Hugh Ross says, “the scientific record and the biblical message of creation extensively overlap.”<sup>38</sup> For our purposes, we do not need to agree on exactly what is meant by “extensively,” and it is evident that agreement can occur only when the two disciplines are probing the same phenomenon or idea. Further, Concordism does not require scientists and theologians to use the same tools and processes, but their conclusions should be compatible. If they disagree, one or the other or both are wrong—or they just seem to disagree due to reference frame or phenomenological differences. Plantinga sees science and religion in superficial conflict and in deep harmony.<sup>39</sup> We do, too.

Writers have defined Concordism in myriad ways, some of which conflict. We offer a brief overview. Randy Isaac describes a Concordism continuum from “strong” to “weak.”<sup>40</sup> A position at one end of this continuum could be called “nonconcordist.” Strong concordists anticipate complete agreement between science and the scriptures, whereas weak concordists (a.k.a. accommodationists) expect to see less agreement. The latter view derives from the idea that the biblical record was adapted to the worldview and cultural milieu of the first hearers/readers. Nonconcordists, at the opposite end of the continuum, would not anticipate any agreement. Some examples of Concordists follow. Carol Hill promotes a moderate concordist position that she calls “The Worldview Approach.”<sup>41</sup> Hugh Ross, a strong concordist, says “Concordists see complete harmony...between the biblical account and nature’s record.”<sup>42</sup> John Walton, who might, in Isaac’s schema, be termed a weak concordist, posits that Genesis 1 was “an account of functional...rather than an

account of material origins...”<sup>43</sup> Amos Yong continues along this vein by suggesting that a Pentecostal hermeneutic should yield more of a complementary melding of readings of nature and scripture rather than a strong concordist interpretation.<sup>44</sup>

In a similar but slightly different manner, Lamoureux defines “strict” and “general” Concordism. Strict Concordism accepts young earth creation. General Concordism accepts old earth creation. For both, any direct correlation between science and the Bible is proof of divine inspiration because scripture was written before modern science.<sup>45</sup> Ted Davis<sup>46</sup> and Bernard Ramm<sup>47</sup> equate (hard) Concordism with old earth creationism (a.k.a. progressive creationism).

Lamoureux, a critic of Ross’s strong Concordism, differentiates between scientific, theological, and historical Concordism. For example, theological concordists believe that “the Holy Spirit revealed scientific facts to the biblical writers thousands of years before their discovery by science.”<sup>48</sup>

Although not specifically evaluated by the survey instrument described in this article, some people expect scientists and theologians to actively seek integration whenever possible. They should embrace each other’s methods and contributions whenever appropriate. This differs from the complementarist approach of simply “adding” science and theology together to get a more complete picture. We call people with this perspective integrational Concordists. They promote a dynamic interaction between the two: a deep interdependence. They believe that science, when taking into account ethical and theological considerations, does not look the same as science that leaves “those subjective concerns” to the theologians. In the same vein, theology benefits from the findings of science when the various origins positions held by Christians are examined. Integrational Concordism is similar to “Theistic Science” as advocated by Moreland and Craig,<sup>49</sup> and the “Creative Mutual Interaction” of Russell.<sup>50</sup> By definition, these approaches are antithetical to the methodological naturalism advocated by many scientists. Like Moreland, Craig, and Russell, integrational Concordists believe that there are truths that can only be adequately explored through the deep collaborations of theology and science.

## Development of a Valid and Reliable Science-Theology Paradigm Scale

One of us (Bundrick) created a survey instrument to measure science-theology paradigms used by scientists as part of his doctoral research in 2003.<sup>51</sup> We reduced the instrument's length and confirmed its reliability and validity in 2011 using responses of participants in the inaugural Faith and Science Conference sponsored by the Assemblies of God.<sup>52</sup>

Prior to Bundrick's Science-Theology Paradigm Scale (STPS; originally the Science-Faith Paradigm Scale 2003), no survey instrument existed to measure theoretical patterns for relating science and theology. To ensure that the STPS would have good validity and initial reliability, standard procedures for developing psychometric instruments (surveys) in the affective domain were followed,<sup>53</sup> including standard protocols for producing and implementing the online survey.<sup>54</sup> Subjects responded anonymously and confidentially to survey items. The longer 2003 version initially incorporated 79 questionnaire items that had been judged by a panel of expert raters to correspond to the conceptual definitions of the five theoretical paradigms.<sup>55</sup> The survey was later pared down to 50 items via exploratory factor analysis. Also included in the survey were demographic items and three existing scales to assist in evaluating construct validity: the Scientific Attitude Inventory II,<sup>56</sup> the Francis Scale of Attitudes toward Christianity—Adult Form, Short Version,<sup>57</sup> and the Marlowe-Crowne Social Desirability Scale—Short Form C.<sup>58</sup> The shorter 2011 STPS version (see Appendix) has 25 items, selected from the larger survey by factor analysis.

### *The Sample: Science Professors*

The investigator employed a stratified random sample methodology to collect data within each specific strata of college and university science professors in the US: (a) gender; (b) ethnicity; (c) science discipline (e.g., chemistry, biology, geology, astronomy); (d) academic rank (instructor, assistant professor, associate professor, professor); (e) type of institution (public, private-not religious, private-Catholic, private-Protestant, and private-other religion) where the science professors served; (f) categories of institutions (e.g., Research I university or community college) as formerly classified by the Carnegie

Foundation for the Advancement of Teaching; (g) personal religious affiliation (None, Evangelical Protestant, Mainline Protestant, Catholic, Other) of the professors; and (h) self-reported religious commitment (minimum, below average, average, above average, maximum) of the scientists surveyed. A sample of 1,500 college and university science professors teaching in the "hard sciences," both life and nonlife, was thus delineated.<sup>59</sup> Data from 312 acceptable survey responses were analyzed.<sup>60</sup> Initial analysis verified that there was a fairly even distribution of survey responders in terms of their demographic variables (itemized in this case as a-h).

### *Survey Validity and Reliability*

Principal components analysis can tell researchers how many latent variables or components underlie survey responses. That is, it can help researchers identify the mental constructs or ways of thinking that survey takers use to respond to survey statements.<sup>61</sup> Principal components analysis of these data provided strong empirical evidence for the existence of the five anticipated components or "science-theology paradigms": Factor 1 *Conflict: Science over Theology*;<sup>62</sup> Factor 2 *Conflict: Theology over Science*; Factor 3 *Compartmentalism*; Factor 4 *Complementarism*; and Factor 5 *Concordism*.<sup>63</sup> Factor loading analysis<sup>64</sup> yielded a 50-item Science-Theology Paradigm Scale (STPS) consisting of five subscales, each possessing strong content validity,<sup>65</sup> construct validity,<sup>66</sup> and initial reliability.<sup>67</sup> Later iterations of the instrument have confirmed its reliability and validity.

Reliability refers to the internal consistency of each STPS subscale (component or factor). Each factor corresponds to one of the five science-theology paradigms. Cronbach's alpha (coefficient of reliability) is the most common measure of internal consistency, that is, how closely related a set of items are as a group.<sup>68</sup> A Cronbach's alpha of 0.70 or greater (1.0 is maximum internal consistency) is generally accepted as adequate evidence of reliability. The Cronbach's alphas of the five STPS subscales ranged from 0.87 to 0.95. This means that if we repeated the survey with the same sample population, we would probably get the same results.

### *Identification of Science-Theology Paradigms of Scientists*

Producing a valid STPS with initial reliability was successful. However, is such a survey instrument



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able to identify the theology-science relational paradigms actually employed in practice by various people? In an attempt to answer that question, we assessed the potential usefulness and adequacy of the STPS to differentiate groups of respondents based on their affinities with one or more of the five science-theology paradigms.

A comparison of differences in mean standardized scores on the five STPS subscales (science-theology paradigms) demonstrated that the STPS successfully

differentiated among groups of respondents on the basis of various demographic variables. While, in general, it did not appear that respondents' *gender, race, ethnicity, or science discipline* influenced their scores on the five STPS subscales, the variables of personal *religious affiliation* and self-reported levels of *religious commitment* correlated highly significantly with all five factors (Table 1). Initial apparent correlations with other demographic variables disappeared when they were controlled for religious commitment and religious affiliation.

