Proposal to the John Templeton Foundation
Exploring the Constructive Interaction of Science and Religion

Proposal ID# 266 ~ William A. Dembski

Main Topical Category: Evidence of Purpose
Secondary Topical Category: Expanding Concepts of God
Proposal Type: Professional Scholarly Book
Book Title: *Being as Communion*
Book Subtitle: *The Science and Metaphysics of Information*

Being as Communion: The Science and Metaphysics of Information

Rationale: Ours is an information age. Even so, information remains an elusive entity. Scientific reductionists are confident that brute undirected processes can generate information. To be sure, undirected processes can transmit already existing information. But how information itself originates remains a mystery. Many scientists are now admitting as much. Paul Davies in his most recent book, *The Fifth Miracle*, regards the information problem as the outstanding open problem confronting science. Manfred Eigen in *Steps towards Life* claims that it is the central problem facing origin-of-life research: "Our task is to find an algorithm, a natural law that leads to the origin of information" (p. 12). In field after field, scientists are finding that the information problem is the key conceptual hurdle they must overcome. The problem of consciousness, the mind-body problem, the origin of life, the unreasonable effectiveness of mathematics in describing the physical world, and the fine-tuning of cosmological constants are just a few of the problems that promise resolution once the information problem itself is resolved.

Information is the subject of a well-developed mathematical theory known as "information theory." The mathematical theory of information, however, is a purely statistical theory. Consequently, it neglects the patterning of information that is so crucial to the special sciences. As a statistical theory, the mathematical theory of information is about the improbability or complexity of information, not about the patterning or specification of information. Complexity *per se* is not the problem. The information problem, as Paul Davies rightly points out, is how to explain "tightly specified complexity" (*The Fifth Miracle*, p. 112). What's needed, then, is a theory of *specified complexity*, or what's also coming to be known as *complex specified information*. The aim of *Being as Communion* is to sketch the broad outlines of such a theory and then to draw out its implications for theology and metaphysics. **««**

Proposal ID# 266

Theological Motivation: Common to Jewish, Christian, and Muslim theism is the view that creation proceeds through a divine spoken word. Such a view has enormous implications for the nature of reality, or what philosophers call ontology. Ontology asks what are the fundamental constituents of reality. According to the scientific naturalism that currently prevails in the West, the world is fundamentally an interacting system of mindless entities (be they particles, strings, or fields). Mind (the Greek *nou'ß*) therefore becomes an emergent property of suitably arranged mindless entities. But if creation and everything in it proceeds through a divine spoken word, then the entities that are created don't suddenly fall silent at the moment of creation. Rather, they continue to speak. In particular, a thing's reality derives from its capacity to communicate with other entities in creation and ultimately with God.

The problem of being thus receives a straightforward solution: To be is to be in communion, first with God and then with the rest of creation. It follows that the fundamental science, indeed the science that needs to ground all other sciences, is a theory of communication, and not, as is widely supposed an atomistic, reductionist, and mechanistic science of particles or other mindless entities, which then need to be built up to ever greater orders of complexity by equally mindless principles of association, known typically as natural laws or algorithms. Within such a theory of communication the proper object of study is not particles, but the information that passes between entities.

The aim of *Being as Communion* is to sketch the broad outlines for such a theory. Within such a theory, information is characterized as *specified complexity*. Just about everything is complex. But only when what is complex is also specified does it become genuinely informative. Information as specified complexity is richer than the statistical form of information developed by Claude Shannon in his classic *A Mathematical Theory of Communication*. Shannon addressed the transmission of information across communication lines subject to noise. What Shannon's theory does not do, and indeed was never intended to do, is distinguish information in terms of significance. Shannon's theory is concerned solely with complexity, not with specification.

Being as Communion weds specified complexity to Shannon's theory of information. An immediate consequence of this marriage is a conservation law for complex specified information. According to this law, undirected natural causes can transmit but cannot originate complex specified information. This law suggests that a fundamental teleology underlies the natural world. It follows that complex specified information, though instantiated in the natural world, is not reducible to the natural world. This is precisely the opening one needs for a relational ontology of communion: To be is to be in communion, and to be in communion is to exchange information. *Being as Communion* argues that this view makes not only good scientific sense, but also good metaphysical and theological sense. **««**

Proposal ID# 266

Executive Summary: Nature abounds with information that is both complex and specified. Even so, how nature generates complex specified information remains a mystery. This is the information problem, and a growing body of scientists believe that it is the great unsolved problem of science. The aim of *Being as Communion* is not to resolve the information problem, but to develop a theoretical framework for properly understanding and formulating it. This framework in turn underwrites a relational ontology that accommodates purpose.

