GENERAL
INTRODUCTION

This book is about one of the most fascinating and important features of human intellectual geography: the landmasses of natural science and religion, and the little-explored region between them. Formerly thought to be so far apart as to be unbridgeable, or so near as to make a bridge between them unnecessary, science and religion now appear to be two families of activity with a most intriguing relationship. A large number of scholars are systematically exploring this relationship and facilitating the movement of intellectual traffic back and forth between the two regions. This book aims to introduce the complex and exciting interdisciplinary venture of religion and science to the reader with some background in religion, natural science, or both. It also seeks to contribute to that venture in a number of ways.

The bulk of this introduction is concerned with discussing religion and science in terms of the metaphor of “building bridges,” and then arguing that this form of inquiry so understood is called into existence and motivated by a multifaceted mandate. This argument expresses the editors’ view of the nature and importance of the hybrid discipline of religion and science.

Throughout the introductions of this book, “theology” is used to refer to the “intellectual wing” of religion, that part of religion that is concerned with the articulation and justification of religious beliefs. This is a more general enterprise than just Christian theology or Jewish theology, though in practice most theological work is done within the context of a particular tradition. Some of the contributors treat their theological subjects from the point of view of specific religious tradition, usually Christianity. Some of the topics covered are also oriented to particular traditions (such as the third and fourth case studies of Part III), though others are more widely applicable. Being aware of the scope each author intends for “theology” or “religion” will aid understanding. The editors use “religion” more or less broadly and “theology” more or less narrowly in their introductions.

I. BUILDING BRIDGES BETWEEN RELIGION AND SCIENCE

Intellectual work at the junction of religion and science resists simple characterizations. It seems odd to call it a “field” or a “discipline” since its subject matter does not have the
requisite distinctiveness. Moreover, "area of inquiry," though accurate enough, is too vague to generate any insights into what it is, or into its relations to theology, to science, to philosophy, or to any other "area of inquiry."

The actual work done at the intersection of religious and scientific concerns is highly varied, covering what Ian Barbour has described as dialogue over boundary issues and methodological parallels, as well as the construction of natural theologies, theologies of nature, and entire worldviews in which theological and scientific insights are systematically integrated. Added to this, one might use theology or religion to advance a critique of scientific culture. For example, Christian liberation theologies of the Third World, a variety of Jewish religious intellectuals, and eco-feminists of various religions examine the relationships among scientific knowledge, technology, and socioeconomic power. Furthermore, the interface between religion and science can be and is considered from ethical, historical, or hermeneutical perspectives, among others. And the mode in which these explorations are carried on varies from rigorously systematic to vaguely suggestive, from spiritually enlightening to ethically motivating, from multi-scholar research programs to individual ventures.

In view of this diversity, it is obvious that a book of this type requires a center of gravity. This volume focuses above all on the way religion and science contribute to our knowledge of the world, and so on the relationship between theology and science. This involves turning to the past for insight (as in Part I), exploring the ways scientific and theological knowledge claims are similar and different (as in Part II), and trying to mount dialogues between specific scientific and theological themes (as in Part III).

The plurality of approaches to studying the relationship between religion and science warns against hastily drawn or oversimplified definitions of the specialization devoted to that task. What we are calling "theology and science" is far from being the whole of the specialization of religion and science, but it has its own importance and value. The intrinsic importance and wider cultural ramifications of "theology and science" can be appreciated through a discussion of its conception and central tasks in terms of the image of "building bridges."

"Building bridges" serves as a generalized, metaphorical description of much of the dialogue that takes place in theology and science. The metaphor expresses the fact that there is a breach evident at the surface between theology and the sciences in our present cultural context. There will be no intellectual traffic without active construction. All of the elaborate engineering detail that goes into bridge building aptly expresses the sometimes technical and painstaking labors associated with making connections and free traffic possible between these aspects of our culture.