**Table 1.** Pearson Correlations between Scores on the Science-Theology Paradigm Scale Factors and Demographic Variables

Demographic Variable	Factors				
	1	2	3	4	5
Gender	-.019	.046	.091	-.086	.034
Race	-.024	.009	.011	.022	-.002
Hispanic	-.056	.081	-.033	.032	.076
Academic Discipline	-.027	.005	.001	-.015	.021
Religious Affiliation	-.280**	.204**	-.250**	.243**	.268**
Religious Commitment	-.713**	.525**	-.592**	.609**	.577**
Institution Type	-.309**	.118	-.238**	.336**	.205**
Academic Rank	.001	-.142*	.057	-.043	.034
Carnegie Classification	-.042	.177**	-.137*	.031	.097

\* Correlation is significant at the 0.05 level (2-tailed).

\*\* Correlation is significant at the 0.01 level (2-tailed).

### SCIENCE FACULTY, 2003

Survey respondents were deemed to embrace a paradigm if they agreed or strongly agreed with 80% of the survey statements aligned with that position. While many (46%) science faculty did not use any science-theology paradigm, a majority (54%) incorporated at least one (Table 2).

**Table 2.** Science Faculty Who Used No, One, or Two Simultaneous Science-Theology Paradigms (n=312; 2003)

Science-Theology Paradigm Used	% (n)
None	46.5% (145)
One Only	42.6% (133)
Two Simultaneous	10.9% (34)
Total	100.0% (312)

Our research did not support the popular notion that most scientists use either the Conflict: Science over Theology or the Compartmentalism (science

and theology share no common ground) paradigms. Rather, for scientists using only one paradigm, Complementarism (science and theology are incomplete without the other) was the plurality paradigm (70%), followed by Conflict: Science over Theology (14%), Concordism (8%), Compartmentalism (5%) and Conflict: Theology over Science (2%) (Table 3).

**Table 3.** Science-Theology Paradigms of Science Faculty Employing Only One Science-Theology Paradigm (n=133)

Science-Theology Paradigm	% (n)
Complementarism	69.9% (93)
Conflict: Science over Theology	14.3% (19)
Concordism	8.3% (11)
Compartmentalism	5.3% (7)
Conflict: Theology over Science	2.2% (3)
Total	100.0% (133)

Similar results were found for scientists using two simultaneous paradigms; Complementarism with Concordism (41%), Conflict: Science over Theology with Compartmentalism (38%), Conflict: Theology over Science with Concordism (15%), Compartmentalism with Complementarism (3%), and Conflict Science over Theology with Complementarism (3%) (Table 4).

**Table 4.** Science Faculty Using Two Science-Theology Paradigms Simultaneously (n = 34)

Combined Science-Theology Paradigm	% (n)
Complementarism with Concordism	41.2% (14)
Conflict: Science over Theology with Compartmentalism	38.2% (13)
Conflict: Theology over Science with Concordism	14.7% (5)
Compartmentalism with Complementarism	2.9% (1)
Conflict: Science over Theology with Complementarism	2.9% (1)
Total	99.9% (34)

Similar findings were reported by sociologist Elaine Ecklund.<sup>69</sup> She described in-depth interviews with 275 natural and social scientists at the top twenty-one US research universities. The great majority (70%) seek to “develop overlapping and context-specific narratives for negotiating religion-science relationships.” Only 15% saw religion and science in conflict, and another 15% believed that religion and science are never in conflict because they have nothing to say to each other (Compartmentalism). Ecklund also reported that scientists are only slightly less religious than the general US population and that about 50% of evangelicals believe that science and religion can inform each other (compared to 38% of Americans).<sup>70</sup>

The science-theology paradigm embraced by any particular science professor has very much to do with personal religious affiliation (Evangelical Protestant, Mainline Protestant, Catholic, Other, or None) and degree of commitment to that religion.

As a group, only science professors reporting their religious affiliation to be “None” employed either the Conflict: Science over Theology paradigm or the Compartmentalism paradigm.

Those respondents identifying with more conservative religious affiliation (Evangelical Protestant), compared to those identifying with more liberal religious affiliation (Mainline Protestant) and “Other,” were far more likely to shun the Conflict: Science over Theology or the Compartmentalism paradigms—with Catholics on average being more comparable to mainline Protestants.

Nonreligious-affiliated science professors scored extremely negatively on the Conflict: Theology over Science subscale. Evangelical Protestant science professors did not embrace the Conflict: Theology over Science paradigm, but they were far less likely than others to shun its use.

Generally, all categories of science professors, except that of “None” (no religious affiliation), scored positively on the Complementarism paradigm—but with distinctly different average scores: Evangelical Protestants the highest, Catholics next, Mainline Protestants low, and “Other” lowest.

Finally, with respect to religious affiliation, only Evangelical Protestant science professors as a group identified positively with the Concordism paradigm. Those not religiously affiliated were dramatically distant from the Concordism paradigm.

Similar patterns of differences in average scores among groups of respondents are observable on the demographic variable of religious commitment (self-reported on a scale from “minimum” to “maximum”). Average scores on the Complementarism, Concordism, and Conflict: Theology over Science paradigm subscales increased in direct proportion to increases in reported levels of religious commitment. That is, the more committed a science professor is to her religion, the more likely she is to employ one of these three patterns for relating science and theology.

Conversely, average scores on the Compartmentalism and Conflict: Science over Theology paradigm subscales decreased in direct proportion to increases in reported levels of religious commitment. That is, the more committed a science professor is to his religion, the less likely he will be to employ one of these two patterns for relating science and theology.

These findings illustrate the value of the STPS in the examination of how scientists relate theology and science. When the respondents’ personal religious

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affiliation was taken into account, scores varied greatly on the Compartmentalism subscale on the basis of gender. Female respondents (regardless of religious affiliation) scored much lower than males on the Compartmentalism subscale. In other words, female college and university science professors were significantly less likely than males to compartmentalize their scientific and theological perspectives about the natural world.

We formed three major conclusions from the development of the STPS and its application to science faculty. First, the data demonstrate the existence of at least five broadly synthesized patterns of relating science and theology in the tradition of Western Christianity among college and university science professors in the United States. Second, the STPS can measure the degree to which individuals identify with the respective science-theology paradigms. Third, through preliminary exploratory analysis of differences in mean STPS scores based on demographic variables, evidence indicates that the STPS is capable of differentiating among groups.

### AG EDUCATORS, PASTORS, AND STUDENTS, 2011

We also used the STPS to examine science and theology relational approaches of Assemblies of God (AG) constituents. Survey respondents were 117 AG pastors, educators, and students who attended a faith and science conference sponsored by the AG in June 2011 (240 total conference attendees).

Most respondents were male (80%), older than 30 (60%), affiliated with the AG (78%), and very religiously committed (99%). Their areas of expertise were evenly divided among science, theology, and "other." Most were educators (30%), pastors (27%) and students (9%).

Principal components analysis suggested that the respondents used four science-theology constructs: "Conflict: Theology over Science," "Complementarism with Concordism," "Anti-Compartmentalism," and "Anti-Conflict-Science over Theology." These findings correspond well with the empirical constructs described earlier in this article. Reliabilities (Cronbach's alpha) were acceptable, ranging from 0.80 to 0.68 for the four factors.

Respondents were determined to be affiliated with a particular science-theology paradigm if they agreed

or strongly agreed with 80% of the survey statements allied with that position. A few (21%) respondents did not align with any science-theology paradigm. A plurality aligned with one (50%), and some (29%) conflated two or three science-theology paradigms (Table 5).

**Table 5.** AG Constituents Who Used No, One, Two, or Three Simultaneous Science-Theology Paradigms (n=117; 2011).

Science-Theology Paradigm Used	% (n)
None	20.5% (24)
One Only	50.4% (59)
Two Simultaneous	23.1% (27)
Three Simultaneous	6.0% (7)
Total	100.0% (117)

Most respondents who used only one science-theology paradigm utilized Complementarism (76%), followed by Concordism (12%) and Conflict: Theology over Science (12%) (Table 6).

**Table 6.** Science-Theology Paradigms of AG Constituents Employing Only One Science-Theology Paradigm (n=59).

Science-Theology Paradigm	% (n)
Complementarism	76.3% (45)
Concordism	11.9% (7)
Conflict: Theology over Science	11.9% (7)
Total	100.0% (59)

Respondents using two or three simultaneous science-theology paradigms favored Complementarism with Concordism (78%), followed by Conflict: Theology over Science with Complementarism (15%), and Conflict: Theology over Science with Concordism (7%) (Table 7). Seven (6%) combined three: Conflict: Theology over Science with Concordism and with Complementarism (Table 5).

