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Models in Christianity and Chemistry: Truth or Utility

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This article shows that a good model is useful—that is, for enabling work and communicating concepts—and true, in the sense that it coheres with theory or doctrine. Using a typology of models based on intended purpose, it shows that the relationship between truth and utility in chemical and theological models depends on the intended function of the model. It also shows that in some traditions, theological models may be warranted, primarily by scripture, and held to be necessarily true and useful, but no similar warrant appears in chemistry. The consequence of the scriptural warrant is that, in some traditions, particular models are retained even if their utility is questionable. An alternative view is suggested proposing that scriptural metaphors may be recast into new models.

Keywords: model, metaphor, chemistry, theology, penal substitution, truth, utility, theory, doctrine

Models form an integral part of how we communicate ideas and concepts in science, the arts, and theology, but what makes a good model? What are the criteria that are used to judge the suitability of a particular model? It might be argued that in science this is easily answered—a good model accurately reflects experiment. But is that sufficient? What criteria can be used to validate one model over another in theology, which cannot access results from experiment?

From the middle of the last century, there have been two types of theological literature related to models—discussion *about* models and discussion *using* models. The discussion *about* models has principally focused on the comparison of models in science and theology—differences and similarities. The discussion *using* models in theology has largely been an intramural affair, resting within the theological domain. Consequently, there is an implicit understanding that theological truth—coherence with scripture, tradition, or both—is the criterion that makes for a good model.[1] Absent is any discussion of other criteria.[2]

While the evaluation of theological models remains within the domain of theology, it is difficult to identify other criteria that make a model good. However, if we bring the theological perspective on models into conversation with a different area of endeavor, other criteria may be brought to light, particularly if it can be shown that the comparative area chosen has sufficient similarities with theology in its use of models to make the comparison fertile. I will argue here that chemistry is such a suitable field of endeavor.

When we examine what makes a good model in chemistry, a very different perspective appears. As an example, Michael Dewar noted that organic chemists, for many years, have been guided by a simple qualitative model of the chemical bond based on shared pairs of

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electrons localized between atoms. However, there are phenomena in organic chemistry that cannot be accounted for by this simple model, suggesting that electrons are not localized between atoms but spread out (delocalized) across the entire molecule. Unfortunately, models that give a better theoretical account of the electronic structure of molecules are regarded as too complex for everyday use. Despite its shortcomings, the localized electron pair model continues to provide useful insights, leading Dewar to conclude that "the only criterion of a model is its usefulness, not its 'truth.'"[3] Yet, Dewar's conclusion is too facile; a good model must also communicate, that is, present a concept in a way that gives increased understanding.

By juxtaposing models in chemistry and Christianity, I argue that a good model is both *useful* and *true*. Useful models enable further work and effectively communicate the concept modeled. Truthful models illuminate in coherence with theory or doctrine, even though that coherence will be partial at best. Models that fail to meet these two criteria must be revised or abandoned—in both chemistry and Christianity.

This argument will be developed by first examining the natures of models, metaphors, truth, and reality. This will be followed by a critical comparison of general scientific and theological models. The extension of these comparisons to models in chemistry and theology is then used to suggest a new typology of models based on intended function: that the intended function of the model dictates its relationship to utility and truth. Finally, I will also argue that the use of warranted models in theology differs fundamentally from the way models are used in chemistry and propose a resolution to the conflicts that result from insisting that if a model is true, it must be useful.

Models and Metaphors, Truth, and Reality

Dewar defined models in chemistry as the simplified images and representations that chemists use to solve problems in which direct application of theory results in overwhelming complexity. This definition is inadequate on two counts. Firstly, by focusing on prediction, it devalues the function of the model in providing understanding—its ability to communicate. Secondly, it does not address the mirror-side of the model. A model may "reproduce certain properties," but it does so at a cost. There is both an "is" and an "is not" aspect to the model. Sallie McFague argues that a model is a "sustained and systematic" metaphor.[4] From a scientific perspective, Mary Hesse makes a similar argument in different terms. She describes the aspects of the model that refer to the subject as the *positive* analogy; those which do not, the *negative* analogy; and those for which correspondence is unknown, the *neutral* analogy.[5] The introduction of the "is" and "is not" element to the description of the model is critical.[6] Thus, a model is a metaphor writ large while a metaphor is a model writ small. For the chemist, Theodore Brown concurs with this view: "Models, which are extended metaphors, give rise to metaphorical entailments, which influence the ways in which the model is understood and applied."[7]

Understanding metaphors and models as differing in scale also helps to see that the larger scale model may be *constructed* from multiple smaller-scale metaphors. The chemical ball-and-stick model of the molecule includes metaphors for both the atom and bond as ball and stick respectively. Similarly, the theological atonement model of the courtroom includes metaphors for God as judge and humankind as the accused. The constructed nature of models—that models are constructed from multiple smaller, often metaphorical, subunits—is a second critical aspect of this discussion.

In the context of models, truth is best defined in terms of coherence to the thing modeled—frequently theory or doctrine. It is hoped that theory or doctrine corresponds to the world as it is and thus, indirectly, that the model will also do so.[8] In chemistry, truth is ultimately arbitrated by experiment but as perceived by model and theory. In theology, truth must finally be arbitrated by scripture,[9] but similarly as perceived through model and doctrine. Both coherence and correspondence definitions fall within the inflationist position, whereby truth is understood to be a substantial property of the thing described as true.[10] The consequence of taking this position is a commitment to some form of critical realism for both chemistry[11] and theology.[12]

Models in Science and Religion

The academic study of models in science and religion may be divided into two stages: (1) a period of construction in the last few decades of the twentieth century when most of the foundational texts appeared; and (2) a period in the early twenty-first century when criticism predominated.

Perhaps the earliest comparative study of the use of models in science and theology is found in the Whidden Lectures given by Ian Ramsey in 1963.[13] Subsequently, Frederick Ferré (1968) included such a comparison as part of a wider study in the use of metaphors and models in religion.[14] Thomas Fawcett's *The Symbolic Language of Religion* appeared in 1971,[15] but was, unfortunately, not widely referenced. Robert Scharlemann made a significant, but seldom noted, contribution in 1973, describing the *construction* of models in theology.[16] The landmark study was undoubtedly Ian Barbour's *Myths, Models, and Paradigms* which appeared in 1974[17] and marked the beginning of the heyday of comparative work which lasted until 1997, when Barbour published a revised version of the text as *Religion and Science*.[18] Significant monographs from the period were Sallie McFague's *Metaphorical Theology* (1982)[19] and *Models of God* (1987),[20] Janet Martin Soskice's *Metaphor and Religious Language* (1985),[21] and Arthur Peacocke's *Intimations of Reality* (1984).[22]

After the turn of the century, it appeared that the constructive work was done, so that Alister McGrath's 2020 summary of models in the third edition of *Science and Religion* is based on Barbour's 1974 and 1997 publications.[23] Yet, some constructive work continued, including a 2003 exchange on the testing of models in science and religion,[24] and Soskice's brief return to the subject of patriarchal models in 2007.[25]