Perhaps the most important virtue of the metaphor is its suggestion of pillars penetrating the deep waters and connecting the bridge to solid bedrock below. The stability, the very possibility, of a bridge depends on there being solid, albeit invisible, bedrock underlying and connecting the landmasses to be bridged. So it is with the interdisciplinary activity of theology and science: it presupposes and makes evident in an
ILLUMINATING WAY WHAT THEOLOGY AND SCIENCE HAVE IN COMMON, AND DOES SO AT A TIME WHEN THEIR DIFFERENCES ARE MORE OBVIOUS TO MANY THAN THEIR SIMILARITIES.

THE METAPHOR IS NOT WITHOUT ITS LIABILITIES, BUT EVEN THESE ARE ILLUMINATING. IT WOULD BE MISLEADING, FOR EXAMPLE, IF THE BRIDGE METAPHOR WERE THOUGHT TO IMPLY THAT THEOLOGY AND SCIENCE WERE INDEPENDENT, WELL-Defined, TIGHTLY FOCUSED ACTIVITIES, REMAINING CONVENIENTLY STATIONARY AS THE BRIDGE BUILDERS DO THEIR WORK TO CONNECT THEM WITH A DEFINITIVE BRIDGE. ON THE CONTRARY, THEOLOGY AND THE SCIENCES ARE INTERNALLY COMPLEX AND DYNAMIC ENTERPRISES WHOSE SUBJECT MATTER BOUNDARIES SHIFT. BETWEEN SUCH INTERESTING AND VARIEGATED INTELLECTUAL ACTIVITIES IT IS APPROPRIATE TO THINK OF THERE AS MANY BRIDGES AS THERE ARE TASKS TO BE PURSUED; OR ELSE A SINGLE BRIDGE WITH AN INDEFINITE NUMBER OF SUPPORTS, CORRESPONDING WITH THE MANY SUPPORTING MOVES TO BE MADE IN ORDER TO CONNECT THESE FIELDS; OR ELSE ONE OR MORE BRIDGES WITH A LARGE NUMBER OF ENTRY POINTS FOR TRAFFIC ON BOTH SIDES, AS THEOLOGY AND SCIENCE ARE BOTH FAMILIES OF RELATED INTELLECTUAL ENTERPRISES, OFFERING A NUMBER OF STARTING POINTS FOR INTERDISCIPLINARY CONSIDERATIONS.

OUR METAPHOR WOULD ALSO BE MISLEADING IF THE BRIDGE WERE TO SUGGEST THE PERMANENCY OF OUR ACCOMPLISHMENTS AT THE INTERFACE OF THEOLOGY AND SCIENCE. IF WE ARE PROPERLY MODERATE ABOUT OUR CONSTRUCTIONS WE WILL RECOGNIZE THEIR HISTORICAL, CONTINGENT NATURE, AND WE WILL ANTICIPATE CHANGE NO LESS IN THE BRIDGE THAN IN THE STATES OF THEOLOGY AND SCIENCE THEMSELVES. WE MAY WANT OUR BRIDGES AND HIGHWAYS TO STAY PUT, BUT WE CAN EXPECT THE THEOLOGY-SCIENCE ENTERPRISE TO SHIFT AND TURN FROM TIME TO TIME. SOMETIMES THE CHANGES WILL BE MINOR. BUT WE CANNOT PRECLUDE THE POSSIBILITY THAT SOME CHANGES WILL BE MORE SUBSTANTIAL AND STRUCTURAL.


II. THE MANDATE FOR THEOLOGY AND SCIENCE

ON THE BASIS OF THIS DISCUSSION, IT IS POSSIBLE TO POSE, AND SUGGEST AN ANSWER TO, THE QUESTION OF THE PURPOSE OF “THEOLOGY AND SCIENCE.” WHY GO TO THE TROUBLE OF BUILDING BRIDGES? WHY IS THE INTERDISCIPLINARY TRAFFIC MADE POSSIBLE BY SUCH BRIDGES WORTH THE EFFORT? ONE CRUCIAL ANSWER—AND IT SEEMS TO US TO BE THE MOST IMPORTANT ANSWER—is THAT BRIDGE BUILDING BETWEEN THEOLOGY AND SCIENCE IS A FORM OF INQUIRY INTO THE NATURE AND FUNCTION OF HUMAN UNDERSTANDING, AND SO THE WORLD WE INHABIT. THEREFORE, THE METAPHORICAL BEDROCK INVISIBLE BENEATH THE DEEP WATER SPANNED BY THE BRIDGE IS MORE THAN WHAT THEOLOGY AND SCIENCE HAVE IN COMMON; IT IS WHAT HUMAN BEINGS ARE, AND WHAT THE WORLD
is. After all, it is human beings who engage in theological and scientific activities, and it is the world, the ultimate "dialogue partner," that corrects and improves our theological and scientific beliefs about it.