**Table 7.** AG Constituents Using Two Science-Theology Paradigms Simultaneously (n=27).

Combined Science-Theology Paradigm	% (n)
Complementarism with Concordism	77.8% (21)
Conflict: Theology over Science with Complementarism	14.8% (4)
Conflict: Theology over Science with Concordism	7.4% (2)
Total	100.0% (27)



We found that this group related theology and science to a high degree. Nearly 80% of respondents used some combination of Concordism, Complementarism, and Conflict: Theology over Science. Of these, the two integrative approaches (Concordism and Complementarism) were often conflated. One of the conflict paradigms (Conflict: Theology over Science) was solidly represented also. The scientists in this group ( $n=23$ ) favored Complementarism.

#### STUDENTS AT A CHRISTIAN UNIVERSITY IN THE SOUTH, 2014

Five hundred fifty-one students at a large Christian university in the South completed the STPS during the Spring 2014 semester. They identified themselves as Protestant Christian (62.6%), Catholic Christian (20.3%), nonreligious (8.3%), and religious non-Christian (3.8%). Most (52.6%) were freshmen, followed by sophomores (28.1%), juniors (10.9%), and seniors (8.2%). They majored in a wide array of disciplines: Life Sciences (39.0%), Social Sciences (23.6%), Physical Sciences (5.6%), and other (20.3%). Nearly all respondents (99.1%) were younger than 24 years of age.

Most of the respondents used only one paradigm (51.0%; Table 8), and the most common single approach was Complementarism (Table 9). The other paradigms were used by relatively few people (Table 9). Many fewer people used two paradigms at the same time (12.7%), three simultaneously (1.6%), and four at the same time (0.2%). A significant percentage (34.2%) did not use any identifiable science-theology paradigm (Table 8).

**Table 8.** Christian University in the South Respondents Who Used No, One, Two, Three, or Four Simultaneous Science-Theology Paradigms ( $n=551$ ; 2014).

Science-Theology Paradigm Used	% (n)
None	34.1% (188)
One Only	51.0% (283)
Two Simultaneous	12.7% (70)
Three Simultaneous	1.6% (9)
Four Simultaneous	0.2% (1)
Total	100.0% (551)

**Table 9.** Science-Theology Paradigms of Christian University in the South Respondents Employing Only One Science-Theology Paradigm ( $n=283$ ).

Science-Theology Paradigm	% (n)
Complementarism	70.7% (200)
Conflict: Theology over Science	10.2% (29)
Conflict: Science over Theology	7.4% (21)
Concordism	6.4% (18)
Compartmentalism	5.3% (15)
Total	100.0% (283)

A large majority (41.4%) of respondents using two simultaneous science-theology paradigms favored Complementarism with Concordism (Table 10). Eight other combinations were used, with Conflict: Theology over Science with Complementarism as the next most frequently utilized paradigms (28.6%).

**Table 10.** Christian University in the South Respondents Using Two Science-Theology Paradigms Simultaneously ( $n=70$ ).

Combined Science-Theology Paradigm	% (n)
Complementarism with Concordism	41.4% (29)
Conflict: Theology over Science with Complementarism	28.6% (20)
Conflict: Science over Theology with Compartmentalism	11.4% (8)
Conflict: Theology over Science with Concordism	10.0% (7)
Conflict: Science over Theology with Complementarism	2.9% (2)
Conflict: Science over Theology with Concordism	1.4% (1)
Conflict: Theology over Science with Compartmentalism	1.4% (1)
Compartmentalism with Complementarism	1.4% (1)
Compartmentalism with Concordism	1.4% (1)
Total	100.0% (70)

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Ten respondents (1.8% of the total) used three and four paradigms simultaneously (Table 11).

**Table 11.** Christian University in the South Respondents Using Three and Four Science-Theology Paradigms Simultaneously (n=10).

Combined Science-Theology Paradigms	% (n)
Conflict: Science over Theology with Complementarism with Concordism	40% (4)
Conflict: Theology over Science with Complementarism with Concordism	30% (3)
Conflict: Science over Theology with Compartmentalism with Concordism	10% (1)
Conflict: Theology over Science with Compartmentalism with Complementarism	10% (1)
Conflict: Science over Theology with Conflict: Theology over Science with Complementarism with Concordism	10% (1)
Total	100% (10)

This population is more similar to the science faculty surveyed in 2003 than to any of the other studied

populations (AG educators, pastors, and students [2011], Protestant educators, pastors, and students [2014], faith and science conference attendees [2014] or the faculty and students at AG colleges and universities [2014–2015]). Nevertheless, as with each of the other populations, Complementarism is the dominant relational approach used.

Starting with this sample, and continuing with subsequent groups, we also asked them to indicate their preferred origins model (Young Earth Creation (YEC), Old Earth Creation (OEC), Evolutionary Creation (EC; a.k.a. Theistic Evolution), Deistic Evolution (DE), and Atheistic Evolution (AE)). We examined these perspectives for those who used only one or no science-theology paradigm (n=471; Table 8).

As expected, most atheistic evolutionists favored Conflict: Science over Theology and no science-theology paradigm. Deistic evolutionists, evolutionary creationists, old earth creationists, young earth creationists favored Complementarism or no science-theology paradigm (Table 12).

**Table 12.** Origins Perspective and Dominant Science-Theology Paradigm Used by Students at a Christian University in the South (n=471)

Science-Theology Paradigm Used							
Origins Perspective	Concordism % (n)	Comple-mentarism % (n)	Compartmentalism % (n)	Conflict: Theology over Science % (n)	Conflict: Science over Theology % (n)	None Used % (n)	Total % (n)
YEC	3.6% (3)	37.3% (31)	4.8% (4)	18.1% (15)	1.2% (1)	34.9% (29)	17.6% (83)
OEC	4.3% (5)	44.3% (51)	2.6% (3)	6.1% (7)	4.3% (5)	38.3% (44)	24.4% (115)
EC	5.2% (8)	52.9% (81)	2.0% (3)	1.3% (2)	0.0% (0)	38.6% (59)	32.5% (153)
DE	2.2% (1)	46.7% (21)	4.4% (2)	4.4% (2)	4.4% (2)	37.8% (17)	9.6% (45)
AE	0.0% (0)	12.5% (3)	8.3% (2)	0.0% (0)	45.8% (11)	33.3% (8)	5.1% (24)
Other	2.0% (1)	25.5% (13)	2.0% (1)	5.9% (3)	3.9% (2)	60.8% (31)	10.8% (51)
Total	3.8% (18)	42.5% (200)	3.2% (15)	6.2% (29)	4.5% (21)	39.9% (188)	100.0% (471)

## PROTESTANT PASTORS, EDUCATORS, AND STUDENTS, 2014

In June 2014, 109 attendees at a faith and science conference sponsored by the General Secretary of the AG, Evangel University, and the Pensmore Foundation, completed the STPS survey. Respondents were church leaders (30.8%), college educators (26.5%), college students (2.6%), and "other" (40.1% including business owners, high school teachers, medical professionals, etc.) (350 total attendees).

Most respondents were Protestant Christian (90.6%), Pentecostal (76.1%), and above-average to maximally religiously committed (92.4%). Their areas of expertise were evenly divided among science, theology, and "other."

Compared to the previous populations studied, this group exhibited a very high degree of integration. Only 11% did not utilize any integrative approach (Table 13), and the Conflict: Science over Theology and Compartmentalism approaches were not utilized at all (Table 14).

Forty-four percent utilized only one science-theology paradigm, while 45% used more than one paradigm at the same time. (Table 13).

**Table 13.** 2014 Faith and Science Conference Respondents Who Used No, One, Two, or Three Simultaneous Science-Theology Paradigms (n=109).

Science-Theology Paradigm Used	% (n)
None	11.0% (12)
One Only	44.0% (48)
Two Simultaneous	34.9% (38)
Three Simultaneous	10.1% (11)
Total	100.0% (109)

For single paradigm users, Complementarism dominated (68.8%), followed by Conflict: Theology over Science and Concordism (Table 14).