However, most of the published work on models in science and religion after the turn of the century was critical of the previous findings. One of the two main lines of criticism argued that the indescribable, unknowable nature of God made comparisons between theological models and the testable models of invisible entities in science unworkable. Michael Fuller takes this reasoning down an apophatic pathway, concluding: "Ultimately, the approach to God has to do not with knowing—science—but with not-knowing—nescience. And no model can assist in that approach."[26]

Robert Bolger reached a different conclusion from a similar starting point. He sees religious models as relating to how we live and what we believe, while scientific models relate to understanding and knowing and the comparison between the two types of models as a form of category error. "Religious models are regulative and not representative. They are existential and not epistemological."[27]

A second criticism was that comparisons between religious and theological models exhibited a form of scientism.[28] Taede Smedes specifically criticizes Barbour as aiming to "unify and harmonize science and religion via process philosophy,"[29] in part, through his comparison of scientific and religious models. Barbour responded to this criticism noting that his study examined equally both similarities and differences between scientific and religious models.[30] A response from Smedes did not address the question of models.[31] Bolger also criticized the comparative efforts as attempts to make "religion look more scientifically acceptable"[32] and claimed that "the theological use of scientific modeling has led to a distortion of the concept of God."[33]

The accusation of scientism against Barbour and the other foundational authors writing on scientific and religious models is misplaced. As noted above, Barbour has answered the criticism for himself. Two of the other significant contributors, McFague and Soskice, also reject the claim that they are attempting to validate or make theological models scientifically acceptable.[34] Neither author compares scientific and religious models to validate one or the other. Scientific models are not the standard to which religious models are compared, but a source of referential analysis. The goal of the comparison is to seek understanding of the way models work. By observing scientific and theological models together, we may learn about both.

The same principle applies to this study—the objective is not to present chemical modeling as a best practice against which theological modeling must be compared, but to seek the similarities and differences between the two fields and thus develop insights into the role and fitness of models. Although examples from chemistry are included in the existing literature on science and religious models, there has been no study dedicated to comparing models in theology and in chemistry. This is somewhat surprising, given the vital dependence of chemistry on models, particularly in the field of organic and inorganic chemistry where much of the everyday work of the chemist is model based.

Are Chemical Models Comparable to Theological Models?

At first glance, it may seem that there is little commonality between the use that chemistry and

theology make of models. There is, however, a profound connection that makes the comparison productive, despite the criticisms of Smedes and Bolger. Chemistry is, at bottom, the science of understanding macroscopic observables in terms of unobservable atoms and molecules. Hirofumi Ochiai states that "inferring invisible microscopic events from macroscopic observations … has been habitual with chemists since chemical atomism arose in the nineteenth century."[35]

That same habitual inference is practiced by theologians who see the visible manifestations of the world as the creation and reflection of an invisible God. Chemistry and theology are united by interpretation of the visible in terms of the invisible. Further, both endeavors depend on models to enable this habitual inference. There are, however, real differences that need to be held in mind.

Fawcett, writing in 1971, noted that scientific models are *observer* models while theological models are *participator* models.[36] Barbour refers to this idea as theological models demanding a greater personal involvement, while others have referred to them as existential or evoking a moral and spiritual response. Perhaps another way of expressing this is to say that theology, and its models, are to do with faith and salvation, whereas chemistry is not. According to McFague, "Science asks the question, what is this phenomenon and how does it work?" while theology asks the question "What is the meaning of life in the world?"[37] Thus, according to McFague, "theological models have a valuational component lacking in scientific models … theological models affect feelings and actions in the world."[38]

Polkinghorne would seem to agree.

> An honest science addresses only one set of questions (roughly How?—concerned with the processes of the physical world), while theology addresses another set (roughly Why?—concerned with the meaning, value and purpose present in what is happening).[39]

It is certainly true that "chemistry is not the place to go for insights about the incarnation, atonement, and resurrection, but it is a legitimate domain for discovering the creative design of God 'in all the things that have been made' (Rom. 1:20)."[40] Theology may, similarly, have little to say to the organic chemist purifying a product, but there are other aspects in which theology and chemistry are found to be in deep conversation.

Alister McGrath, quoting Emil Brunner, claims that if

> God "leaves the imprint of his nature … upon what he does," it follows that it is a fundamentally Christian belief that "the creation of the world is at the same time a revelation, a self-communication of God."[41]

Believing chemists have the opportunity to observe that self-communication at the molecular level as they observe the ordering and innate beauty of the chemical world. The exquisite selectivity of biological-effect molecules in medicinal and agricultural chemistry speaks to the subtlety of the creating God. The unexpected radiofrequency resonance of protons in a magnetic field highlights the ingenuity of the creator as molecules sing in harmony to the glory of God. It is too strong a claim to say that the models of these interactions have no valuational content.

McFague claims that the link between model and actuality does not "affect feelings and actions,"[42] but for the believing practitioner of organic chemistry, this is also too bold a claim. Organic synthesis—the manipulation of one molecule into another—reflects the chemical rules laid down within creation itself and can, at times, be a profoundly spiritual experience. Indeed, "Sometimes a light surprises …"[43] even as the chemist in laboratory and lab coat examines the wonders of the chemical world and sees evidence of the creator God. The believing chemist is engaged not only in furthering science, but also in following the ancient understanding of *scientia* as a discipline of the mind.[44] Such spiritual responses indicate that scientific models have valuational content.

A second difference between theological and chemical models is that, in some, but not all, traditions, theological models are revealed or "given" rather than constructed. McGrath hints at this difference: "For a religion such as Christianity, it has been traditionally understood that the analogies or models are 'given,' not chosen."[45]

McGrath also notes that his view is not supported by all theologians but that this "traditional view remains influential."[46] For theologians such as Alister McGrath, the source of the givenness of Christian models is, presumably, scripture. This choice of the word *given* suggests that such models are revealed, fully formed. A better formulation recognizes that theological models are also constructed. Scharlemann notes that "models are constructed, not naturally given."[47] "Constructed" gives precedence to the human role of interpreting scripture

in order to construct theological models and allows for the possibility of error, while "given" implies a once-for-all act with no option for modification of the model. So, while the metaphors which form the basis of religious models are *found* in scripture, they must be collected and collated to form the model. This is a human activity, hopefully guided by the Spirit, rather than a God-given finished task.

Models: Didactic, Pragmatic, and Theoretic

Several authors have promulgated a typology of models, often based on Max Black's original generic approach.[48] Peter Achinstein divides models into three classes: representational, theoretical, and imaginary.[49] Rom Harré, writing in the context of theory generation in science, divided models into two classes depending on whether the subject and source are identical or different.[50] Jacopo Tomasi separates models into material and abstract types, with the former as physical images of either concrete or imaginative form and the latter as mathematical formulations.[51] Jaap van Brakel describes thirteen types of chemical model without developing a typological scheme.[52]

Theological models tend to be organized by subject matter, rather than type. Numerous descriptions of models exist in areas of theology such as scripture and scriptural interpretation, contextual theology, the church, and the eucharist, making the construction of a typology of these models challenging.