If human rationality is mysterious, then surely the contrast between scientific and theological work is an instance of this mystery—a rather vivid one, in fact. Mysteries are to be enjoyed and celebrated, of course, but they also invite investigation and the attempt at explanation, at least by those predisposed to such a response. The interdisciplinary venture of theology and science, it seems to us, is inspired by a vision of a unified conception of human rationality and of the world, a vision in which the spiritual and the intellectual impulses of humanity are harmonized in an ethically, socially, and environmentally healthy way. This, then, is a mandate for the interdisciplinary venture.

Something like this vision motivates most of the theologians, philosophers, poets, ethicists, and scientists who work at the interface of science and theology. They are in general agreement on the tasks that are implied in the vision, one primarily theoretical and one practical. On the one hand, they are seeking to gain clarity about human rationality and the world in which it functions. On the other hand, they wish to understand and solve the practical problems that arise in the absence of coherent relations among our many rational activities.

For some people this mandate is discharged through inspiring poetry and suggestive allusions, through almost worshipful reticence and illuminating illustrations. For the contributors to this volume, and for the Center for Theology and the Natural Sciences, whose tenth birthday this volume celebrates, this mandate is chiefly fulfilled through painstaking analysis of theological and scientific procedures and results; systematic comparisons and contrasts of theological and scientific content; elaborate models of the interaction between the two families of disciplines, tested rigorously and adjusted with impressive ingenuity; and the tracing out of implications not only for theology and science themselves, but also for philosophy, ethics, spirituality, ecology, social policy, historiography, and still other domains of inquiry.

The mandate for the interdisciplinary science-theology study is implicit in its hybrid nature. By comparison with the autonomous character of theological and scientific activity individually, the hybrid character of the theology-science specialization is plain to see. For example, it does not possess a distinctive subject matter nor a specific method, as do autonomous disciplines. Rather, like interreligious dialogue, it consists in tasks to facilitate mutual understanding, to foster the exchange of substantive and relevant information between the two disciplines, to generate insight both for the philosophical construction of conceptions of human rationality and for guiding practical decisions. This orientation to tasks, rather than a characteristic set of objects or methods, suggests a contingent, transitory form of inquiry that typifies neither theology nor the natural sciences. Such an interdisciplinary form of inquiry is brought into existence deliberately by its advocates because a perceived need mandates it.

This mandate arises in different ways for each of the autonomous disciplines that
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Contribute researchers, insights, and content to the theology-science enterprise. First, from a philosophical point of view, there exists a demand for consistent theories of knowledge and of reality across all human rational activities, because these activities have shared rational principles. Methods and goals may vary as the contours of subject matter demand, and conceptions of what is valuable or useful may likewise differ. But intersubjective structures of meaning in the form of language and practices, methods and rules, exist in every kind of rational human activity. When these activities are as diverse as systematic religious reflection, natural scientific investigation, and practical decision making, some kind of spelling out of the rational commonalities is called for. Some see the beginnings of an explanation of this commonality in the unity of the human biological organism, while others look to sociohistorical and constructive explanations stimulated by the structure of the similarities themselves. In any case, bringing together two diverse disciplines with rich and entangled histories is a good place to begin the investigation.

Second, theology within the Western traditions for the most part demands the integration of understandings of the world that emerge from the religious-theological and natural-scientific spheres. One of the core beliefs of these traditions bears directly on the interdisciplinary theology-science project. The unity of God, as the single source of all creation, implies that the quest for coherence in our various descriptions of reality is not only reasonable but necessary. Implicit in the Jewish, Christian, and Islamic understandings of God and creation is the contingency and intelligibility of the universe, and a respect for the human capacity to “know,” at least in part. The very content of this theological claim leads to an investment in the success of interdisciplinary dialogue.