**Table 14.** 2014 Faith and Science Conference Respondents Employing Only One Science-Theology Paradigm (n=48).

Science-Theology Paradigm	% (n)
Complementarism	68.8% (33)
Conflict: Theology over Science	18.8% (9)
Concordism	12.5% (6)
Conflict: Science over Theology	0.0% (0)
Compartmentalism	0.0% (0)
Total	100.0% (48)

The preferred two-paradigm approach was Complementarism with Concordism (57.9%). Conflict: Theology over Science with Complementarism (29.0%) and Conflict: Theology over Science with Concordism (13.2%) were combined less frequently (Table 15).

**Table 15.** 2014 Faith and Science Conference Respondents Using Two Science-Theology Paradigms Simultaneously (n=38).

Combined Science-Theology Paradigm	% (n)
Complementarism with Concordism	57.9% (22)
Conflict: Theology over Science with Complementarism	29.0% (11)
Conflict: Theology over Science with Concordism	13.2% (5)
Total	100.0% (38)

Eleven respondents (10.1% of the total) used three paradigms simultaneously (Conflict: Theology over Science with Compartmentalism and with Concordism).

The relationships between origins views and science-theology paradigms are summarized in Table 16. Young earth creationists favored Conflict: Theology over Science while old earth creationists and evolutionary creationists relied on Complementarism.



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**Table 16.** Origins Perspective and Dominant Science-Theology Paradigm of 2014 Faith and Science Conference Respondents (n=59)

Origins Perspective	Science-Theology Paradigm						Total % (n)
	Concordism % (n)	Complementarism % (n)	Compartmentalism % (n)	Conflict: Theology over Science % (n)	Conflict: Science over Theology % (n)	None Used % (n)	
YEC	9.1% (1)	18.2% (2)	0.0% (0)	54.5% (6)	0.0% (0)	18.2% (2)	18.6% (11)
OEC	12.5% (4)	68.8% (22)	0.0% (0)	6.3% (2)	0.0% (0)	12.5% (4)	54.2% (32)
EC	0.0% (0)	66.7% (4)	0.0% (0)	0.0% (0)	0.0% (0)	33.3% (2)	10.2% (6)
DE	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
AE	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
Other	10% (1)	50% (5)	0.0% (0)	10% (1)	0.0% (0)	30% (3)	16.9% (10)
Total	10.2% (6)	55.9% (33)	0.0% (0)	15.2% (9)	0.0% (0)	18.6% (11)	100% (59)

### FACULTY AND STUDENTS AT AG COLLEGES AND UNIVERSITIES, 2014–2015

During November 2014 and January 2015, faculty and students at AG institutions of higher learning were invited to take the STPS. Four hundred and two valid responses were collected and evaluated. Respondents were students (62%), educators (21.3%), church leaders (6.5%), and “other” or no response (10.2%).

Most respondents were Protestant Christian (91.5%), Pentecostal (79.3%), and regularly attended an AG church (66.8%). The vast majority were above-average to maximally religiously committed (93.0%). Most were working in religious studies (27.3%), the social sciences (27.0%), and the humanities (13.3%). Only 17.6% of the respondents were in the sciences. Students were fairly evenly divided between Freshmen (12.3%), Sophomores (12.0%), Juniors (19.5%), Seniors (16.5%), and graduate students (12.3%). The ages of this population were bimodal. A little over half of the respondents were under 24 years of age (undergraduate students). The rest were fairly evenly distributed among the decades between 24 and 60 or older.

While 20% used no science-theology paradigm, 42.5% used one (mostly Complementarism—see Table 18), 29% utilized two, and 8.5% used three or four simultaneous science-theology paradigms (Table 17).

**Table 17.** Faculty and Students at AG Colleges and Universities (2014–2015) Who Used No, One, Two, Three, or Four Simultaneous Science-Theology Paradigms (n=402).

Science-Theology Paradigm Used	% (n)
None	19.9% (80)
One Only	42.5% (171)
Two Simultaneous	29.1% (117)
Three Simultaneous	8.0% (32)
Four Simultaneous	0.5% (2)
Total	100.0% (402)

The three favored approaches used by those with one science-theology paradigm were Complementarism (67.3%), Conflict: Theology over Science (18.7%), and Concordism (12.9%) (Table 18).

**Table 18.** Faculty and Students at AG Colleges and Universities (2014–2015) Who Used One Science-Theology Paradigm (n=171).

Science-Theology Paradigm	% (n)
Complementarism	67.3% (115)
Conflict: Theology over Science	18.7% (32)
Concordism	12.9% (22)
Conflict: Science over Theology	1.2% (2)
Compartmentalism	0.0% (0)
Total	100.0% (171)

Respondents using two simultaneous paradigms preferred Complementarism with Concordism (45.3%), followed by Conflict: Theology over Science with Complementarism (28.2%), and Conflict: Theology over Science with Concordism (22.2%) (Table 19).

**Table 19.** Faculty and Students at AG Colleges and Universities (2014–2015) Who Used Two Simultaneous Science-Theology Paradigms (n=117).

<b>Combined Science-Theology Paradigm</b>	<b>% (n)</b>
Complementarism with Concordism	45.3% (53)
Conflict: Theology over Science with Complementarism	28.2% (33)
Conflict: Theology over Science with Concordism	22.2% (26)
Conflict: Theology over Science with Compartmentalism	3.4% (4)
Conflict: Science over Theology with Compartmentalism	0.9% (1)
Total	100.0% (117)

A few respondents used three or four simultaneous combined paradigms (8.5%) (Table 17 and Table 20).

**Table 20.** Faculty and Students at AG Colleges and Universities (2014–2015) Who Used Three Simultaneous Science-Theology Paradigms (n=32).

<b>Combined Science-Theology Paradigm</b>	<b>% (n)</b>
Conflict: Theology over Science with Complementarism with Concordism	96.9% (31)
Conflict: Science over Theology with Complementarism with Concordism	3.1% (1)
Total	100.0% (32)

Two respondents used four paradigms simultaneously: (1) Conflict: Science over Theology with Conflict: Theology over Science with Compartmentalism and with Complementarism; and (2) Conflict: Science over Theology with Conflict: Theology over Science with Compartmentalism and with Concordism.

Relationships between origins perspectives and science-theology paradigms are summarized in Table 21 below. For this sample, young earth creationists used Conflict: Theology over Science and Complementarism equally frequently. Concordism was used half as often. As with previous samples, old earth creationists and evolutionary creationists primarily utilized Complementarism.

**Table 21.** Origins Perspective and Dominant Science-Theology Paradigm of Students and Faculty at AG Colleges and Universities (2014–2015) (n=232)

<b>Science-Theology Paradigm</b>							
<b>Origins Perspective</b>	<b>Concordism % (n)</b>	<b>Complementarism % (n)</b>	<b>Compartmentalism % (n)</b>	<b>Conflict: Theology over Science % (n)</b>	<b>Conflict: Science over Theology % (n)</b>	<b>None Used % (n)</b>	<b>Total % (n)</b>
YEC	12.0% (9)	26.7% (20)	0.0% (0)	26.7% (20)	0.0% (0)	34.7% (26)	32.3% (75)
OEC	9.5% (7)	47.3% (35)	2.7% (2)	13.5% (10)	0.0% (0)	27.0% (20)	31.9% (74)
EC	7.6% (5)	66.7% (44)	0.0% (0)	0.0% (0)	0.0% (0)	25.8% (17)	28.4% (66)
DE	0.0% (0)	80.0% (4)	0.0% (0)	0.0% (0)	0.0% (0)	20.0% (1)	2.2% (5)
AE	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
Other	0.0% (0)	50.0% (6)	0.0% (0)	8.3% (1)	0.0% (0)	41.7% (5)	5.2% (12)
Total	8.8% (21)	45.8% (109)	0.8% (2)	12.7% (31)	0.0% (0)	31.9% (69)	100.0% (232)

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### Conclusions

Many scientists, theologians, philosophers of science, pastors, and laypersons have attempted to engage in science-theology dialogue but have been limited by an unfamiliarity of the jargon and an absence of established schemata. In order to move ahead with a common vocabulary and hermeneutical framework, we propose the terms Compartmentalism, Conflict: Science over Theology, Conflict: Theology over Science, Complementarism, and Concordism to describe ways to relate theology and science. Our research has empirically verified the existence of these science-theology paradigms.