In summary, all of these typologies rest on a descriptive approach, either in terms of the relationship between source and object or on form and subject matter. When examining models in terms of utility and truth, a more fecund typology would be functional, or purpose based. As Marx Wartofsky states, "Models are embodiments of purpose and, at the same time, instruments for carrying out such purposes."[53] A possible functional typology divides models in both chemistry and theology into three types: didactic models (used for teaching purposes), pragmatic models (used in the quotidian work of both chemist and theologian), and theoretic models (used to explain or illuminate complex concepts).

Didactic Models

The primary role of didactic models is teaching. These models often focus on a single aspect of the subject matter at the expense of other aspects. They are, therefore, often more metaphorical than other types because the "is" of the metaphor relates directly to the objective of the model and the "is not" to the less pertinent matters. These models are frequently based on relatively simple historical descriptions that were subsequently replaced by more complex constructs. For instance, the Bohr orbital model of the atom, representing negatively charged electrons revolving around a positively charged nucleus, rather like planets around the sun, is a simple model that represents some of the features of atomic orbitals and electron energy quantization, with transition of an electron from a higher to a lower energy shell explaining the quantized wavelength of limit emitted from the atom (fig. 1). The model is simple enough for teaching purposes, but assumes a simple, circular orbital pattern at odds with more complex models; it communicates a particular aspect of theory at the expense of a more truthful representation.

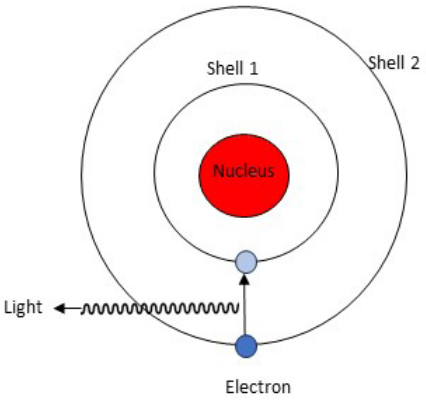

Figure 1. The Bohr Model of the Atom

Similarly, the teaching model of the cross as the "bridge" spanning the gulf between sinful humankind and a holy God (fig. 2) was much beloved of confirmation classes in the sixties and seventies

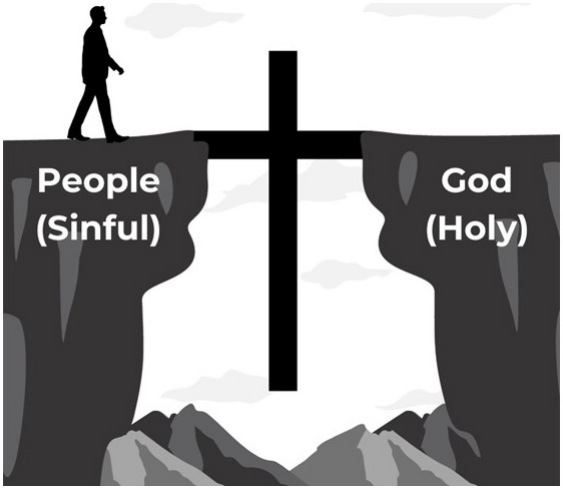

Figure 2. The Bridge Model of Salvation

and is still used today.[54] The model teaches a simple lesson but ignores more complex models of the atonement. In both chemistry and theology, communication is the key usefulness criterion for a good didactic model. As a teaching tool, the model must communicate a complex idea in simple terms. It must, of course, still have a relationship with truth, but that relationship—which might be termed the veridical distance—may be greater than in the other types of models.

Pragmatic Models

By far the largest group of models in both chemistry and theology are *pragmatic*, that is, useful for day-to-day tasks. For chemists, the prime examples are those that chemists use to represent chemical structures—the three-dimensional shape of a molecule. Roald Hoffmann and Pierre Laszlo described the hierarchy of structural representations, using models of the molecule camphor (similar to those shown in fig. 3) and noted that chemists "are hooked on these little diagrams."[55]

Each type of representation provides different information and serves a different purpose. The molecular formula (A) would be sufficient to calculate the relative molecular mass of camphor for use in reaction planning.[56] The stick diagram (B) is the typical shorthand used to represent a three-dimensional structure in two-dimensional space. A more detailed three-dimensional ball-and-stick model (C) can be generated by a relatively simple computer modeling package, allowing the molecule to be rotated and examined on the computer screen. The space-filling model (D) gives the overall shape of the molecule and might be used to examine docking with biological receptors. Hoffmann and Laszlo ask, "Which is the molecule?" and answer, "Well, all are, and none is. Or, to be serious—all of them are models, representations suitable for some purposes, not for others."[58]

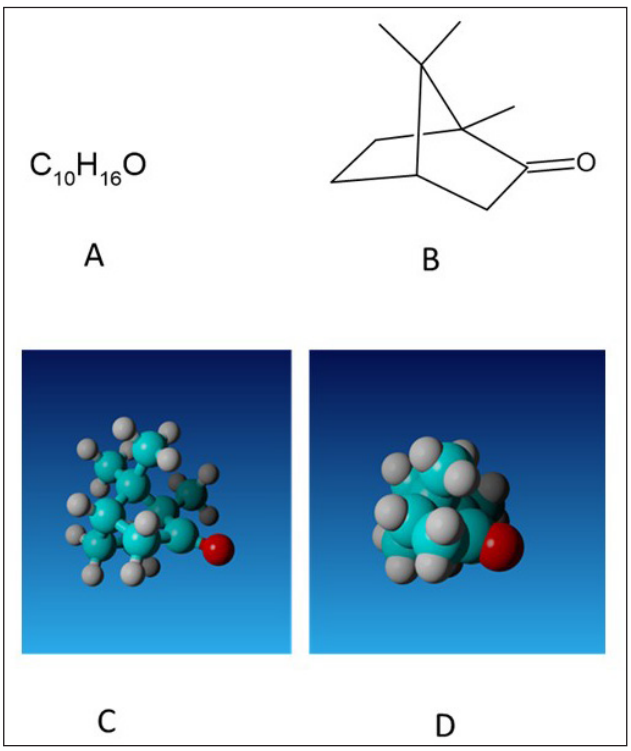

Figure 3. Models of Camphor[57]

Theologians also use a variety of pragmatic models, but whereas chemistry tends to employ hierarchical models so that higher-level models incorporate lower-level models, in theology, the models tend to be less hierarchical (*contra* McFague),[59] with the theologian selecting the model appropriate for the circumstance or underlying theological predilection. The theologian may still switch between models as circumstance requires, but not only does the new model not necessarily incorporate the old model, it may also be incompatible with it.