Being as Communion starts by examining the current ferment over information. Paul Davies' has recently identified specified complexity as the key problem confronting science. The first chapter details just how pervasive this information problem is throughout the special sciences. Next, I turn to the relative lack of interest in this problem until recently. Mechanism, the dominant metaphor at the rise of modern science, casts a long shadow and is still with us. In chapter two I describe how mechanism and the philosophies that tried to come to terms with it undercut information.

Chapter three catalogues the different types of information currently in use. Information, whatever the type, can be both complex and specified. Chapter four develops a theoretical framework for complex specified information. What it means for something to be complex and specified needs to be made precise before we can adequately assess how specified complexity poses a problem for science.

Reductionist approaches to specified complexity have been tried and found wanting. Chapter five details the failures. Notable here are the "no free lunch" (NFL) theorems by David Wolpert and William Macready. These theorems severely restrict the type of problems genetic algorithms can solve, principal being the generation of specified complexity. Whereas chapter five looks at individual failures, chapter six analyzes the underlying mathematical reason for these failures. I establish that specified complexity satisfies a conservation law and that reductionist attempts to account for specified complexity per force violate that law.

Chapter six establishes what appears to be a purely negative result (i.e., a conservation law stating how specified complexity may not be generated). But in fact this result invites a much richer understanding of specified complexity than is possible within a strictly reductionist and mechanistic framework. Specified complexity is a reliable marker of purpose and is properly situated within a relational ontology whose principle of relationality is information.

The last three chapters focus on the connection between specified complexity, purpose, and ontology. In chapter seven I propose a model of *orthogonal causation* in which physical mechanism and information transmission are fundamental causal powers capable of interacting coherently and without interfering with one another. When applied to divine action, this model avoids the usual problems associated with interventionism, but also renders divine action counterfactually definite (i.e., God's action becomes free and effectual). I then apply this model to sacramental theology (chapter eight) and the problem of being (chapter nine). **««**

Proposal ID# 266

Proposed Table of Contents

Chapter Summaries

Chapter 1: Bit before It? In *Logic and Information* (Cambridge University Press, 1991) mathematician Keith Devlin asks whether information should be regarded as "a basic property of the universe, alongside matter and energy, and being ultimately interconvertible with them." In field after field, scientists are beginning to suspect that information may be the key to resolving their deep unanswered questions. The problem of consciousness, the mind-body problem, the origin of life, the unreasonable effectiveness of mathematics in describing the physical world, and the fine-tuning of cosmological constants are just a few of the problems that promise resolution once information is adequately understood. This is the information problem: to provide a full theoretical account of information adequate for science. The aim of *Being as Communion* is not to resolve the information problem, but rather to assist in its resolution by developing a theoretical framework for properly understanding and formulating it. The first step in this project is to convince the reader that there really is a problem here. Thus, after summarizing Paul Davies' recently expressed views about the centrality of the information problem to science (cf. *The Fifth Miracle*, Simon & Schuster, 1999), this chapter examines a series of case studies detailing just how pervasive the information problem is throughout the special sciences. Fundamental problems in cognitive science, biology, quantum physics, thermodynamics, cosmology, and the applicability of mathematics to the natural sciences all hang on the information problem. The chapter closes by reviewing Michael Polanyi's critique of scientific reductionism. In his critique Polanyi argued for the irreducibility of certain physical structures to brute undirected processes. Polanyi's critique was really an argument for the fundamental place of information in our understanding of the physical world. ««

Chapter 2: Modernity's Misplacement of Information. Information has only recently returned to the fore. With the emergence and development of modern science, information fell into disuse. The reason is not hard to trace. Mechanism, the dominant metaphor at the rise of modern science, has no place for information. Francis Bacon's demarcation between science and metaphysics is emblematic here. Bacon, in his critique of Aristotle, separated Aristotle's four causes into those that are properly scientific and those that are strictly metaphysical (cf. Bacon's *Advancement of Learning*). Under the properly scientific causes Bacon placed material and efficient causes. Under the strictly metaphysical causes Bacon placed formal and final causes. Since information is about the structure rather than the constitution or dynamics of things, it is no accident that information should receive short shrift within Bacon's characterization of science. Holdouts arguing for the legitimacy of information in science remained for a time. Newton, for instance, attributed the dynamics of the solar system to mechanism, but argued that the initial positioning of the planets and sun "could only proceed from the counsel and dominion of an intelligent and powerful being" (General Scholium to Newton's *Principia*). Newton here was invoking a principle of information. By the time of Laplace, however, information was no longer needed to account for the initial positioning of the solar system. Laplace's nebular hypothesis accounted for that positioning in terms of a gravitational mechanism that dispensed with information. The history of science and philosophy from the 17th century through much of the 20th century has struggled with how to incorporate information into a scientifically tenable worldview. This chapter details that struggle. What's more, it suggests that the premodern conception of information, which fell into disuse during the heyday of mechanistic science, may soon be revived in a suitably updated and mathematically rigorous form. **««**

Chapter 3: Types of Information. This chapter catalogues the different types of information treated in the scientific and philosophical literature. Information comes in various types, and researchers who work with one type of information often have little acquaintance with the others. To gain a better sense of how pervasive information is not just in science but also in our workaday lives, it will therefore help to gather all these types of information in one place. This has not been done before. The chapter opens with the best known type of information, Shannon information, which treats information as a measure of statistical improbability. Next the chapter takes a linguistic turn and considers information as it arises in the philosophy of language (i.e., syntactic, semantic, pragmatic, and functional information). Next the chapter treats certain more specialized and less well-known types of information: algorithmic information (the Chaitin-Kolmogorov approach to information as data incompressibility—the more compressible the data, the less information), error-corrected information (basically Shannon information coded syntactically and given certain redundant features so that in its transmission across a communication channel the original information can be accurately recovered), and cryptographic information (information that's encrypted and decrypted according to some cryptographic scheme). Finally, the chapter treats Fisher information, which construes information as an inverse dispersion measure. Though hitherto confined mainly to statistics, Fisher information is promising to unify the whole of physics by reconceptualizing physical laws as attempts to extract Fisher information from data (cf. the work of Roy Frieden). ««

Chapter 4: Information as Specified Complexity. Information, whatever the type, can be both complex and specified. This chapter develops a theoretical framework for complex specified information. What it means for something to be complex and specified needs to be made precise before one can adequately assess how specified complexity poses a challenge to science. Complexity theory is well-understood, and saying what it is for an item of information to be complex is reasonably straightforward. The more difficult question is saying what it is for an item of information to be specified. Clearly, specification refers to the "patterning" of information. The difficulty here, however, is that everything is patterned in some way or other. A long sequence of random coin flips will exhibit a pattern, but in all likelihood won't exhibit a pattern that calls for explanation. This is Nelson Goodman's problem of projectible and non-projectible predicates, but applied to statistics. Just about any data set will contain strange and improbable patterns if one looks hard enough. Statisticians therefore force experimenters to set their rejection regions independently of an experiment, thereby protecting the experiment from spurious patterns that could just as well result from chance. The account of specification developed here generalizes the rejection regions of statistics, thereby turning complex specified information into a rigorous tool for scientific inquiry. ««

Chapter 5: Reductionist Attempts to Explain Specified Complexity. Reductionist approaches to specified complexity have to date proven unsuccessful. This chapter details the failures. Richard Dawkins' cumulative selection model fails because specifications are holistic patterns that cannot be decomposed into simpler patterns. Thus, when Dawkins simulates cumulative selection on a computer to generate the target sequence METHINKS IT IS LIKE A WEASEL (= complex specified information), he must first insert the target sequence into the computer's memory—thereby merely re-expressing the target sequence, but not actually generating it. This is the problem generally with complex specified information: attempts to generate it always lead to patterns of information more complicated than those initially in question. Genetic algorithms have not fared better than Dawkins' cumulative selection model. The "no free lunch" (NFL) theorems by David Wolpert and William Macready severely restrict the type of problems genetic algorithms can solve—the generation of specified complexity being a case in point. Inflationary scenarios in cosmology try to wash away the specified complexity problem by appealing to a selection effect. But even with inflationary scenarios, the mounting evidence is that information-in exceeds information-out. Alan Guth's well-known claim that the universe is a "free lunch" is becoming increasingly difficulty to maintain. Some scientists, like Stuart Kauffman and Roger Penrose, look to unknown-yet-to-be-discovered natural laws to solve the information problem. But this raises the question whether "natural laws" are even the right category for trying to account for complex specified information. ««

Chapter 6: Generating Specified Complexity. This chapter establishes what appears to be a purely negative result, namely, a conservation law stating how specified complexity cannot be generated. Yet in fact this conservation law invites a much richer understanding of specified complexity than is possible within a strictly reductionist and mechanistic framework. The upshot of this chapter is that specified complexity is a reliable marker of purpose and is properly situated within a relational ontology whose principle of relationality is information. To get there requires a conservation law known as the Law of Conservation of Information. A deterministic form of this law has been recognized for some time. Sir Peter Medawar described it in *The Limits of Science* (Harper & Row, pp. 78–82). Douglas Robertson has developed it in more detail recently and used it to examine the question of free will, characterizing free will as the ability to "create information" ("Algorithmic Information Theory, Free Will, and the Turing Test," *Complexity* 4(3), 1999: 25–34). This chapter generalizes the Law of Conservation of Information to cover not only deterministic but also stochastic processes. It follows from this general form of the Law of Conservation of Information that undirected natural processes are incapable of generating specified complexity. This is a powerful result, and it opens the door to teleology in unprecedented ways, merging classical metaphysical ideas about teleology with contemporary information theory. **««**

Chapter 7: Divine Action. How does complex specified information get into the world? The Law of Conservation of Information suggests that complex specified information is a "non-natural" feature of the world. This is not to say that complex specified information requires a crude interventionism where God has to violate the laws of nature to insert complex specified information into the world. But it is to say that undirected natural causes are fundamentally incomplete and cannot account for specified complexity. What's needed, then, is a model of divine action in which the world has a functional integrity with respect to its inherent causal structure, but is also open to the emergence of novel information from God. Thus, to account for specified complexity in nature, this chapter proposes a model of *orthogonal causation* in which physical mechanism and information transmission constitute fundamental causal powers capable of interacting coherently and without interfering with one another. This model differs from Austin Farrer's model of double action, in which physical causes become the channel for divine intentions. Orthogonal causation is consistent with Farrer's model, but also allows for the emergence of novel information whose information content strictly exceeds that inherent in the physical causes themselves. Within the orthogonal causation model, God interacts with the world by transmitting information, not by disturbing the world's physical structure. This model has the double advantage of preserving the integrity of nature and at the same time opening up nature to possibilities that nature could never have foreseen. When applied to divine action, this model avoids the usual difficulties associated with interventionism, but also renders divine action counterfactually definite (i.e., God's action becomes free and effectual). **««**

Chapter 8: The World as Sacrament. At the heart of sacramental theology is not an enumeration of so-and-so-many sacraments (seven in the Roman Catholic and Eastern Orthodox communions). At the heart of sacramental theology, rather, is the idea that the world reflects the divine life—that the world is a mirror for peering into the divine mysteries if only we can clarify our vision and adopt the right vantage for looking at it. But what sort of world can be a vehicle for communicating divine mysteries? According to the scientific naturalism that currently prevails in the West, the world is fundamentally an interacting system of mindless entities (be they particles, strings, or fields) built up to ever greater orders of complexity by equally mindless principles of association, known typically as natural laws or algorithms. Such a world cannot communicate divine mysteries. What sort of world, then, can? Common to Jewish, Christian, and Muslim theism is the view that the world is created through a divine spoken word. If the world and everything in it is indeed created through a divine spoken word, then the entities that are created don't suddenly fall silent at the moment of creation. Rather, they continue to speak. In particular, a thing's reality derives from its capacity to communicate with other entities in creation and ultimately with God. Such a world can communicate the divine mysteries. The aim of this chapter is to take this communicative view of reality, unpack it in information-theoretic terms, and then show how it frees the world to be a sacrament. **««**

Chapter 9: The Problem of Being. James Ashbrook argues that consciousness and its neurological underpinnings reflect a "cry for the other" ("A Rippling Relatableness in Reality," *Zygon* 31, 1996: 469–482). Ludwig Wittgenstein has argued that language is impossible apart from a community of discourse. Social constructivists argue that knowledge and even reality itself is socially constructed. Jürgen Moltmann argues for a social view of the Trinity (*The Trinity and the Kingdom*, Harper & Row, 1981). What's common to these separate lines of inquiry—drawn as they are from psychology, philosophy, sociology, and theology—is the personal and communal nature of reality. Being is fundamentally relational. This chapter develops a relational ontology of communion in which to be is to be in communion, first with God and then with the rest of creation. Moreover, when entities are in communion, what they communicate is information. Information thus becomes a metaphysical relation between entities that gets reflected in the complex specified information observable in the physical world. It follows that the fundamental science—indeed the science that needs to ground all other sciences—is a theory of communication. Such a science is incapable of being divorced from metaphysics in the way that the mechanistic science of the modern era was regularly divorced from metaphysics. Communication theory qua science mirrors a relational ontology of communion qua metaphysics. Accordingly, the Enlightenment vision of a cold, stark rationality that stands outside it all cannot be sustained. To be is to be in communion, and to be in communion is to be in the thick of it. It is to have a foot on earth, but also one in heaven. It is to bridge transcendence and immanence. **««**