The STPS makes it possible to identify the science-theology paradigms employed by individuals and groups, and enables researchers to examine associations with other affective variables. We report on some of these interactions for science professors of various religious affiliations along with a group of people affiliated with the Assemblies of God (AG), and a group of college students from a large Christian university.

American scientists (2003) favored Complementarism. Fewer used Conflict: Science over Theology, Concordism, Compartmentalism, and Conflict: Theology over Science. Students at a large Christian university (2014) similarly favored Complementarism. AG educators, pastors, and students (2011) favored Complementarism and Concordism, as did Protestant faith and science conference attendees (2014) and faculty and students at AG institutions of higher learning (2014–2015). The science-theology paradigms Complementarism and Concordism were combined more frequently in the latter three groups.

Notable differences between the studied populations have to do with the proportions of respondents using no science-theology paradigms. The greatest percentages in this category were the science faculty (2003) (46.5%) and students at a Christian university in the South (2014) (34.1%). The lowest rates of no science-theology paradigm use were found in the attendees at the 2014 faith and science conference (11.0%), faculty and students at AG institutions of higher learning (2014–2015) (19.9%), and attendees at a 2011 faith and science conference (20.5%). These differences probably have more to do with levels of religious commitment than any other measured demographic. These relationships warrant further study.

Our comparisons of respondent perspectives on origins, along with the science-theology paradigms they use, merit deeper investigation. At this stage, we can say that for the populations we studied, Complementarism and Conflict: Theology over Science are the predominant approaches for YEC adherents. For OEC and EC adherents, Complementarism dominates, followed by Concordism. These findings suggest to us that the Concordism paradigm should not be equated with any particular origins viewpoint such as YEC or OEC. Rather, like an affinity for intelligent design theory, it cuts across camp boundaries. We intend to follow up these tentative findings with deeper investigations of more heterogeneous populations.

The STPS instrument, in its current iteration, does not probe the important aspect of mutual interdependence of theology and science. We believe that many people agree with Carlson's science and theology "Partnership" model which posits that science must embrace relevant aspects of theology (such as ethics and morality) and that theology must embrace relevant contributions from science.<sup>71</sup> Future iterations of the STPS will include such items.

To develop theology and science integrative proficiency, we should consider the science-theology relational patterns we use in practice, and compare them to the models we favor in principle. Not only will our theory and practice become more consistent, but this process may lead to more respectful and insightful interactions with people who use different science-theology paradigms. This, in turn, may lead to better understandings by the layperson of particular science-theology paradigm strengths and weaknesses.

Finally, fine-tuning our science-theology paradigms will help the church engage with culture and the scientific establishment, and may mitigate the mass defection of Christian young people to atheism.<sup>72</sup>

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## APPENDIX

### Science-Theology Paradigm Scale Short Form

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Please use the following scale to indicate your best response to each item:

a. Disagree Strongly      b. Disagree      c. Neutral      d. Agree      e. Agree Strongly

- |   |  |
|---|--|
| 1. ___ Science and theology deal with entirely different realms of knowledge, and so they must be kept separate.  | 11. ___ Because the Genesis account of creation is true, evolution is necessarily false.   |
| 2. ___ The Bible is literally and completely true even when it appears to contradict a scientific matter.   | 12. ___ True knowledge about anything can come only from the scientific method, not from theology.   |
| 3. ___ Reliable information comes only as the result of investigation by the scientific method.   | 13. ___ Descriptions of the natural world provided by science should be consistent with descriptions of the natural world provided by theology.  |
| 4. ___ Accurate scientific investigations of the natural world affirm the valid conclusions of theology.  | 14. ___ Every part of biblical revelation that seems to present a scientific mechanism must surely do so with absolute authority and finality.   |
| 5. ___ Science can contribute nothing of significance to our understanding of theology, and theology can contribute nothing of significance to our understanding of science.                      | 15. ___ Science and theology have little significance for each other.  |
| 6. ___ Differing insights derived from both theology and science should be taken into account equally in the attempt to develop a more adequate and coherent view of the natural world.           | 16. ___ Science and theology, when true to their respective principles and methodologies, provide differing, yet valid and relevant, insights that must be taken into account when describing the nature of reality. |
| 7. ___ All phenomena find their only true and complete description in the physical and chemical description of the behavior of matter.  | 17. ___ Complete consistency between scripture and science regarding the ending of the universe should be attainable.  |
| 8. ___ Science has little or nothing to say about theology, and theology has little or nothing to say about science.  | 18. ___ We must reject any input from science that conflicts with theological interpretation of the Bible.   |
| 9. ___ A scientifically constructed mathematical model for the existence of the universe would be logically consistent with a theologically derived explanation for why the universe exists.      | 19. ___ A scientific description is the only meaningful description of reality that can be given.  |
| 10. ___ When using languages and methods appropriate to their own realms of discourse, both science and theology may provide different but meaningful descriptions of the same natural phenomena. | 20. ___ In order to obtain the fullest insight into the nature of reality, the different (but complementary) insights of science and theology should be integrated.  |
|   | 21. ___ It is highly unlikely for science and theology to have any valid interaction.  |

# Article

## *A New Survey Instrument and Its Findings for Relating Science and Theology*

22. \_\_\_ Valid scientific descriptions and valid theological descriptions of the world will not contradict each other.
23. \_\_\_ Science is the only valid source of insights into the nature of reality.
24. \_\_\_ Both science and theology may generate explanations of the natural world that, taken together, give us a more complete understanding of reality.
25. \_\_\_ When theology and science conflict, theological conclusions must always take precedence over the claims of science.

### SCORING

	Survey Item #
Paradigm I	3, 7, 12, 19, 23
Paradigm II	2, 11, 14, 18, 25
Paradigm III	1, 5, 8, 15, 21
Paradigm IV	6, 10, 16, 20, 24
Paradigm V	4, 9, 13, 17, 22

Your primary pattern for relating science to Christian theology ("science-theology paradigm") is indicated by the largest percentage score calculated on the basis of weighted responses on each paradigm scale. For the scoring mechanism, contact the author.

### KEY

Paradigm I = Conflict: Science over Theology

*Conflict: Science over Theology* is that pattern of relating science and theology that is based on the understanding that science and theology describe the same kind of things about the same realm of reality. In this pattern, when scientific and theological descriptions conflict, scientific descriptions are believed to be correct.

Paradigm II = Conflict: Theology over Science

*Conflict: Theology over Science* is that pattern of relating science and theology that is based on the understanding that science and theology describe the same kind of things about the same realm of reality. In this pattern, when scientific and theological descriptions conflict, theological descriptions are believed to be correct.

Paradigm III = Compartmentalism

*Compartmentalism* is that pattern of relating science and theology that is based on the understanding that science and theology describe different kinds of things about different realms of reality. In this pattern, since there is no common ground between science and theology, conflict between the two is impossible by definition.

Paradigm IV = Complementarism

*Complementarism* is that pattern of relating science and theology that is based on the understanding that science and theology describe different kinds of things about the same realm of reality. Each, when utilized authentically (i.e. in accordance with its own genuine capabilities and methodology), provides valid insights into the nature of reality from its unique perspective. Through dialogue between authentic science and authentic theology, a more coherent and adequate view of reality may be obtained by integrating both scientifically derived insights and theologically derived insights.

Paradigm V = Concordism

*Concordism* is that pattern of relating science and theology that is based on the understanding that science and theology describe the same kind of things about the same realm of reality. A perfect scientific description of the world and a perfect theological description of the world would be completely harmonious.

## About the Authors

**Michael Tenneson** (PhD in science education, University of Missouri; MS in biology/statistics, University of North Dakota; MA in missiology/biblical literature, Assemblies of God Theological Seminary; and BA in biology, UCLA) is a professor of biology and Chair of the Department of Science and Technology at Evangel University. He has taught there for nearly 30 years. He has studied the ecology and behavior of a variety of animals, and has most recently been involved in research related to the science/theology interface.

**David Bundrick** (PhD in adult and higher education at the University of Missouri; ThM, Princeton Theological Seminary; and MDiv, Assemblies of God Theological Seminary) served in Christian higher education for 31 years as a professor and administrator. In his doctoral research, he analyzed the historical tension between science and theology in American higher education and identified the paradigms employed by university science professors for relating theology and science.