Perhaps the most foundational pragmatic models in theology are those concerning the inspiration and interpretation of scripture. When preparing sermons or writing commentaries, theologians employ appropriate working models of scripture. For example, John Goldingay divides models for scripture into four types: the *witnessing tradition* of narrative, the *authoritative canon* of the law, the *inspired word* of prophecy and the *experienced revelation* of poetry, epistle, and apocalypse.[60] Goldingay applies each model to a different genre of scriptural writing and not to the Bible as a whole. Thus, the practitioner seeking to preach or comment on the Gospel narratives might work through a witnessing tradition model, whereas interpretation of a psalm might use an inspired word model. Other pragmatic models critical to the work of the theologian include models of the church proposed by Avery Dulles and the models of contextual theology described by Stephen Bevans.[61]

Good pragmatic models enable the practitioner to do his or her work; they must be useful for the task at hand. Models enable the organic chemist to work in the laboratory and the theologian to work with scripture. Even though enabling is primary, a relationship with truth is still required. For the chemist using a structural model for experimental purposes, the model is useless if it directs to the wrong result. Of

course, it is possible to produce the observed result based on an incorrect model—Dewar demonstrated that. However, it is more likely that a model which gives an observed result will also be closer to theory than one that does not. As G. García Zerecero notes: "… since the beginnings of structural theory, chemists and stereo chemists have recognized, though not always explicitly, that their symbolic representations must point to some aspects of reality."[62]

Similarly, for the theologian working with scripture, the model chosen must, to some extent, cohere with the truth of the preferred doctrinal position on revelation. In both fields, the veridical distance is shorter than for the didactic type.

Theoretic Models

In *theoretic* models the veridical distance becomes shortest. Their purpose is to represent an aspect of reality as closely as possible. Yet, some sort of picture is essential to turn that dense theory into an understandable concept (*contra* McFague).[63] For chemists, quantum theory and quantum mechanics produce complex mathematical models of the atom and molecule that can be reduced to visible form using computer modeling packages. When a particular force-field (equations representing forces between atoms) is applied, the output is often a structural picture of the molecule subject (a model of a model). The relationship of that model to reality can be compared with the output from other force-fields and experimental results. If all results concur, there is some evidence for the validity of the model. The chemist knows (or at least should remember) that the force-fields are not absolute truth, just approximations of a potential reality.

If theology is the study of God, it is, almost by definition, an impossible task. God in the traditional Christian view is omniscient, omnipotent, and omnipresent, and the study of God is a study of the infinite. Consequently, it is no surprise to find theoretic models used to express the inexpressible. The nature of God is one obvious example of this type of model, but this is not the limit of theoretic theological models.

On any given Sunday, millions of Christians break bread and pour wine in the mystery of the eucharist. Theoretic models provide a means of expressing that mystery. Kevin Irwin cites ten models of the eucharist with the goal of offering "… a number of mutually enriching and interconnected 'models' which, when taken together and seen in relation to each other, can be understood to be a liturgical theology of the Eucharist."[64] As Irwin notes, each of his models is insufficient on its own to express the mystery—each represents a facet of the whole.

A good theoretic model is one that communicates the theory or doctrine in such a way that the recipient's understanding is enhanced. There is, of necessity, a shorter veridical distance for the theoretic model, since the goal of the model is to communicate truth. Theoretic models also tend to evoke the greatest level of emotional commitment. Chemists can become attached to their favorite models such as those of interactions with biological systems or reaction mechanisms, though hopefully still seeing them as models and being willing to discard them when they fail. More significantly, theologians and Christians in the pew become much more intensely committed to their models, to the extent that they become the actuality of faith, as will be shown below. Discarding such models when they fail becomes much harder.

The "Warranted" Model[65]

In a recent address to the General Synod of the Church of England, Stephen Cottrell, the archbishop of York, suggested that the opening words of the Lord's Prayer were "problematic" because of their patriarchal association,[66] essentially challenging the usefulness of the model of God as male. The model of the first person of the trinity as "Father" has been called into question for many years. Writing in 1983, McFague noted:

> The issues of idolatry and irrelevance come together in the image of God as father, for more than any other dominant model in Christianity, this one has been both absolutized by some and, in recent times, found meaningless by others. The feminist critique of God as father centers on the *dominance* of this one model to the exclusion of others, and on the *failure* of this model to deal with the anomaly presented by those whose experience is not included by this model.[67]

Writing a few years later, McFague called for alternative models for God, including mother, lover, and friend, repudiating the androcentric, hierarchical character of the Western religious tradition.[68]

In many churches, theological praxis has reflected this criticism, particularly in *ex tempore* prayer. Applying alternative models for the first person of the trinity, including those proposed by McFague,

inclusive versions of the Lord's Prayer are used in some churches. Much theological writing, including this text, attempts to avoid the use of pronouns for God, thus evading the need to assign gender and avoiding the patriarchal model. Yet, some object vigorously to any critique of the Lord's Prayer in its traditional form. It also remains firmly on the lips of millions of Christians every Sunday.

In the same *Guardian* article that reported Cottrell's musing, Chris Sugden, the chair of Anglican Mainstream, a conservative Anglican group, asks, "Is the Archbishop of York saying Jesus was wrong, or that Jesus was not pastorally aware?" In making this attack, Sugden is, in essence, claiming that the model of God as male is warranted by scripture, and it must be accepted without regard to its utility (or lack thereof) or its truth in the sense that it is a true description of God (though those who hold the position would most likely argue that it is a true description of God because it is warranted by scripture—no other warrant is required). The model appears as a descriptor of God throughout the Gospels and frequently on the lips of Jesus, most notably in the institution of the Lord's Prayer itself. Consequently, for those who take this position, the masculinity of God is no longer a model, useful or otherwise, but an article of faith—a doctrinally required description of God.

In chemistry, models are rarely, if ever, warranted. Even the fundamental laws of chemistry and their associated models may be subject to scrutiny, even if successful revision is unlikely. In a famously tongue-in-cheek response to an attempt to synthesize a "molecular ratchet"[69] that would, if it worked as proposed, violate the second law of thermodynamics, Anthony Davis made a serious point using rather theological language.