To say this, of course, rules out certain conceptions of theology that deny any factual element in theological statements. Theological statements do not merely express emotional states, though they certainly do that. Nor are they merely coded exhortations for eliciting religious or moral attitudes, though they do serve that purpose also. Most who undertake the theology-science enterprise are committed to the view that, along with their expressive, exhortative, aesthetic, and moral dimensions, theological statements usually have a fact-asserting, representative element; they make claims about reality that may be true or false. In some cases, empirical evidence may be brought to bear as a test of theological truth claims. In other cases, the truth claims are inherently beyond the reach of empirical testing, being more akin to traditional metaphysical propositions. But in all cases familiar theoretical ideals, such as intelligibility, consistency, coherence, applicability, adequacy, fruitfulness, and aesthetic value, function as criteria for excellence in attempts to present theological statements in a coordinated way.

The process of systematically articulating theological propositions has always had to satisfy these criteria in two overlapping arenas. Consider the ideals of adequacy and intelligibility, for instance. Theological propositions must adequately convey the beliefs of members within the particular religious community. But beyond the confines of the tradition, those same theological propositions must be intelligible, and they must be adequate to knowledge about reality autonomously gained. Of course, the two arenas
overlap because members of religious communities also belong to a wider context of life. However, there is a real distinction to be maintained here. The need to give rational and practical expression to religious convictions (for example, the unity and goodness of creation) will appear very differently from an internal religious perspective and from the point of view of contemporary physical cosmology. For instance, the rational articulation of the Christian and Jewish conviction of divine providential activity is one thing when thought of as having to warrant such religious activities as worship, prayer, and social action, and quite another when asserted in the context of a deterministic metaphysic in the natural sciences. The criteria of adequacy and intelligibility are demanding, therefore, and meeting them is greatly aided by interdisciplinary studies connecting theology to other spheres of discourse.

It is the existence of truth claims in theological discourse—notwithstanding the presence there of other modes of speech and levels of meaning—which requires that theology account for its claims in a wider cultural milieu. Since this demand arises within theology, rather than being imposed upon it from without, the call to be accountable for theological truth claims cannot be evaded on theological grounds. For instance, in an age when the world’s cultures interact more than ever, traditionally exclusive theological claims are having to justify themselves in the face of religious pluralism. Dealing honestly and effectively with this issue, and others like it, has become a matter of credibility for theology in the contemporary world, and credibility in these matters is a theological interest. This indicates the scope and origin of the theological requirement to account for its truth claims in a broad, intersubjective context. The mandate to engage the content and method of the natural sciences is an instance of this more general requirement.

Third, natural scientists bring with them their own mandate for working at the junction of their discipline with theology. Owing to the more constrained method of the natural sciences, which has no obvious concern with comprehensiveness in the way that philosophy and theology do, it is difficult to see how this mandate could arise from anything except the personal interest of scientists. For instance, the geneticist with some personal religious commitment desiring to coordinate his or her religious and scientific beliefs about human nature might get involved in the science-theology dialogue to satisfy this personal aim.

However, there is one sense in which this mandate can be seen to arise from within the bounds of the autonomous natural sciences themselves. If the accounts given by some philosophers of science are correct about the constructed character of scientific theories, then there is reason to ascribe responsibility to the scientific community specifically as scientists (rather than generally as humanitarians) for the constructions they choose to explore and defend. This responsibility takes the scientist—again, as scientist—beyond fidelity to experimental results to consider ethical, metaphysical, and theological concerns that may underlie his or her theorizing. In any event, scientists of all areas within the natural sciences join in the work of the theology-science specialization with a desire for a unified conception of reality, and in some cases this is motivated by ethical and theological concerns about the development of scientific theories.
Finally, we may note the impact of the many practical crises facing humanity. Some of the more significant of these crises are the direct result of an imbalance in human competencies: while we have developed enormously powerful technologies for all manner of applications, we lack the powers of foresight and will to use them responsibly and with appropriate concern for other species, for future human generations, or even for the survival of our own generation. While problems of nuclear and biomedical technologies, and environmental and social degradation, are enormously complex, and solutions to them are not at all clear, they highlight a need to integrate the critical and spiritual-religious impulses of our species. Identifying problems and refining technologies are not enough; we must face squarely the values that justify our apportioning of intellectual and monetary resources, and the motives that lie behind public policies and behaviors. This may seem abstract in view of the urgency of the practical problems, but this integration is inescapable if we are to meet new and present challenges. The interaction of theology and the natural sciences is one obvious place to turn for a case study of the tension between human critical and spiritual-religious instincts.

III. THE POSSIBILITY OF FULFILLING THE MANDATE FOR THEOLOGY AND SCIENCE

In all of these ways, the interdisciplinary venture of theology and science is clearly and powerfully mandated. However, the weight of this confluence of concerns might cause us to ask whether the fulfilling of the mandate is even possible. Can the theology-science specialization contribute to a unified conception of human rational and practical activity? Can it show such a conception to be resilient and fruitful when tested against the history and substance of the interaction between theology and science? Can practical crises be more effectively addressed with the aid of such an interdisciplinary venture?

There is no shortage of skeptics who look askance at an interdisciplinary project with such goals. Some reject theology as a legitimate discipline at all, not finding there the same kind of definite procedures characterizing scientific activity. Others are so firmly committed to a view of theology and science as separated and incommensurable disciplines that the effort to relate them seems wasted. Still others repudiate the view of theological language usually presupposed in the interdisciplinary effort, namely, partly representative, fact-asserting discourse. And yet others believe all attempts to construct a unified conception of human rationality are in principle, like all totalizing projects, more misleading than enlightening. These implied criticisms are not easy to dismiss, but neither do they constitute knock-down arguments against the interdisciplinary attempt. If the theology-science venture produces stable and illuminating results, that is the only rebuttal needed.

This pragmatic reply to the skeptics is appropriate, simply in view of the outstanding work accomplished in the theology-science specialization in recent decades. However, there are several perspectives from which the interdisciplinary project of theology and science appears to be well positioned to secure the results it seeks.
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First, the ground has been cleared for productive interaction by the advance of scientific knowledge itself, especially in areas such as general relativity and cosmology; quantum mechanics; chaos, complexity, and nonlinear dynamics; evolutionary and molecular biology; and sociobiology; and the neurosciences. Ironically, these advances have made some scientific areas more amenable to theology at precisely those points where, formerly, they had been antagonists. Although possibly temporary congeniality can never be the premise for a hybrid discipline, it cannot be denied that consonance (and not just the familiar dissonance in details) between scientific theory and established theological positions is encouraging.

Second, a clearer understanding of similarities and differences between theological and scientific method is gradually emerging. Philosophers of science have furnished a more subtle and complex account of the method by which scientific communities assign warrant to, and select among, their hypotheses. Similarly, theologians have begun to pinpoint some continuities with the scientific method thus reconstructed. At root, this is probably because they are both forms of inquiry and, as intimated already, human inquiry may have some general features that can be expected to appear in any particular instance of it. In any event, with these well articulated similarities in the background, theologians are becoming more confident in affirming those differences that distinguish theology from the natural scientific ideal of progressive knowledge. This is a marked improvement over the former posture of utter separation based on the impression of irreconcilable methodological differences. Though much more needs to be done in this direction, the future of inquiry into human rationality within the science-religion specialization looks more promising than it has for many years.

Third, we are gradually seeing how exposure of theologians to scientific material and scientists to theological modes of reflection fosters greater understanding of the familiar discipline as well as the unfamiliar one. This applies both to historical studies of interaction in the past and to substantive interactions in the present. Interreligious dialogue has shown us that one of the greatest fruits of interdisciplinary work is enriched understanding, and not merely a more peaceful coexistence. This increased level of familiarity is hopeful, since partial successes in practice eventually can lead to systematic intellectual expression.

Fourth, a widespread sense of urgency among academics and the general public alike calls for intellectual resources to be applied to practical interests. This is powerful motivation to press onward toward the fulfillment of the mandate for the theology-science specialization, as well as an indirect reason to expect some success.

The future holds the evidence for whether the theology-science venture is really capable of fulfilling its bold aims. Conceivably, the interdisciplinary project might cease because its goals prove too difficult to reach, or dissolve because the goals are largely met. Alternatively, the interdisciplinary venture might continue indefinitely as a distinct field, developing methods and identifying a distinctive subject matter. It is not easy to predict its fate. At present, however, the awkwardness of the dialogue, and assump-
tions of culture at large, make it abundantly evident that an independent forum, almost on the scale and complexity of a small field of study itself, is essential. And hope for at least some success seems appropriate.

IV. STRUCTURE AND PURPOSE OF THIS VOLUME

This volume is intended primarily as an introduction to the interdisciplinary theology-science venture, and has been designed with a class in religion and science at the advanced undergraduate or graduate level in mind. Additionally, however, the essays in this volume advance research on a number of frontiers. It is a measure in some ways of the youthful state of the religion-science specialization that both elements can be included in the same design.

The various sections of the book correspond to three major kinds of inquiry that are undertaken in the theology-science specialization: historical studies, methodological analyses, and substantive dialogue. As we have said, other kinds of inquiry are omitted in deference to the need to maintain a clear focus.

The essays of Part I are historical in character, the notable partial exception being the prospective reflection of Holmes Rolston, III. However, even this forward-looking essay is based on a clear understanding of historical context. Each paper presents important aspects of the history of the relation between theology and science in various periods from the European Enlightenment onward.

There is considerable controversy and an ongoing lack of consensus in the area of comparative methodology of theology and science. Accordingly, Part II has been constructed as a two-round discussion involving four perspectives. Each perspective is clearly set forth in the first round, then most of the participants react to each other’s positions in the second. The introduction to this part of the volume includes a brief critical appraisal of the debate, with the aim of securing some degree of clarity about similarities and differences between theological and scientific method.

Part III is a set of six case studies demonstrating different types of constructive interaction between science and theology. In addition to their obvious research value, we believe that the case studies as a whole illustrate for students of theology and science a variety of ways that interdisciplinary work may be carried out. There is no single model in all six case studies for the constructive task, neither do we claim to have represented all possibilities. The set of case studies not only illustrates a high level of informed creativity and openness to new perspectives in the study of theology and science, but also is particularly useful as a family of partial tests of adequacy for the methodological constructions of Part II. One might also compare these efforts with the modes of interaction discussed in the historical essays of Part I.

The book concludes with suggestions for further reading that highlight many of the major books and papers of the last few decades in religion and science. There will be found abundant suggestions for readings to supplement those provided here. There are
also suggestions of books to move the reader beyond the “theology and science” constraints of this volume into other approaches within the gamut of the study of religion and science.

V. ACKNOWLEDGMENTS

There are many people to thank for the inspiration and production of this book. First and foremost, we must recognize the Center for Theology and the Natural Sciences (CTNS), an affiliate of the Graduate Theological Union in Berkeley, California. Founded and directed by Professor Robert John Russell, CTNS continues to be among the world’s leaders in advancing the dialogue and interaction between theology and the natural sciences. Since its beginnings in 1982, CTNS has significantly affected the shape of this kind of interdisciplinary research. Its work has inspired this volume, which exists in part as a celebration of that first decade of work and service. Although the structure and purpose of Religion and Science stands on its own, early versions of a few of the essays contained in it were presented at a conference celebrating the tenth anniversary of the Center. Furthermore, CTNS has provided valuable administrative support, for which our thanks go to Robin Ficklin-Aired, Bonnie Johnston, and Karen Cheatham.

We also thank the many essayists in this volume. They represent one of the most talented and accomplished collections of scholars one could find for a volume such as this. They have contributed because of their commitment to the field, and because of their appreciation for the leadership of CTNS. Many of them have had an increasingly important impact on theological education in recent years through their participation in the theology-science venture, including the establishment of organizations with purposes allied with those of CTNS.

Among contributors to this volume we want to single out Ian Barbour. His Issues in Science and Religion helped rekindle the theology and science discussion shortly after the middle of the twentieth century, and he helps keep the fire going even now. We appreciate his kindness in agreeing to write the Foreword for the volume.

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