**Matthew S. Stanford** (PhD in neuroscience, MA in experimental psychology, BS in psychology, Baylor University) is CEO of the Hope and Healing Center & Institute (HHCI) in Houston, TX, and adjunct professor in the Department of Psychiatry and Behavioral Sciences at Baylor College of Medicine and the Department of Psychology at the University of Houston. Stanford is a fellow of the Association for Psychological Science. He is the author of two books, *Grace for the Afflicted: A Clinical and Biblical Perspective on Mental Illness* and *The Biology of Sin: Grace, Hope and Healing for Those Who Feel Trapped*.

## Notes

<sup>1</sup>Alister E. McGrath, "Faith and the Natural Sciences," *CCCU Advance*, Fall 2002. A professor of historical theology holding a DPhil in molecular biophysics, McGrath took seriously his own assertion of the importance of relating Christian theology to the natural sciences and has written prolifically on the subject, as illustrated here: *The Foundations of Dialogue in Science and Religion* (West Sussex, UK: Blackwell, 1999); *Science and Religion: A New Introduction* (Oxford: Blackwell, 1999); *A Scientific Theology*, 3 vols. (London: T&T Clark, 2002–2003); *The Science of God: An Introduction to Scientific Theology* (Grand Rapids, MI: Eerdmans, 2004); *Dawkins' God: Genes, Memes, and the Meaning of Life* (Malden, MA: Blackwell, 2005); *A Fine-Tuned Universe: The Quest for God in Science and Theology*, Gifford Lectures (Louisville, KY: Westminster John Knox, 2009); *Darwinism and the Divine: Evolutionary Thought and Natural Theology* (Malden, MA: Wiley-Blackwell, 2011); and *Surprised by Meaning: Science, Faith, and How We Make Sense of Things* (Louisville, KY: Westminster John Knox, 2011).

<sup>2</sup>In this article, the authors employ "science" in the sense of "mainstream science" or "normal science," which includes the methods, processes, and conclusions of studies of the natural world.

<sup>3</sup>Generally, in this article, the authors employ the terms "religion," "theology" (or "biblical theology"), and "faith" (or "Christian faith") somewhat interchangeably,

in the sense of a set of reasoned beliefs concerning God, humanity and the cosmos derived from interpretation of the Bible and Christian tradition. In regard to the surveys administered as part of the studies reported herein, the researcher designed the questions with the intention that the respondents, who represent a diversity of religious beliefs (including "None" and "Other"), would bring their own meanings to the terms.

<sup>4</sup>See S. M. Guralnick, *Science and the Ante-Bellum American College* (Philadelphia, PA: The American Philosophical Society, 1975).

<sup>5</sup>Charles Darwin, *On the Origin of Species by Means of Natural Selection, or, the Preservation of Favoured Races in the Struggle for Life* (London: J. Murray, 1859).

<sup>6</sup>Stephen Jay Gould, "Nonoverlapping Magisteria," *Natural History* 106 (March 1997): 16–22.

<sup>7</sup>Elaine Howard Ecklund, "Scientists Negotiate Boundaries between Religion and Science," *Journal for the Scientific Study of Religion* 50, no. 3 (2011): 552–69.

<sup>8</sup>The Barna Group, "Six Reasons Young Christians Leave Church," accessed December 4, 2011, <https://www.barna.org/barna-update/millennials/528-six-reasons-young-christians-leave-church#.VZLCKE2SLL8>.

<sup>9</sup>Robert John Russell, ed., *Fifty Years in Science and Religion: Ian G. Barbour and His Legacy*, Ashgate Science and Religion Series (Burlington, VT: Ashgate Publishers, 2004). Major works by Ian G. Barbour on the topic are listed here in chronological order: *Christianity and the Scientist*, The Haddam House Series on The Christian in His Vocation (New York: Association Press, 1960); *Issues in Science and Religion* (Englewood Cliffs, NJ: Prentice-Hall, 1966); "Science and Religion Today," in *Science and Religion: New Perspectives on the Dialogue*, ed. Ian G. Barbour (New York: Harper & Row, 1968), 3–29; *Myths, Models, and Paradigms: A Comparative Study in Science and Religion* (New York: Harper & Row, 1974); *Religion in an Age of Science*, vol. 1, *The Gifford Lectures 1989–1991* (San Francisco, CA: Harper, 1990); *Religion and Science: Historical and Contemporary Issues*, revised and expanded edition of *Religion in an Age of Science* (San Francisco, CA: Harper, 1997); *When Science Meets Religion: Enemies, Strangers, or Partners?* (San Francisco, CA: HarperSanFrancisco, 2000); and *Nature, Human Nature, and God*, Theology and the Sciences Series (Minneapolis, MN: Fortress Press, 2009).

<sup>10</sup>H. Richard Niebuhr, *Christ and Culture* (New York: Harper, 1951).

<sup>11</sup>Barbour, *Christianity and the Scientist*, 86, 89, 106–18. A quarter century later, Nancey Murphy, like Barbour, explicated a typology for the relation of theology to science based on Richard Niebuhr's five-fold typology of Christian attitudes toward culture. See N. Murphy, "Theology the Transformer of Science? A Niebuhrian Typology for the Relationship of Theology to Science," *Pacific Theological Review* 18 (1985): 16–23. While the category descriptions below come from Murphy, the labels employed to summarize the descriptors are the authors':

a. *Theology requires the rejection of science where the two conflict.* This fits Niebuhr's "Christ against culture category," the view that loyalty to Christ requires the rejection of the culture. When applied to theology and science, the perspective that evolutionary science and the biblical account of creation are competing truth claims exemplifies this view.

b. *Science requires the rejection of theology where they conflict.* This is based on Niebuhr's category, "Christ of



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culture," the position represented by the Protestant cultural hegemony of the late nineteenth and early twentieth centuries in which theology is accommodated to culture. In this view, aspects of theology that cannot be accommodated to culture are excised.

- c. *Theology subsumes science.* "Christ above culture" is the position that science and theology, sharing a common method of reasoning, may be synthesized into one coherent system. In this view "theology and science are related to one another as encompassing whole to part," with theology and science organized as concentric spheres, and with theology at the outermost edge representing the ultimate context of explanation.
  - d. *Science and theology are separate.* The Niebuhrian category, "Christ and culture in paradox," leads to the dualist or "two-world" view of faith and science. According to this view, science and theology have separate spheres, involve different kinds of knowledge, and employ distinct languages; therefore, they cannot interact or compete.
  - e. *Theology affects science.* Niebuhr's final category, "Christ as the transformer of culture," is the viewpoint that says theology can and ought to affect science. Scientific theories are not derived purely from collected data; instead, "control beliefs"—some philosophical and some theological—influence the invention and acceptance of scientific theories.
- <sup>12</sup>Barbour, "Science and Religion Today," in *Science and Religion: New Perspectives on the Dialogue*.
- <sup>13</sup>Barbour, *Religion in an Age of Science*; Barbour, *Religion and Science: Historical and Contemporary Issues*.
- <sup>14</sup>Barbour, *When Science Meets Religion*.
- <sup>15</sup>*Ibid.*, 10–17.
- <sup>16</sup>*Ibid.*, 17.
- <sup>17</sup>*Ibid.*, 23.
- <sup>18</sup>*Ibid.*, 25.
- <sup>19</sup>Arthur R. Peacocke, *Theology for a Scientific Age: Being and Becoming—Natural and Divine* (Oxford: Basil Blackwell, 1990); and John C. Polkinghorne, *Science and Christian Belief: Theological Reflections of a Bottom-up Thinker* (London: SPCK, 1994), published simultaneously as *The Faith of a Physicist* (Princeton, NJ: Princeton University Press, 1994).
- <sup>20</sup>Arthur R. Peacocke, *The Sciences and Theology in the Twentieth Century*, The Oxford International Symposium (Notre Dame, IN: University of Notre Dame Press, 1981), xiii–xv.
- <sup>21</sup>In response to Peacocke, R. J. Russell ("A Critical Reappraisal of Peacocke's Thought on Religion and Science," *Religion and Intellectual Life* 2 [1985]: 48–58) refined Peacocke's schema geometrically by pointing out that Peacocke's positions may be differentiated with respect to four dimensions of the science-theology relationship: approaches, languages, attitudes, and objects (corresponding to Peacocke's categories 3, 4, 5, and 6). In each of these four dimensions, the relationship between science and theology can be described on a continuum ranging from (a) similar and interacting or (b) different and non-interacting. Thus, in four-dimensional space, the axis in each dimension represents one of the four categories describing the relationship between science and theology: approaches, languages, attitudes, and objects. For example, the axis representing "attitude" would have "subjective" at one extreme end and "objective" at the opposite. Some would put science and theology at opposite ends, while others would see some overlap, indicating that theology

and science both include overlapping measures, objectivity and subjectivity. Russell's schema presents advantages and disadvantages. Each of the arguments about the relationship (interacting and similar or noninteracting and different) between science and theology can be framed independently of the other. At the same time, these arguments can be incorporated into a unified structure, making explicit "the inherently complex and rich multi-dimensional nature of the theology and science terrain" (Russell, p. 50). However, in reality, Russell's four-dimensional grid provides for an infinite number of theoretical positions, making it virtually impossible to identify and categorize specific science-theology paradigms.