> Some would argue that this experiment was misconceived. To challenge the Second Law may be seen as scientific *heresy* … and the theoretical arguments against molecular ratchets and trapdoors are well developed. However, as scientists we should take the view that nothing is *sacred*, that experimental results outweigh all theoretical considerations, and that it is quite appropriate to revisit old questions as new techniques become available.[70]

A more serious challenge involved the model of chemical structure. Johannes Hunger claimed, "The structure of a molecule, however depicted, is one of the very central concepts in chemistry,"[71] yet in 1988, R. Guy Woolley challenged this central dogma in a paper entitled "Must a Molecule Have Shape?" Woolley argued that the "idea of molecular structure (or 'molecular shape')" which was so "familiar and deeply ingrained in our thinking" might not be an intrinsic property of a molecule in isolation.[72] The significance of this challenge is hard to underestimate since stereochemistry—one of the major fields of organic and inorganic chemistry—is predicated on the concept of molecular shape. Yet, as Ramsey noted, "Woolley claims shape is only "a powerful and illuminating metaphor" rather than an "object of belief."[73] Woolley's 1988 paper and subsequent publications prompted a veritable cottage industry of academic discussion concerning the reality of molecular shape.[74]

Woolley's argument was based on the well-known fact that "molecular structure makes no appearance in a quantum treatment of molecules starting from first principles."[75] It is only by applying various assumptions, principally the Born-Oppenheimer approximation, that shape and structure can be derived from quantum theory.[76] The empirical model of shape is required for the concept of molecular structure to emerge. This theoretical lacuna was largely ascribed to the inability to solve the immensely complex Schrödinger equation for the many-body case.[77]

Woolley's proposition implied a complete break between the model of molecular structure and the theory (truth?) of chemistry. It is tempting to see this as a challenge to a useful model that does not cohere with the truth of theory—a challenge to a central "belief" or "dogma" of organic chemistry (Woolley's choice of language is significant). However, the utility of the concept cannot be denied. Molecular shape has been enormously effective in accounting for stereochemistry, isomerism, reaction mechanism, and a host of other aspects of the chemical endeavor, suggesting that the idea of shape may be a warranted model in chemistry—because it must be true? However, subsequent authors have pointed out that while an isolated molecule may not have shape, the act of observing the molecule and its interaction with its environment may bestow shape upon it,[78] essentially resolving the apparent paradox.

While it seems likely that this story has not yet been fully told, this is a rather rare example in which a model is being modified to make it cohere to theory without the addition of experimental support. It also demonstrates the willingness of chemists to modify

even a central tenet of chemistry when confronted with contrary theoretical insights.

That the warranted model is found more frequently in theology is not without nuance. Some theologians understand the various atonement theories as models in a way similar to how models function in chemistry. Others adopt an inclusively warranted position—selecting one model as dominant but allowing others as subordinate. Yet others take an exclusively warranted stance (where only one model is accepted).

Oliver Crisp rejects metaphor and theory as appropriate descriptors of the various perspectives on the atonement and concludes, "If we have to use language other than doctrines of atonement, it might be more appropriate to speak about *models* of atonement instead."[79] Notably, Crisp draws on the analogy with models in the natural sciences in supporting his view.

Joel Green also appears to be sympathetic to this position.

> At the interface of the particular moment of Jesus' crucifixion and the eternal mission of God, we can find not one but many models of the atonement. So limited is the ground on which we walk and so infinite the mystery of God's saving work that we need many interpretive images, many tones, many voices.[80]

Other theologians, however, reject this concept of multiple models.

For theologians allowing an inclusive warrant, one particular model dominates. The other models are not rejected outright, but rather they play a supporting role providing additional color to the primary construct. Thus, Gregory Boyd argues,

> [The Christus Victor] model centers on the truth that through the incarnation, life, death and resurrection of Christ, *God defeated the devil* … I will argue that this aspect of Christ's work can plausibly be construed as more fundamental than other aspects of Christ's work and that other aspects of the "rich variety" of the wisdom of Christ's work can be best understood within this context.[81]

While Thomas Schreiner counters that a different model of the atonement dominates, he explains,

> I am not claiming that [penal substitution] is the *only* truth about the atonement taught in the Scriptures. Nor am I claiming that penal substitution is emphasized in every piece of literature or that every author articulates clearly penal substitution. I am claiming that penal substitution functions as the anchor and foundation for all other dimensions of the atonement when the Scriptures are considered as a canonical whole.[82]

For theologians promulgating an exclusively warranted model, other views are either rejected outright or in some way subsumed within the one model. Thus, James Packer writes,

> Exegetically, it is clear that penal substitution (Christ bearing in our place the curse, that is, the retribution that hung over us) is Paul's final and fundamental category for understanding the cross … How did the Savior's self-sacrifice have this propitiatory effect? By being a vicarious enduring of the retribution declared due to us by God's own law … in other words, by *penal substitution*.[83]

John Stott takes a similar position:

> So substitution is not a "theory of the atonement." Nor is it even an additional image to take its place as an option alongside others. It is rather the essence of each image and the heart of the atonement itself.[84]

Stott was writing in 1986 and Packer in 2004, but this is very much a live issue as witnessed by the furor that arose recently when a well-known evangelical questioned the value of the penal substitutionary model of the atonement.[85]

For theologians such as Crisp and Green, the doctrine of the atonement is a high-level description of the teaching of the church on the fact of Jesus's saving actions, but the doctrine does not include the mechanisms—Crisp's word—that describe how that saving action works. These mechanisms are described by multiple models. The models inform and flesh out the doctrine but are not integral to it—the doctrine is sufficient without supporting models. In contrast, Boyd and Schreiner do not view all the descriptions of the atonement on an equal basis. For these theologians, the one inclusively warranted model that they espouse is less a model in the chemical sense and more an integral part of the doctrine.

It is highly questionable whether an exclusively warranted model should still be considered a model. Stott's use of the word "image" suggests that he may still retain some sort of metaphorical/model conception of penal substitution. However, this is unclear, and his position is more likely closer to that of Donald Bloesch who, discussing the issue of God the Father described above, specifically rejects any

metaphorical/model language in favor of analogy and symbol:

> To say that God is a Rock or Fortress is metaphorical, but to call God Father or Lord is analogical. A metaphor connotes a suggested likeness between two things that are manifestly dissimilar, whereas an analogy presupposes an underlying similarity or congruity in the midst of real difference.[86]

Citing Barth as a source, Bloesch further claims:

> [These] foundational symbols … cannot be replaced because they are based not on cultural experience but on a divine intrusion into cultural experience, a revelation that originates not in history or culture, but in eternity.[87]

And further:

> God is not a man, but, for the most part, he chooses to relate himself to us as masculine.[88]

For Bloesch, the conceptualization of God as Father is not a model or a metaphor but a divinely revealed doctrine. By removing the concept from the arena of metaphor/model, Bloesch attempts to blunt criticism of the symbol. God the Father is a revealed truth about God that, in Bloesch's view, is critical to the doctrine of the Trinity. God may have feminine aspects, but God is male, and "he" is God's chosen pronoun. It seems that when a model is inclusively, and especially exclusively, warranted, it begins to lose its metaphorical content. The "is" begins to outweigh the "is not" and the model starts to merge with and becomes identified with doctrine and even dogma.

Conclusion

In this study, we have juxtaposed a chemical and theological perspective on models and concluded that a good model is both useful and true—useful in enabling and communicating a concept, and true in cohering with theory or doctrine, albeit in a limited sense. Previous studies have identified important differences between chemical and theological models, but one difference that has not received attention is the existence of warranted models as a feature of theology absent from chemistry. Many theologians adopt an attitude toward models similar to that found in chemistry: useful models should be retained but models that no longer function should be modified or rejected. But some traditions insist on retaining models that are of questionable value and resist attempts to revise their models. They insist that particular models are true—revealed in whole cloth—and that such models must, therefore, be useful.