- <sup>22</sup>John C. Polkinghorne, *One World: The Interaction of Science and Theology* (London: SPCK, 1986), 64.
- <sup>23</sup>*Ibid.*, 65–77.
- <sup>24</sup>*Ibid.*, 79–80.
- <sup>25</sup>*Ibid.*, 77.
- <sup>26</sup>*Ibid.*, 77–83.
- <sup>27</sup>*Ibid.*, 83–85.
- <sup>28</sup>Richard T. Wright, *Biology through the Eyes of Faith* (San Francisco, CA: Harper & Row, 1989).
- <sup>29</sup>Richard H. Bube, *Putting It All Together: Seven Patterns for Relating Science and the Christian Faith* (Lanham, MD: University Press of America, 1995).
- <sup>30</sup>Richard F. Carlson, ed., *Science and Christianity: Four Views* (Downers Grove, IL: InterVarsity Press, 2000).
- <sup>31</sup>Kurt P. Wise, *Faith, Form, and Time: What the Bible Teaches and Science Confirms about Creation and the Age of the Universe* (Nashville, TN: B&H Publishing Group, 2002).
- <sup>32</sup>Ken Ham and Greg Hall, *Already Compromised* (Green Forest, AR: Master Books, 2011).
- <sup>33</sup>This view was formalized by Stephen Jay Gould, "Non-overlapping Magisteria," *Natural History* 106 (March 1997): 16–22.
- <sup>34</sup>Bigthink.com, "Neil deGrasse Tyson: Atheist or Agnostic?" blog entry by Mark Cheney, YouTube video, April 25, 2012, <http://bigthink.com/think-tank/neil-degrasse-tyson-atheist-or-agnostic>.
- <sup>35</sup>Denis O. Lamoureux, *Evolutionary Creation: A Christian Approach to Evolution* (Eugene, OR: Wipf & Stock, 2008).
- <sup>36</sup>Francis Collins, *The Language of God* (New York: Free Press, 2006).
- <sup>37</sup>Melville Y. Stewart, ed., *Science and Religion in Dialogue*, 2 vols. (West Sussex, UK: Wiley-Blackwell, 2010).
- <sup>38</sup>Hugh Ross, *More Than a Theory: Revealing a Testable Model for Creation* (Grand Rapids, MI: Baker Books, 2009), 30.
- <sup>39</sup>Alvin Plantinga, *Where the Conflict Really Lies: Science, Religion, and Naturalism* (Oxford: Oxford University Press, 2011).
- <sup>40</sup>The website of the American Scientific Affiliation, "Concordism," blog entry by Randy Isaac, February 27, 2008, <http://www2.asa3.org/users/randyisaac/weblog/ce81e/Concordism.html>.
- <sup>41</sup>Carol A. Hill, "A Third Alternative to Concordism and Divine Accommodation: The Worldview Approach," *Perspectives on Science and Christian Faith* 59, no. 2 (2007): 129–34.
- <sup>42</sup>Ross, *More Than a Theory*, 30.
- <sup>43</sup>John H. Walton, *The Lost World of Genesis One: Ancient Cosmology and the Origins Debate* (Downers Grove, IL: InterVarsity Press, 2009), 163.
- <sup>44</sup>Amos Yong, "Reading Scripture and Nature: Pentecostal Hermeneutics and Their Implications for the Contempo-

- rary Evangelical Theology and Science Conversation," *Perspectives on Science and Christian Faith* 63, no. 1 (2011): 3–15.
- <sup>45</sup>Lamoureux, *Evolutionary Creation*, 17.
- <sup>46</sup>The BioLogos Forum, "Science and the Bible: Concordism, Part 1," blog entry by Ted Davis, June 19, 2012, <http://biologos.org/blog/science-and-the-bible-concordism-part-one>.
- <sup>47</sup>Bernard Ramm, *The Christian View of Science and Scripture* (Grand Rapids, MI: William B. Eerdmans, 1954), 145.
- <sup>48</sup>Lamoureux, *Evolutionary Creation*, 475.
- <sup>49</sup>J. P. Moreland and William Lane Craig, *Philosophical Foundations for a Christian Worldview* (Downer's Grove, IL: InterVarsity Press, 2009).
- <sup>50</sup>Robert J. Russell, *Cosmology, Evolution, and Resurrection Hope: Theology and Science in Creative Mutual Interaction* (Kitchener, ON: Pandora Press, 2006).
- <sup>51</sup>David Ray Bundrick, "The Development of a Scale to Identify College and University Science Professors' Science-Faith Paradigms" (PhD diss., University of Missouri-Columbia, 2003), ProQuest (AAI3091906).
- <sup>52</sup>*Proceedings of the Inaugural Faith and Science Conference: Springfield, Missouri, June 27–28, 2011*, ed. David R. Bundrick and Steve Badger (Springfield, MO: Gospel Publishing House, 2011), 38–42.
- <sup>53</sup>Robert K. Gable and Marian B. Wolf, *Instrument Development in the Affective Domain: Measuring Attitudes and Values in Corporate and School Settings*, 2nd ed. (Norwell, MA: Kluwer Academic Publishers, 1993).
- <sup>54</sup>Don A. Dillman, *Mail and Internet Surveys: The Tailored Design Method*, 2nd ed. (Hoboken, NJ: John Wiley, 2007).
- <sup>55</sup>The panel consisted of eleven professionals (scientists and science professors) with expertise in the content areas of both science and theology and familiarity with the interface between them. The panel of experts included a professor of chemistry at a Christian liberal arts college; a state college science instructor who serves as adjunct professor of pathology at a medical college; a professor of biochemistry at a Christian liberal arts college; a professor of science education who serves as an associate dean in the college of education at a state research university; a professor of science history at a Christian liberal arts college; a retired instructor in mathematics at a Canadian university; an author and member of the Interdisciplinary Biblical Research Institute; a professor of geology at a state research university; an instructor in physics at a historically church-related college who serves as an adjunct professor in a Lutheran seminary; an associate professor of biology at a Christian liberal arts college; a professor of physics and astronomy at a Christian liberal arts college and founding member of the International Society for Science and Religion. These judges used a content validity rating form developed by the researcher according to the sample provided by Gable and Wolf (*Instrument Development in the Affective Domain*, 99–100), to assign each of the original 132 items to the most appropriately corresponding science-faith paradigm conceptual definition. The judges also indicated how certain they felt about their assignment of each item to its respective category, using the following scale: 1. I am *not* very certain that this placement is correct; 2. I am *rather* certain that this placement is correct; 3. I am *very* certain that this placement is correct.
- <sup>56</sup>R. W. Moore and R. L. Hill Foy, "The Scientific Attitude Inventory: A Revision (SAI II)," *Journal of Research in Science Teaching* 34 (1997): 327–36.
- <sup>57</sup>Leslie J. Francis, "Reliability and Validity of the Francis Scale of Attitude towards Christianity," *Panorama: Journal of Comparative Religious Education and Values* 4 (1992): 17–19; Leslie J. Francis, "Reliability and Validity of a Short Scale of Attitude towards Christianity among Adults," *Psychological Reports* 72 (1993): 615–18; and Leslie J. Francis, J. M. Lewis, D. Lester, and R. Philipchalk, "Reliability and Validity of a Short Scale of Attitude towards Christianity among Students in the UK, USA, Australia, and Canada," *Psychological Reports* 77 (1995): 431–34.
- <sup>58</sup>D. P. Crowne and D. Marlowe, "A New Scale of Social Desirability Independent of Psychopathology," *Journal of Counseling Psychology* 24 (1960): 349–54; W. M. Reynolds, "Development of Reliable and Valid Short Forms of the Marlowe-Crowne Social Desirability Scale," *Journal of Clinical Psychology* 38 (1982): 119–25; and A. B. Silverstein, "Validity of Random Short Forms: II. The Marlowe-Crowne Social Desirability Scale," *Journal of Clinical Psychology* 39 (1983): 582–84.
- <sup>59</sup>Anthony Biglan, "Relationships between Subject Matter Characteristics and the Structure and Output of University Departments," *Journal of Applied Psychology* 57 (1973): 204–13. Professors were selected from the subject matter areas represented by two octants in Biglan's classification scheme: the Hard-Pure-Life system (botany, entomology, microbiology, physiology, zoology) and the Hard-Pure-Nonlife system (astronomy, chemistry, geology, math, physics). This classification scheme corresponds roughly to the two categories of "biological sciences" and "physical sciences" used in replications of Leuba's benchmark study: cf. James H. Leuba, *The Belief in God and Immortality: A Psychological, Anthropological, and Statistical Study* (Boston, MA: Sherman, French & Co., 1916); E. J. Larson and L. Witham, "Scientists Are Still Keeping the Faith," *Nature* 386 (1997): 435–36; and E. J. Larson and L. Witham, "Leading Scientists Still Reject God," *Nature* 394 (1998): 313.
- <sup>60</sup>Adequacy of the number of valid survey responses ( $n=312$ ) was supported by (a) utilization of a stratified random sample paired with (b) demonstrated good variance among the respondents relative to the following demographic categories: gender, personal religious affiliation, levels of religious commitment, academic rank, academic discipline (life sciences and the nonlife sciences), institutional public/private-religious affiliation types, and Carnegie Classification of the professors' respective schools. Additionally, 312 completed surveys fall within the range deemed acceptable by (a) Gable and Wolf (see note 54), who recommend a sample size of 6–10 times the number of items on this type of survey instrument, and (b) Dillman (see note 55), who recommends 246 completed surveys for a population between 100,000 and 1,000,000 to achieve a 95% confidence level with a  $\pm 5\%$  sampling error, assuming an 80/20 split.
- <sup>61</sup>Robert F. DeVellis, *Scale Development: Theory and Applications*, 3rd ed. (Los Angeles, CA: Sage Publications, 2011).
- <sup>62</sup>The "Conflict" model for the relationship between science and theology in American higher education gained prominence in the latter half of the nineteenth century; was chronicled in Andrew Dickson White, *A History of the Warfare of Science with Theology in Christendom* (London: Macmillan, 1896); and was epitomized by the 1925 Scopes Monkey Trial in Dayton, Tennessee (Doug Linder, "Speech on the Occasion of the 75th Anniversary of the Opening of the Scopes Trial," July 10, 2000, University of Missouri Kansas City School of Law, *Famous Trials in*