The chemist—ever the pragmatist—might ask why some theologians insist on, for example, a patriarchal model of God and its entailments that has the potential to offend half the population and does offend many.[89] Why insist on the penal substitutionary model of the atonement, with its entailments of blood sacrifice and "cosmic paternalism, neglect, and child abuse"[90] that are found offensive in the current era? Do these models work? Do these models serve to effectively communicate the Gospel to the world? If, as appears to be the case, they have become detrimental to spreading the good news of God's love, then the pragmatic chemist would say that they are no longer good models because they are no longer useful—they fail to communicate.

The theologians of patriarchy and penal substitution might respond that these models are warranted in scripture and therefore to be faithful to scripture they cannot be discarded and, further, *must be useful* because they are God given. However, as discussed above, models are not *given* but *constructed* by the human mind from the smaller-scale metaphors that are *found* in scripture. Those metaphors, and others that can be *found* in scripture, can be used to *construct* models appropriate for the twenty-first century, just as Jürgen Moltmann uses the metaphor of God the Father to construct a non-patriarchal model of a trinitarian God and as Green uses multiple metaphors of the atonement to construct the kaleidoscopic model.[91] It is possible to retain adherence to scripture and work creatively to construct new models appropriate for the twenty-first century from the metaphors of scripture. The metaphors may live, even as the old model dies. If the juxtaposition of models in chemistry and theology shows anything, it is that the work of creative model building and modification must go on in theology just as it does in chemistry, refining and constructing models that effectively illuminate the love of God for today's world.

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Notes

[1]A classic example of this is found in the many "four views" books on Christian doctrine. In these texts, the authors almost exclusively work within theological parameters, comparing the truth of their doctrinal positions or coherence with scripture, but they rarely ask whether the models that they espouse communicate the gospel outside of the theological world. See IVP Spectrum Multiview Series (22 titles), https://www.ivpress.com/spectrum-multiview-book-series, and Zondervan Counterpoints Series (38 titles), https://zondervanacademic.com/products/category/counter-points, both accessed July 30, 2024.

[2]An exception to this is the work of David Klemm and William Klink cited below. However, this work was aimed at validating theology and its models as an academic subject comparable with other academic subjects.

[3]Michael J. S. Dewar, "Chemical Implications of .sigma. conjugation," *Journal of the American Chemical Society* 106, no. 3 (1984): 669–82, https://doi.org/10.1021/ja00315a036.

[4]Sallie McFague, *Metaphorical Theology: Models of God in Religious Language* (Philadelphia, PA: Fortress Press, 1982), 67.

[5]Mary B. Hesse, *Models and Analogies in Science* (Notre Dame, IN: Notre Dame Press, 1966), 8.

[6]Harré claims that there is a real difference between metaphors and models, but also notes that this difference is seldom observed by authors: Rom Harré, "Review of David E. Leary, ed. *Metaphor in the History of Psychology*," *British Journal for the Philosophy of Science* 47, no. 1 (1996): 142.

[7]Theodore L. Brown, *Making Truth: Metaphor in Science* (Chicago, IL: University of Illinois Press, 2003), 29.

[8]Correspondence view: X is true *iff* X corresponds to the facts. Coherence view: X is true *iff* X appropriately belongs to a coherent set S. See Pascal Engel, *Truth* (Montreal, ON: McGill-Queen's University Press, 2002), chapter 1, for a summary of classical definitions of truth.

[9]Throughout this study, theology refers to Christian theology. Since Christianity is based on the life and work of Jesus Christ and scripture is the primary source for data on the life and work of Jesus, it is not unreasonable to claim that scripture is the arbiter of theological truth. Others may wish to include reason and tradition alongside scripture, but ultimately in *Christian* theology these will also be colored and shaped by the scriptural account of Jesus's life.

[10]In contrast to a deflationist position that adding the phrase "is true" to an assertion does not change that assertion (Engel, *Truth*, chap. 2).

[11]For example, "Scientific realism comes in many different flavors, but nearly everyone agrees on a couple of basic premises. First, there is a real world out there, and it exists independently of our knowledge of it. Second, the great successes of modern science and technology go a long way toward assuring us that we can have stable, reliable knowledge of it." Brown, *Making Truth*, 186.

[12]For example, "Religious realism is the view that the existence or non-existence of God is a fact independent of whether you or I or anyone else believes that God exists. If God exists, God is not simply an idea or ideal in our minds, but an ontological reality, the ultimate creative power of the universe." John Hick, "Believing—And Having True Beliefs," in *Is God Real*, ed. Joseph Runzo (London, UK: Macmillan Press, 1993), 115.

[13]Ian T. Ramsey, *Models and Mystery* (London, UK: Oxford University Press, 1964).

[14]Frederick Ferré, "Metaphors, Models, and Religion," *Soundings: An Interdisciplinary Journal* 51, no. 3 (1968): 327–45, https://www.jstor.org/stable/41177726.

[15]Thomas Fawcett, *The Symbolic Language of Religion* (Minneapolis, MN: Augsburg Publishing House, 1971).

[16]Robert P. Scharlemann, "Theological Models and their Constructions," *The Journal of Religion* 53, no. 1 (1973): 65–82, https://www.jstor.org/stable/1201666.

[17]Ian G. Barbour, *Myths, Models, and Paradigms* (London, UK: SCM Press, 1974).

[18]Ian G. Barbour, *Religion and Science: Historical and Contemporary Issues* (San Francisco, CA: Harper, 1997).

[19]McFague, *Metaphorical Theology*.

[20]Sallie McFague, *Models of God: Theology for an Ecological, Nuclear Age* (Philadelphia, PA: Fortress Press, 1987).

[21]Janet Martin Soskice, *Metaphor and Religious Language* (Oxford, UK: Clarendon Press, 1985).

[22]Arthur Peacocke, *Intimations of Reality: Critical Realism in Science and Religion* (Notre Dame, IL: University of Notre Dame Press, 1984).

[23]Alister E. McGrath, *Science and Religion: A New Introduction,* 3rd ed. (Chichester, UK: Wiley Blackwell, 2020).

[24]David E. Klemm and William H. Klink, "Dialogue on Theological Models: Constructing and Testing Theological Models," *Zygon* 38, no. 3 (2003): 495, http://dx.doi.org/10.1111/1467-9744.00517; Langdon Gilkey, "Problems and Possibilities of Theological Models: Responding to David Klemm and William Klink," *Zygon* 38, no. 3 (2003): 529, https://doi.org/10.1111/1467-9744.00518; and David E. Klemm and William H. Klink, "Models Clarified: Responding to Langdon Gilkey," *Zygon* 38, no. 3 (2003): 535, https://doi.org/10.1111/1467-9744.00519.

[25]Janet Martin Soskice, *The Kindness of God: Metaphor, Gender, and Religious Language* (Oxford, UK: Oxford University Press, 2007), chap. 4.

[26]Michael Fuller, "Nescience: A Contrast in the Uses of Models in Science and Theology," in *Issues in Science and Theology: Creative Pluralism?,* ed. Michael Fuller, Dirk Evers, and Anne Runehov (Cham, Switzerland: Springer, 2022), 166.