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*American History*, <http://www.law.umkc.edu/faculty/projects/ftrials/scopes/confspeech.html>). However, much of the late twentieth-century literature discussing the theoretical patterns for relating science and theology tends to minimize the contemporary influence of the conflict paradigm in favor of more compartmental, integrative, or complementary paradigms. Nevertheless, in this current research, the STPS factors having the highest number of items loading were the two conflict models. The Conflict: Science over Theology paradigm was represented by 13 strong factor loadings, and the Conflict: Theology over Science paradigm was represented by 12 strong factor loadings. Therefore, the conflict model is still strongly identifiable in the academy.

<sup>63</sup>Although at least ten survey items loaded  $>0.50$  on each of the first four factors (science-theology paradigms) in the STPS, only five items loaded on factor five, Concordism. This produced a weaker factor that was revealed clearly only by orthogonal rotation during Principal Components Analysis. There are several reasons why this factor may have appeared with less strength than the other four factors. First, the fifth paradigm (Concordism) could have appeared to be weak in the principal components analysis because of the inability of the researcher to adequately construct statements to operationalize the concept of Concordism. Second, results of the first content-validity rating exercise indicated that there were not sufficient distinctions between many items constructed variously for either Complementarism or Concordism. As a result, the second content-validity rating exercise was conducted in an attempt to articulate this distinction more clearly and gain additional validated items for these two categories. This process itself may have indicated that these two science-theology paradigms are closely related, and are perhaps merely subcategories of a larger paradigm in which scientific and religious beliefs are seen to be compatible or convergent, rather than in conflict or compartmentalized. Third, the fifth paradigm may have appeared weak in the principal components analysis because of the very low number of respondents that would have been likely to score consistently on the items representing the Concordism paradigm. Because there are significant religious qualifications for science faculty in Bible colleges, and an essential characteristic of Bible colleges is the harmonization of all academic disciplines with the Bible, it is speculated that Concordism would be a paradigm more characteristically operationalized by science instructors at colleges affiliated with the Association for Biblical Higher Education (formerly the Accrediting Association of Bible Colleges). Therefore, the Concordism factor may have appeared only weakly in the principal components analysis due to the fact that Bible college science professors, who were expected to provide a substantial source of variance in the survey data, were significantly under-represented among the respondents. Despite the relatively weak appearance of factor five, there was adequate evidence for the five-factor solution.

<sup>64</sup>Only factor loadings greater than 0.40 were used in the analysis, see B. Freeman and K. Coll, "Factor Structure and the Role of Questionnaire (RQ): A Study of High School Counselors," *Measurement and Evaluation in Counseling and Development* 30 (1997): 32–40.

<sup>65</sup>The evidence for the content validity for the STPS was determined well before the survey was administered to the sample. This was accomplished by means of the development of conceptual definitions and operational statements for the five theoretical science-theology paradigms on the basis of the literature review. Contributing further evidence to the content validity were the judgmental rating exercises conducted by the researcher with the assistance of a panel of content experts utilizing content-validity rating forms specially prepared for that purpose (see note 56). Further evidence for the content validity of the STPS is provided by the fact that all 50 items appearing on the final version of the STPS loaded on the science-faith paradigms to which they had been assigned by the expert panel during the content validity rating process.

<sup>66</sup>Evidence for the construct validity of the STPS came primarily from the principal components analysis of the data from the 312 cases. Employing Principal Components Analysis with orthogonal (Varimax) rotation, a five-factor solution was found, explaining 56.1% of the variance. This researcher utilized the criterion of 0.50 for factor loading, though factor loadings higher than just 0.40 are considered moderate to high, see Freeman and Coll, "Factor Structure and the Role of Questionnaire (RQ)."

Analysis of the Pearson Correlations between the respondents' standardized scores on the STPS subscales and their scores on the Francis Scale of Attitudes toward Christianity (FSAC) provided additional evidence for the construct validity of the STPS. These correlations were highly significant ( $p < 0.01$ ), were in expected directions (positive or negative), provided positive evidence to support the construct validity of the instrument, and added to the interpretability of the STPS. Analysis of the Pearson Correlations between the respondents' standardized scores on the STPS subscales and their scores on the Scientific Attitude Inventory-II (SAI-II) provided some additional but limited evidence for the construct validity of the STPS.

<sup>67</sup>Statistical analysis performed on the five subscales was successful in gaining evidence for initial reliability of the STPS. Test-retest reliability was beyond the scope of this initial scale development.

<sup>68</sup>Lee J. Cronbach, "Coefficient Alpha and the Internal Structure of Tests," *Psychometrika* 16 (1951): 297–334.

<sup>69</sup>Elaine Howard Ecklund, "Scientists Negotiate Boundaries between Religion and Science," *Journal for the Scientific Study of Religion* 50, no. 3 (2011): 552–69.

<sup>70</sup>Elaine Howard Ecklund, "Surveying Religious People about Science and Scientists," Lecture, AAAS 2014 Annual Meeting, Chicago, Illinois, February 16, 2014.

<sup>71</sup>Carlson, ed., *Science and Christianity: Four Views*.

<sup>72</sup>The Barna Group, "Six Reasons Young Christians Leave Church," <https://www.barna.org/barna-update/millennials/528-six-reasons-young-christians-leave-church#.VZLCKE2SL8>; and Dan Guenther, "Reconciling the Faith: Christian Students Who Move from Fear to Engagement with the Sciences," in *Proceedings of the Inaugural Faith and Science Conference*, ed. David Bundrick and Steve Badger (Springfield, MO: Gospel Publishing House, 2011).

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