[27]Robert K. Bolger, *Kneeling at the Altar of Science: A Mistaken Path of Contemporary Religious Scientism* (Eugene, OR: Pickwick Publications, 2012), 57.

[28]Scientism has been variously defined as the view that "the scientific method is the only reliable path to knowledge," (Barbour), and "Science is our only means of access to reality," (Trigg). Ian Barbour, *Religion in an Age of Science* (New York: Harper and Row, 1990), 4; and Roger Trigg, *Rationality and Science* (Oxford, UK: Blackwell, 1993), 90.

[29]Taede A. Smedes, "Beyond Barbour or Back to Basics? The Future of Science-and-Religion and the Quest for Unity," *Zygon* 43, no. 1 (2008): 235, http://dx.doi.org/10.1111/j.1467-9744.2008.00910.x.

[30]Ian G. Barbour, "Taking Science Seriously without Scientism: A Response to Taede Smedes," *Zygon* 43, no. 1 (2008): 259, https://doi.org/10.1111/j.1467-9744.2008.00911.x.

[31]Taede A. Smedes, "Taking Theology and Science Seriously without Category Mistakes," *Zygon* 43, no. 1 (2008): 271, https://doi.org/10.1111/j.1467-9744.2008.00912.x.

[32]Bolger, *Kneeling at the Altar of Science*, 5.
[33]Ibid., 8.
[34]McFague, *Metaphorical Theology*, 103; and Soskice, *Metaphor and Religious Language*, 104–5.
[35]Hirofumi Ochiai, "The Logical Structure of Organic Chemistry and the Empirical Adequacy of the Classical Concept of the Molecule," *ChemInform* 45 (2013): 139, https://doi.org/10.1002/CHIN.201441284.
[36]Fawcett, *The Symbolic Language of Religion*, 82.
[37]McFague, *Metaphorical Theology,* 107.
[38]Ibid., 107.
[39]John Polkinghorne, *Science and Religion in Quest of Truth* (New Haven, CT; Yale University Press, 2011), 21. Although this quotation indicates that Polkinghorne is taking a NOMA view, his later writings on the anthropic principle and chaos theory might suggest a partial overlap. However, even here, Polkinghorne writes, "Metaphysical questions must receive metaphysical answers that are given for metaphysical reasons." John Polkinghorne, *Faith, Science and Understanding* (New Haven, CT: Yale University Press, 2000), 99.
[40]Stephen Contakes, "Chemistry, Christianity, and Wisdom," in *Where Wisdom May Be Found: The Eternal Purpose of Christian Higher Education*, ed. Edward P. Meadors (Eugene, OR: Pickwick Publications, 2019), 192.
[41]Alister E. McGrath, *An Open Secret: A New Vision for Natural Theology* (Oxford, UK: Blackwell, 2008), 184.
[42]McFague, *Metaphorical Theology*, 107.
[43]"Sometimes a light surprises the Christian while he sings," from the hymn by William Cowper (1731–1800).
[44]Peter Harrison, *The Territories of Science and Religion* (Chicago, IL: University of Chicago Press, 2015), chap. 1.
[45]McGrath, *Science and Religion: A New Introduction*, 170.
[46]Ibid.
[47]Scharlemann, "Theological Models and their Constructions."
[48]Max Black, *Models and Metaphors: Studies in Language and Philosophy* (Ithica, NY: Cornell, 1962), chap. 13.
[49]Peter Achinstein, *Concepts of Science: A Philosophical Analysis* (Baltimore, MD: Johns Hopkins Press, 1968), chap. 7.
[50]Rom Harré, *The Principles of Scientific Thinking* (Chicago, IL: University of Chicago Press, 1970), 133 ff.
[51]Jacopo Tomasi, "Towards 'Chemical Congruence' of the Models in Theoretical Chemistry," *Hyle – An International Journal for the Philosophy of Chemistry* 5, no. 2 (1999): 79–115, https://api.semanticscholar.org/CorpusID:53348965.
[52]Jaap van Brakel, *Philosophy of Chemistry: Between the Manifest and the Scientific Image* (Louvain, Belgium: Leuven University Press, 2000/2013), 156.
[53]Marx W. Wartofsky, "Telos and Technique: Models as Modes of Action," in *Models: Representation and the Scientific Understanding*, ed. Robert S. Cohen and Marx W. Wartofsky (Dordrecht, Holland: D. Reidel Publishing, 1979), 142.
[54]For example, Navigators, "The Bridge to Life" (NavPress, 1976), https://www.navigators.org/resource/the-bridge-to-life/, accessed 7/28/2023.
[55]Roald Hoffmann and Pierre Laszlo, "Representation in Chemistry," *Angewandte Chemie, International Edition* 30, no. 1 (1991): 1–16.
[56]The molar mass of each of the components can be calculated by summing the relative atomic masses of each of the molecular formulae. The ratio of the relative molecular masses of the reactants in a chemical reaction allows calculation of the masses of each component required.
[57]Diagrams drawn using ACD Labs ChemSketch.
[58]Hoffmann and Laszlo, "Representation in Chemistry," 5.
[59]McFague, *Metaphorical Theology,* 105.
[60]John Goldingay, *Models for Scripture* (Toronto, ON: Clements Publishing, 2004), 18; and John Goldingay, *Models for Interpretation of Scripture* (Grand Rapids, MI: Eerdmans, 1995).
[61]Avery Dulles, *Models of the Church* (New York: Doubleday, 1987); and Stephen B. Bevans, *Models of Contextual Theology* (Maryknoll, NY: Orbis Books, 1992).
[62]G. García Zerecero, "Molecular Models and Scientific Realism," *Foundations of Chemistry* 22, no. 3 (2020): 467–76, https://doi.org/10.1007/s10698-020-09363-7.
[63]McFague, *Metaphorical Theology,* 105.
[64]Kevin W. Irwin, *Models of the Eucharist* (New York/Mahwah, NJ: Paulist Press, 1991), 298.
[65]It should be noted that the concept of the warranted model is descriptive and not prescriptive. Warrant is viewed from the observer's perspective—those who adopt a warranted model most likely would not describe it in this way.
[66]Harriet Sherwood, "Lord's Prayer Opening May Be 'Problematic,' Says Archbishop," *The Guardian*, July 7, 2023, https://www.theguardian.com/world/2023/jul/07/lords-prayer-our-father-opening-may-be-problematic-archbishop-of-york-stephen-cottrell, accessed 7/18/2023.
[67]McFague, *Metaphorical Theology*, 145 (italics original).
[68]McFague, *Models of God*.
[69]A molecular ratchet is a molecule that was designed to rotate in only one direction about an intramolecular axis: T. Ross Kelly, Imanol Tellitu, and José Pérez Sestelo, "In Search of Molecular Ratchets," *Angewandte Chemie, International Edition* 36, no. 17 (1997): 1866–68, https://doi.org/10.1002/anie.199718661; and T. Ross Kelly, José Pérez Sestelo, and Imanol Tellitu, "New Molecular Devices: In Search of a Molecular Rachet," *Journal of Organic Chemistry* 63, no. 11 (1998): 3655–65, https://doi.org/10.1021/jo9723218.
[70]Anthony P. Davis, "Tilting at Windmills? The Second Law Survives," *Angewandte Chemie, International Edition* 37, no. 7 (1998): 909–10, italics added, https://doi.org/10.1002/(sici)1521-3773(19980420)37:7%3C909::aid-anie909%3E3.0.co;2-x.
[71]Johannes Hunger, "How Classical Models of Explanation Fail to Cope with Chemistry—The Case of Molecular Modeling," in *Philosophy of Chemistry: Synthesis of a New Discipline*, ed. Davis Baird, Eric Scerri, and Lee McIntyre (Dordrecht, The Netherlands: Springer, 2006), 131.
[72]Richard Guy Woolley, "Must a Molecule Have Shape?," *New Scientist* 120 (1988): 53–57, https://www.researchgate.net/publication/314751850_Must_a_molecule_have_shape.
[73]Jeffry L. Ramsey, "Realism, Essentialism, and Intrinsic Properties: The Case of Molecular Shape," in *Of Minds and Molecules: New Philosophical Perspectives on Chemistry*, ed. Nalini Bhushan and Stuart Rosenfeld (Oxford, UK: Oxford University Press, 2000), 120.
[74]For example: R.W. Woolley, "The Molecular Structure Conundrum," *Journal of Chemical Education* 62, no. 12 (1985): 1082–84, https://api.semanticscholar.org/CorpusID:97783213; Stephen J. Weininger, "The Molecular Structure Conundrum: Can Classical Chemistry Be Reduced to Quantum Chemistry?," *Journal of Chemical Education* 61, no. 11 (1984): 939–44, https://doi.org/10.1021/ed061p939; Sebastian Fortin and Olimpia Lombardi, "Is the Problem of Molecular Structure Just the Quantum Measurement Problem?," *Foundations of Chemistry* 23, no. 3 (2021):

379–95, https://doi.org/10.1007/s10698-021-09402-x; and Hirofumi Ochiai, "Understanding Molecular Structure Requires Constructive Realism," *Foundations of Chemistry* 22, no. 3 (2020): 457–65, https://doi.org/10.1007/s10698-020-09362-8.

[75]Hirofumi Ochiai, "Philosophical Foundations of Stereochemistry," *Hyle – International Journal for Philosophy of Chemistry* 21, no. 1 (2015): 1–18, https://www.researchgate.net/publication/289619938_Philosophical_Foundations_of_Stereochemistry.

[76]Hunger, "How Classical Models of Explanation Fail to Cope with Chemistry – The Case of Molecular Modeling," 132.

[77]Paul Dirac states, "The underlying physical laws necessary for the mathematical theory of a large part of physics and the whole of chemistry are thus completely known, and the difficulty *is only* that the exact application of these laws leads to equations much too complicated to be soluble," in P.A.M. Dirac, "Quantum Mechanics of Many-Electron Systems," *Proceedings of the Royal Society of London A* 123, no. 792 (1929): 714–33, https://doi.org/10.1098/rspa.1929.0094; and interestingly, Woolley disagrees with the Dirac aphorism noting "For quantum chemistry beyond the Born-Oppenheimer approximation the difficulty is not the complications of the equations; rather it is the lack of appropriate equations," in R.G. Woolley, "Quantum Chemistry beyond the Born-Oppenheimer Approximation," *Journal of Molecular Structure: Theochem* 230 (1991): 17–46, https://doi.org/10.1016/0166-1280(91)85170-C.

[78]Alexander Franklin and Vanessa A. Seifert, "The Problem of Molecular Structure Just Is the Measurement Problem," *The British Journal for the Philosophy of Science* 75, no. 1 (2024): 31–59, https://doi.org/10.1086/715148; and Vanessa A. Seifert, "Do Molecules Have Structure in Isolation? How Models Can Provide the Answer," in *Philosophical Perspectives in Quantum Chemistry*, ed. Olimpia Lombardi, Juan Camilo Martínez González, and Sebastian Fortin (Cham, Switzerland: Springer, 2022), 125–46.

[79]Oliver D. Crisp, *Approaching the Atonement: The Reconciling Work of Christ* (Downers Grove, IL: IVP Academic, 2020), 25.

[80]Joel B. Green, "Kaleidoscopic View," in *The Nature of the Atonement: Four Views*, ed. James Beilby and Paul R. Eddy (Downers Grove, IL: IVP Academic, 2006), 185.

[81]Gregory A. Boyd, "Christus Victor View," in *The Nature of the Atonement,* ed. Beilby and Eddy, 24, italics added.

[82]Thomas R. Schreiner, "Penal Substitution View," in *The Nature of the Atonement,* ed. Beilby and Eddy, 67, italics original.

[83]J. I. Packer, "The Atonement in the Life of the Christian," in *The Glory of the Atonement,* ed. Charles E. Hill and Frank A. James III (Downers Grove, IL: IVP Academic, 2004), 416, italics original.

[84]John R. W. Stott, *The Cross of Christ* (Leicester, UK: IVP, 1986), 202.

[85]Steve Chalke and Alan Mann, *The Lost Message of Jesus* (Grand Rapids, MI: Zondervan, 2003) and responses: Steve Jeffery, Mike Ovey, and Andrew Sach, *Pierced for Our Transgressions* (Nottingham, UK: IVP, 2007); and Derek Tidball, David Hilborn, and Justin Thacker, *The Atonement Debate* (Grand Rapids MI: Zondervan, 2008).

[86]Donald G. Bloesch, *The Battle for the Trinity* (Ann Arbor, MI: Servant Publications, 1985), 21.

[87]Ibid., 23.

[88]Ibid., 33.

[89]Janet Martin Soskice, *The Kindness of God*, 67.

[90]Rita Nakashima Brock, "And a Little Child Will Lead Us," in *Christianity, Patriarchy and Abuse,* ed. Joanne Carlson Brown and Carole R. Bohn (New York: Pilgrim Press, 1989): 52.

[91]Jürgen Moltmann, *The Trinity and the Kingdom* (Minneapolis, MN: Fortress Press, 1993), 164; and Green, "Kaleidoscopic View," in *The Nature of the Atonement,* in ed. Beilby and Eddy.

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d. Percentage Paid (Both Print & Electronic Copies (16b divided bt 16c x 100)	94.57%	96.16%

[ ] I certify that 50% of all my distribution copies (electronic and Print) are paid above a nominal price

17. Publication of Statement of Ownership
[x] Publication required. Will be printed in the **12/01/2024** issue of this publication. [ ] Publication not required

18. Signature and Title of Editor, Publisher, Business Manager, or Owner: Vicki Best — Title: Executive Vice President — Date: 09/25/2024

I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties)