

## ON THE SYMBIOSIS OF SCIENCE AND RELIGION: A JEWISH PERSPECTIVE

by Norbert M. Samuelson

*Abstract.* Three theses are explored, the first two historical and the third philosophical-theological: (1) throughout most of the history of Western civilization, science and religion have been closely connected with each other, and each has benefited from the connection; (2) the belief that science and religion have always been in conflict is not based on the actual history of either set of institutions; and (3) structurally a relationship between the two institutions is in the interest of both. By *religion* here I mean specifically, but not exclusively, Judaism.

*Keywords:* Adam the Protobacterium; Aristotelianism; authority; belief; charity; Christendom; *conversos*; Daniel Dennett; *The Guide of the Perplexed*; *Halakhah*; Hallel; Islam; Jesus; Judaism; *Kabbalah*; Maimonidean controversy; Moses Maimonides; *Mishneh Torah*; modernity; Moses; pioneer macros; Rabbi Simon the Just; Saadia ben Joseph al-Fayyumi; silicon-based self-replicating crystals; Baruch Spinoza; *Tractatus Theologico-Politicus*; truth claim.

---

I explore three theses in this presentation—the first two claims about intellectual history and the third about philosophical theology. First, I argue that throughout most of the history of Western civilization science and religion have been closely connected, and that each has benefited from the connection. I focus on Jewish culture, but the argument about Judaism would be only slightly different if the focus were Islam and pre-Reformation Christianity, and the main point would be the same.

Second, I speculate about the conceptual sources of the opinion, widely held in contemporary Western society, that the relationship between science

Norbert M. Samuelson is the Harold and Jean Grossman Chair of Jewish Studies at Arizona State University, P.O. Box 873104, Tempe, AZ 85287-3104. He is the Secretary-Treasurer of the Academy for Jewish Philosophy and the Secretary of the American Theological Society.

[*Zygon*, vol. 35, no. 1 (March 2000).]

© 2000 by the Joint Publication Board of *Zygon*. ISSN 0591-2385

and religion has always been one of conflict and that a close relationship between the two is to the benefit of neither. This belief also is not based on the actual history of either set of institutions. Judaism especially has not regarded science and religion as antithetical, but even more generally, such a negative belief has no basis in any non-Christian religious civilization.

Third, I argue that, structurally, a relationship between the two institutions is in the interest of both. What association with science does for religion is to help it remember that the search for truth is in itself an integral part of the life of spirit, and what association with religion does for science is to help it remember that all scientific claims about truth are not absolute. Furthermore, a religion that encompasses the life of science is richer religiously than a religion that radically separates itself from science, and similarly a scientific worldview that includes the domain of the spiritual and recognizes the value of religious belief is richer scientifically than a science that dismisses the religious relevance of science with labels such as “secular” and “antireligious.” By “religion” here I mean specifically, but not exclusively, Judaism.

#### ON THE RELATIONSHIP BETWEEN SCIENCE AND RELIGION

The first major statement of philosophy in rabbinic Judaism is found in *The Book of Beliefs and Opinions* (SEFER EMUNOT VE-DEOT) of Saadia ben Joseph al-Fayyumi. Saadia, an Egyptian Jew, as the Gaon of Sura was the most important leader of the Jewish world in the Muslim empire. This book, written primarily as a defense of rabbinic Judaism in response to its schism with the Karaites, set the foundation for all subsequent Jewish philosophical theology and determined the way in which Jewish philosophers would define the fundamental beliefs of Judaism. The first subject he discusses—even before questions about the existence and character of God, Torah, and the Jewish people, Israel—is the relationship between science and religion.

By “science” Saadia means something broader than what contemporary readers mean by the term. He means every kind of rational claim that is based solely on the authority of what human beings observe with their senses and the inferences they draw with logic from those observations. The term includes all of our scientific disciplines, but it also includes what we call the humanities. Conversely by “religion” he means something narrower than what we mean by the term. He means every kind of rational claim that is based on the authority of what certain kinds of human beings, called prophets, express as received revelation from God and the inferences these prophets draw logically from those expressions.

More specifically, by “religion” Saadia means a tradition of rabbinic interpretation of the words of the Hebrew Scriptures. The authority of this tradition rests on the following three claims: (1) these words are an accurate report of what Moses understood God to have revealed to him at the

height of his powers to receive prophecy; (2) there has never been and never will be a prophet superior to Moses at this ultimate stage of his life; and (3) the rabbinic tradition of interpretation of those words is authentic and reliable.

These three claims are important. Religion is believed to have authority because it is believed capable of making truth claims and because the sources of these claims are methodologically distinct from the sources of scientific truth claims. A religion that cannot make truth claims can have no authority over belief.

Conversely, by “science” he means a tradition of rational thinking about a body of authoritative texts whose source is the collected writings attributed to ancient natural scientists such as Aristotle. But it would be a mistake to say that all he means by “science” is Aristotelian philosophy. First, Aristotle’s topics include far more than what is now studied in philosophy departments. They include practically every subject that is studied in a Western university. Second, the writings of Aristotle and the Aristotelians did not have authority because of Aristotle. On the contrary, Aristotle was a pagan and probably even a polytheist, which hardly would recommend his words to monotheists like Jews, Muslims, and Christians. Rather, the books of Aristotle and his disciples had authority because they were considered to be true, because they represented the best scientific thought of their day. In fact, Aristotelianism was not always accepted as true. On the contrary, Jewish philosophers often rejected the so-called dogmas of Aristotelianism when they thought its claims could not be supported either by empirical observation or by rational argument. This was especially the case in astronomy, which generally was judged to have weak empirical foundations.

With “science” and “religion” defined, let us summarize what Saadia said. He asked, How do we know we can trust what our reason deduces from our sense observations? and, If science is reliable, why do we need revelation? The first question would be raised again seven hundred years later by René Descartes (1596–1650): How do we know we can believe what we think we know? Saadia’s answer would be repeated, also seven hundred years later, in a significantly different form, by Baruch Spinoza (1632–1677): We know that we know what we know because there exists a creator who is subject to no known imperfection.

We can trust what we think we know when our claims are logically valid deductions from what we accurately observe. If these rational judgments about experience were not trustworthy, it would be because reason and/or experience were not trustworthy. But both are part of our created nature. Similarly, it is natural for us to believe that what we carefully observe is real and what we logically infer from those observations is true. If the observations did not report what is real, or if logical deductions from true premises were not themselves true, then the God who created us and gave us

these natural powers would be a trickster, and such a God could not be judged good. But a God who is not good is not the God revealed through the tradition of rabbinic commentaries on the Hebrew Scriptures. In other words, the authority of science for truth claims rests on a religious belief in the existence of a creator of everything in this universe who is morally good. The foundation, then, for science is religious.

Saadia then asks, Why do we need divine revelation? Given that science enables us to know the truth, why should there be a source for knowledge independent of science? His answer is both pragmatic and ethical. Pragmatically, revelation enables persons who lack either the ability or the opportunity to study science to know the truth. Ordinary persons can rely on the judgments of their rabbis, who can give reliable answers because the truths that scientists deduce through nature are expressed mythologically in the tradition of the Scriptures in images that ordinary persons can grasp. Ethically, revelation gives people an opportunity to double their rewards for living the good life. What both the Scriptures, when properly understood, and reason, when properly employed, teach is how to be happy. Simply living this life rewards the livers. With revelation, however, their rewards are doubled: they receive the benefits of the life itself, and they also receive the benefits of obeying the will of God. What science determines to be the true and the good, religion reveals as the Word of God. The resulting belief benefits, because it is both true and God's Word; and the resulting behavior benefits, because it is both good and God's command.

The lesson here is important. For classical Jewish philosophical theology the domains of true science and authentic religion are the same. There can be in principle no conflict between them. Hence, any apparent conflict has as its source a misapplication of scientific method or a misinterpretation of the revealed texts. Hence, science and religion function epistemically as correctives for each other, in much the same way that addition is used to check subtraction and subtraction to check addition.

The mathematics metaphor is entirely appropriate. That addition is used to check subtraction does not mean that subtraction is less authoritative than addition. Rather, both are simply different modes of the same kind of rational thinking, and it is precisely because they are the same that they can be expected to yield the same answer. We do not change a subtraction solution to make it match an addition solution. Instead, we take the incoherence to be a sign that a mistake has been made somewhere, and we recheck both operations independently in full confidence that a mistake will be found, because in principle the solutions cannot disagree.

The same can be said for science and religion. The foundation of scientific judgment and religious belief is the will and word of God, and as such the two must be in agreement. If they are not, a mistake has been made. So we recheck both independently. Scientists review their data and their inferences to see whether there has been an error, not because they must

make their data fit their religious beliefs but because, in consequence of their belief in the coherence of the two, they suspect an error. Similarly, religious authorities reexamine their reading of their authoritative texts—again, not because they must make their data fit their scientific judgment but because the incoherence makes them suspect an error in textual interpretation.

This attitude toward the coherence of proper religious belief and scientific knowledge dominates the history of Judaism until modern times. There are differences about the domain of the two. Some Jewish thinkers, such as Moses Maimonides, limit the domain of science to exclude anything about the nature of God, creation, Mosaic prophecy, and the end of days. Later Jewish thinkers, such as Spinoza, limit the domain of Mosaic religion solely to judgments about politics. But they all share the belief that in principle no conflict exists between human observation and divine revelation of what is true and what is good.

#### ON THE CAUSES OF THEIR CONFLICT

By the end of the ninth century, the Muslim conquerors of what they considered to be the civilized world completed the process of translating into Arabic the major works in science and mathematics of the Greeks, Romans, Persians, and Egyptians. Those translations made it possible for the Muslims, as well as the Jews who lived among them, not merely to absorb the wisdom of antiquity but to build upon it and develop science and mathematics beyond any level previously known in Western civilization. The euphoria of the scientific achievement of this golden age of scientific learning lay behind Saadia's questions about the relationship between science and religion, for he assumed that—by reason as well as by revelation, by science as well as by religion—there are no limitations to what human beings can know and do.

Between the thirteenth and the fifteenth centuries, Islam underwent an almost continuous process of decline, both politically and culturally. In terms of politics, the Muslim empire dissolved into a series of independent emirates and religious parties that were constantly at war with each other. In terms of science, the success of the then-new Aristotelianism over the then-considered-old material atomism inherited from the Roman Stoics declined into a more realistic recognition of the inherent limits of human knowledge. Those details need not concern us here, other than to note that the decline of confidence in the powers of unaided human reason led Islamic culture into both mysticism and legalism to the near exclusion of any development in science beyond what this great civilization had achieved prior to the thirteenth century.

The beneficiary of this political and cultural decline of Islam was Western European Christian civilization. Through the expansion of Christendom into the territory of Spain, the Christians came into contact with a

body of scientific literature, in both Arabic and Hebrew, centuries beyond anything that the Christians themselves had even imagined. Concurrent with the territorial growth of Christendom was a growth of economic opportunities in commerce for the nobility and of educational opportunities in almost every area of learning for the church. Jews played a critical role in both. Between the warring Christians in the lands to the north and the Muslims in the lands to the south of the Mediterranean Sea were the Jews, who could, precisely because they were neither Muslims nor Christians, move freely between and among the two empires. The new commercial opportunities brought whole rabbinic Jewish communities into Western Europe, where they played a critical role in transforming the culture from an agrarian barter society into a commercial capitalist one. Within this Jewish community were scientists, most of whom were rabbis, who taught the science of their day to Christian clerics in monastic orders, who established the great universities of Europe.

In this setting of church-related universities, learning developed in Christendom. First the learned writings of the Muslims and the Jews were translated into Latin, and eventually (by the fifteenth and sixteenth centuries) science began to develop in Christian schools beyond the heights it had achieved in Judeo-Muslim civilization in the tenth through the thirteenth centuries.

But not for Jews. By and large, despite some notable exceptions (such as the astronomer Levi ben Gershom [Provence, 1288–1344]), Jewish learning in the sciences froze, as it had in the world of Islam, as rabbinic interest in both mysticism (called *Kabbalah*) and law (called *Halakhah*) developed to new levels.

In the case of Judaism, the focus of the decline was a set of events in Western European Jewish communities during the thirteenth century known as the “Maimonidean controversy.” Maimonides was the author of a major code of Jewish law, the *Mishneh Torah*, and the rabbinic leader of the most important Jewish community in the Muslim world, the Jewish community of Egypt. As such he was the most famous of those rabbis who followed in Saadia’s tradition of the symbiosis of science and religion. His major work on the reconciliation of science and religion, *The Guide of the Perplexed*, became the focus around which Jews reexamined Saadia’s symbiosis.

In general, Saadia’s assumptions about the authority of good science and authentic religious tradition were never questioned. Judaism has never had, at least until modern times, a strong anti-intellectual strain that argued, as some Christian thinkers have, that reason is inherently unreliable as a tool for learning the truth. On the contrary, rabbinic Judaism has always affirmed study, no less than prayer and good deeds, as a primary means for serving and relating to God. Rather, the issue was pedagogic for a Jewish community that found itself, from economic necessity, living in the relatively primitive lands of the English, French, and Germanic peoples,

where illiteracy was almost universal. Under these conditions, where the possibility of serious scientific study was limited, rabbis questioned the value of such learning. Precisely because the domains of both scientific and revealed truth were coincident, the rabbis questioned whether Jews ought to spend time studying science, given that everything that science could teach was accessible, with far greater ease and with far greater reliability, in the tradition of rabbinic commentaries on the Torah. The result here too was that, while Jews continued to study law, the Jewish community ceased to be a place of serious scientific speculation. Hence, Jewish science—or better, the study of science by Jews in the Jewish community—stagnated at the level it had achieved by the end of the twelfth, possibly the thirteenth, century. By the nineteenth century, therefore, when through emancipation they entered Christian European society in large numbers, the Jews found themselves for the first time in their history significantly beneath the level of scientific learning of their neighbors. Thanks largely to the growth in the very Christian universities established and run by church clerics (both Catholic and Protestant), Christendom, with islands of relatively free scientific inquiry called “universities,” had advanced science into the present, while the Jews had remained (at least scientifically) in the thirteenth century. To those Jews with unavoidable curiosity who desired to dedicate themselves to a life of study, Judaism seemed barbaric, even primitive, and Christendom, or at least its culture, was attractive. These curious ones faced a difficult choice. The price of admission into the centers of European learning was conversion, either directly to Christianity or at least out of Judaism, for the most liberal of European intellectuals found it inconceivable that someone could have the intelligence and the spirit to engage in a life of scientific inquiry who stubbornly continued to practice the seemingly ignorant, empty legalisms of the Jewish life of Torah. At the same time, the rabbinic leaders of the Jewish world viewed, with considerable justification, European culture and its science as a threat to Jewish identity and did everything they could to discourage Jews from engaging in it. Judaism had finally developed its own tradition of anti-intellectualism.

The result was a disaster for the Jewish people. The best Jews from an academic perspective (namely, those Jews who had the greatest intellectual curiosity) found their talents repressed within the Jewish religious community and found in what Christians called “secularism” emancipation—that is, the freedom to pursue with relatively little inhibition a life of learning.

An early figure, in many ways a paradigmatic one, in this move of Jewish intellectuals out of the world of rabbinic Judaism into a more liberating world free from religious institutional control was Spinoza. Spinoza paved the way in the seventeenth century for many Jews to follow in the nineteenth and twentieth centuries. He was excommunicated in 1656 for holding and teaching heterodox beliefs. Why this action was taken against him



is a subject of scholarly debate, because excommunication, especially for matters of belief, is unusual in the history of Judaism, and the reasons that political leaders state publicly for what they do are not always the actual reasons for their actions. Although the real reasons for Spinoza's excommunication have not been proved, consider the following:

The book that was critical to Spinoza's problem with the rabbinate was the *Tractatus Theologico-Politicus*, published in the year of his excommunication. There Spinoza distinguished between science and religion on the following grounds. Science is the human attempt to discover what is true. As such it is studied by a single individual, a scientist, whose primary gift, which permits the learning of truth, is intellect. Driven by their passion to know, good scientists follow only the dictates of reason, and nothing else. They are above any other influence because nothing else but reason has relevance to discerning what is true and what is false. As scientists, they stand outside any community, true individualists who, in their passion for the truth, have no other loyalty, be it to family, friends, community, or even the state.

Their opposites are the politicians. Politics is the attempt of a human collective to establish a good society; and, precisely because the goal is social, politicians cannot act as individuals. Driven by their passion to do good, politicians must be concerned with the needs and desires—irrational as well as rational, imagined as well as real, ignorant as well as intelligent—of the people who live in their society.

In a word, if the talents of the scientist are logic and intellect, the talents of the successful politician are rhetoric and imagination. Now, intellect is a virtue and logic a tool in the service of learning truth, but these are useless when it comes to persuading anyone but other scientists. Conversely, imagination is a virtue and rhetoric a tool in the service of persuading people, but these are equally useless for discerning truth. In general, those whose talents are intellectual make good scientists and poor politicians, while those whose talents are imaginative make good politicians and bad scientists.

Now, religions are themselves societies that serve the interest of other, larger societies called nation states, and the leaders of both kinds of institutions are politicians. The ultimate politicians, or so Spinoza declares, were the prophets, and the greatest of all these politicians were Moses and Jesus—the former giving us the legal system of the Torah that served as the constitution of the Jewish state, out of which developed the so-called law of love of Jesus, which was intended to function as a model for growth beyond nations into an empire of enlightened human beings. Moses and Jesus were not bad. On the contrary, they were, unlike their rabbinic and priestly successors, the best of politicians. But they were politicians, not scientists.

In this way Spinoza drew a sharp line between the life of science and the life of religion, a wedge that had never before existed in at least Jewish



philosophy. Traditional Judaism saw the life of science as an inherent part of life in a Jewish community, wherein, combined with worship and charity, its people strove to serve the will of God. Spinoza viewed science and religion as separate, even (at least potentially) hostile, institutions, with people representing religion who had no commitment to the worshipped truth of science and other people representing science who had no commitment to the adored communal good of religion. In this respect, as in so many others, Spinoza articulated the ideology that defined modernity.

What led Spinoza to make such a sharp separation between science and religion? If I am right, it certainly was not the traditional texts of Judaism. In part it was his own unique background. Spinoza was the child of a Spanish *converso* family living in a community in the Netherlands dominated by *conversos*.

In 1492 the rulers of Spain, Isabella and Ferdinand, decided that what it meant for the recently unified state to be Christian was that its inhabitants should all be Christian. Hence, all of the peoples who had become subjects of European Christendom had the choice either to adopt the Christianity of their conquerors or to leave. Many of the people who left had been Muslims for centuries before, but most of those subjected natives of the land who still remained in Spain at the end of the fifteenth century were Jews. Most left, but some chose to remain and adopt Christianity as their religious community. Exactly how many of those who “converted” really became Christian in anything more than name is debatable. Many outwardly claimed to be Christian, but in their hearts and minds they remained Jews and continued to practice at least some form of Judaism in private. These are the Jews known as *conversos*.

Two hundred years later, when the Netherlands was forcibly separated from Catholic Spain as a Protestant state, it became possible for *conversos* to practice their Judaism openly. Their Judaism, however, had long since ceased to be a faith easily recognized as such by other Jews in the seventeenth century. Eventually the *conversos* became reintegrated into more standard orthodox Jewish life, but some sense of difference remained. When they were Jews in secret in Catholic Spain, they lived with a sense of perpetual estrangement from society. Now, even as openly practising Jews, they remained nonetheless estranged from the society of the Dutch Protestants who had seemingly liberated them—and even worse, from the society of European Jews whose Judaism had developed over the two hundred years during which these Spanish Jews (including the family of Spinoza) had lived a secret life.

As a descendant of *conversos*, Spinoza came to accept social estrangement not as something unusual but as a necessary price that must be paid by all who valued truth over success. Judaism seemed to him no less estranging a society than Christianity, and the place Spinoza saw as home became a world of fellow scientists, Christian as well as Jewish, who like

him had to meet in secret social cells in each other's apartments. There, free from public censor, the scientists shared the findings of their private experiments (Spinoza studied optics) and speculated about what science, rather than religion, says about all of the important questions of religion—creation, revelation, and redemption; the nature of God, the world, and even the human being.

The story I have told about Spinoza, like the story I told before about Saadia, is a distinctively Jewish tale; but it is not exclusively Jewish. With only slight changes, the same story could be told about Christendom at the dawn of modernity. Radical circles within society seized upon the notion of a radical separation of science from religion, despite the fact that, were it not for the institution of religion, there would have been no science in Europe. These circles hoped to form a new community, a community of scientists, in which they, freed from the fetters of any other society, could for the first time speak openly with fellow scientists who shared their insights. In a word, a society of the estranged revolutionaries (perhaps like all revolutionaries) sought to create a more ideal society, one that had a place for people like them. The institution of religion was the voice of the society, and the society was a place in which these free thinkers who shaped at least the values of modernity, revolutionaries of the modern world, had no place.

Modernity did not supplant feudalism because of the scientists' ideology. That had much more to do with changes in technology that produced changes in economics that produced changes in government. Thus was an agrarian society, in which warriors fought with swords and horses for a government of warrior land owners, transformed into a mercantile society, in which warriors fought with bullets and guns for a government of merchant republican democrats, and the university transformed from a community of intellectual spiritualists who served God through learning with the support of the church into a collection of intellectual entrepreneurs who served their societies through learning with the support of the state. It was in the university more than in any other institution within modern society that Jews eventually found a place, and these Jews reinforced their Christian academic colleagues, largely in ignorance of intellectual history, in their belief (whose source at least intellectually was Spinoza) that the pursuit of the ideal of truth must be independent of any association with institutional religion.

It is my judgment that this radical separation of the life of reason from the life of faith is undesirable for any number of reasons. First, as I have argued here, it distorts history. Second, it distorts religion, inasmuch as most religions themselves always have had a scientific dimension to them. Third, it distorts science, because science itself also has a religious dimension. And fourth, the radical separation does not serve the best interests of either good science or good religion. It is this last point that I address in

the final section of this presentation. Here I construct what I see to be a more realistic, more historically accurate, and a more useful model for the relationship between science and religion.

ON SOME BENEFITS OF A CONSTRUCTIVE RELATIONSHIP  
BETWEEN SCIENCE AND RELIGION

How, in general terms, can we express a nonconfrontational relationship between contemporary physical and life sciences, on one hand, and tradition and text-rooted religions, such as the various standard versions of Judaism, on the other hand? I would answer this question with the following four points:

First, science can be useful in forming judgments about traditional religious questions. For example, in speculating out of the present data in the human sciences on the origins of life on at least planet Earth, Daniel Dennett (1995, 149–86) traces the origin through a hypothetical first life form, “Adam the Protobacterium” (1995, 156) with autonomous metabolism, to even simpler nonparasitic quasi-life forms that Dennett calls “pioneer macros” (156). These pioneers of life are simple silicon-based, self-replicating crystals which form “ultra-fine particles of clay” (158). Dennett offers these silicates that form, if you will, simple dirt, as the seeds of all complex life forms on this planet. Dennett himself reads this account as a conflicting alternative to the account in Scripture of the origins of life. We can, however, see this story in an entirely different way.

Genesis 1:24 reads, “God said, let the earth bring forth a living life form according to its kind, [viz.] a domestic animal, a creeping thing, and a wild animal [literally, a living form of the earth], according to its kind. And it was so.”<sup>2</sup> In other words, when, according to the Genesis account of creation, God sets out to populate the earth surface, God does not do so directly but rather commands the earth itself to generate the life on its domain. The biblical myth affirms that the earth is the direct causal agent for earth life, but (as in almost every other part of the biblical narrative) the myth provides no details of how the earth carries out this command. Yet we—Jews, at least—are commanded not only to believe in but to understand, to the best of our abilities, how the world was created. These very same life sciences, used by Dennett as his authorities, aid us as committed Jews to do precisely what our revealed tradition of law requires of us: to understand reality.

Today Dennett’s account is a reasonable interpretation of the presently available data, but suppose that the introduction of new empirically based data causes us to change this judgment. Once we have used this bit of scientific theory to understand Scripture, are we then wed to it? I see no reason to think so. What we have now is a reasonable interpretation that we could not have had before of what Scripture means when it says that

the earth generated its life forms. In so interpreting the text, we fulfill a religious duty. But should we subsequently discover that this interpretation is not as reasonable as we thought it was, that discovery too would fulfill a religious duty—for we are commanded to understand God's creation, and "to understand" means to know what is true. If this interpretation is not true, the simple fact that it is useful to fill in a detail of the biblical narrative in itself is not religiously authoritative. Knowing what is true involves, as much religiously as scientifically, knowing what is false and being sufficiently humble as human beings to know that what we reasonably claim to know to be true may prove, just as reasonably, not to be true.

Second, scientists can worship as scientists.<sup>3</sup> Worship involves the elements of praise, petition, and thanksgiving. Each can and does stand either together or on its own as worship. To discover natural beauty is a form of praise of God; to transform an evil, a disease, in nature into a good for humanity or for the world is an expression of petition; and to understand both forms of scientific activity, discovery and engineering, to be expressions of the hand of God is a supreme act of thanksgiving. All of these forms of worship reflect an ideal integration of science and religion in the life of the individual religious scientist.

Third, religion can be useful for scientific questions. At the very least, a Christian or a Jewish orientation to science should teach scientists that they need never set aside their humanity in relations with others merely in the name of science. More specifically, a religious approach to science should teach humility. Every scientist seeks, or should seek, the truth as his or her primary commitment. Each small truth discovered should be understood as a vital element in learning the truth about life and the universe as a whole, the truth with which the God of the liturgy is identified. The theological claim that God is truth teaches that every act of scientific discovery is itself a discovery of God. Furthermore, the realization that the true God of Israel is an infinite and an eternal God means that whatever truth is known, that truth is never final and complete, for it remains in principle finite and limited. To the question, Are we there—at the truth—yet? religion always points to a negative answer. It does so by resisting moves from methodological positivism to epistemological and ontological positivism. What is knowable through science is always positive, but the concept of God entails that reality itself is always more than this or anything else that is merely positive.

Fourth, religious people can seek objective truth as religious people. This is what many academics in North American secular universities fail to understand. There is no inherent conflict between faith and reason, commitment and objectivity. Science and religion are both more than knowing; they also involve, possibly primarily, praxis, that is, forms of doing. In science the praxis is engineering; in religion it is worship.

CONCLUSION: THOUGHT, SERVICE, AND WORSHIP:  
THE PATHS TO REDEMPTION

Let me now propose a model for understanding constructively the relationship between science and Judaism that incorporates all of the foregoing in a single rabbinic statement.

PILLARS OF THE UNIVERSE	TORAH	'AVODAH	GEMILUT HASADIM
<b>Commandment</b>	study	worship	moral social action
<b>Dogma</b>	creation Creator	redemption Redeemer	revelation Revealer
<b>Philosophy/Science</b>	physical sciences	arts	human sciences
<b>Scripture</b>	Genesis 1	Psalms 113–118	Song of Songs

“Rabbi Simon the Just said that the universe stands on three things: on Torah, on divine service [’AVODAH], and on the practise of charity [GEMILUT HASADIM]” (Mishnah, Pirkei Avot 1:2). I propose that we model this saying from the Mishnah as follows: The pillar of Torah is the commandment to study, and it is through both the study of nature in the physical sciences and the revealed biblical text of Genesis that we come to know God the Creator. Genesis tells us that God is creator and the world is creature, and sciences such as physics give us the details of how it came to be.

Next, the pillar of divine service is the commandment to worship, and it is through both the arts and human sciences together with the communal prayer service that we come to hope in God the Redeemer. This message is most dominant in the special prayers recited on all of the Jewish festivals, especially the so-called “Hallel” psalms, Psalms 113–118, through which Jews act out in communal prayer the anticipation of life at the end of days, when all people come together in a chorus. There, as in a Rossini quartet, each voice remains distinctly its own while constructing a harmonic melody in which the whole transcends the parts in a perfect unity. The communal liturgy shows us how to live in the anticipation of the kingdom of God at the end of days, while through art we can envision and value its aesthetic goodness. In a world filled with both beauty and ugliness, good and evil, these disciplines enable us to discern the difference in the concrete, a difference that we can hope will finally be sorted out at the end of days.

Finally, the pillar of charity is the commandment to act out of social concern at every level of our political associations—in family, community, city, state, nation, and world. This action is our primary response to the ever-presence of God the Revealer. Through the study of the Song of

Songs, especially at the initiation of spring on the Sabbath that falls during the Passover, we learn how to recognize the individually commanding voice of God in the constant presence of a love that calls us to love each person who happens to be near us as God loves us, so that we may some day through that love—guided by all that the human sciences can teach us about understanding ourselves, our family, our neighbors, and all others with whom we form community—make actual that divinely commanded love of the other.

All of these commandments—study, worship, and social action—come together as we live every moment in religious devotion, aided by scientific and humane knowledge in movement from our created origins toward our divine ends, toward unity with God, toward that day when the Lord will be one and his name will be one.

#### NOTES

1. Dennett, with reference to the chemist Graham Cairns-Smith, calls them “naked genes” (Dennett 1995, 158).
2. Genesis 1:24: VAYOMER ELOHIM TOTSE HA-ARETS NEFESH HAYAH LEMINAH BEHEMAH VEREMES VEHAYOT-ARETS LEMINAH VAYIHI KHEN.
3. The following remarks were influenced by the description by Pauline Rudd (University Research Lecturer, Oxford Glycobiology Institute) of her own research at the December 1997 workshop of the Center for Theology and the Natural Sciences (Berkeley, California) on biology and the spiritual quest.

#### REFERENCES

- Cairns-Smith, Graham. 1985. *Seven Clues to the Origin of Life*. Cambridge: Cambridge Univ. Press.
- Dennett, Daniel C. 1995. “Priming Darwin’s Pump.” In *Darwin’s Dangerous Idea: Evolution and the Meaning of Life*, chap. 7. London: Penguin.
- Maimonides, Moses. 1963. *The Guide of the Perplexed*. Chicago: Univ. of Chicago Press.
- . 1989. *The Mishneh Torah*. New York and Jerusalem: Moznaim.

## FOR FURTHER STUDY

## ON THE RELATIONSHIP BETWEEN SCIENCE AND RELIGION

- Boyer, Carl B. 1991. *A History of Mathematics*. Rev. Uta C. Merzbach. New York: John Wiley and Sons.
- Farrington, Benjamin. 1947. *Science in Antiquity*. London: Oxford Univ. Press.
- Fisch, Menachem. 1997. *Rational Rabbis: Science and Talmudic Culture*. Bloomington: Indiana Univ. Press.
- Frank, Daniel H., and Oliver Leaman, eds. 1997. *History of Jewish Philosophy*. Routledge History of World Philosophies, Vol. 2. London and New York: Routledge.
- Hourani, George F., ed. 1975. *Essays on Islamic Philosophy and Science*. Albany: State Univ. of New York Press.

## ON THE CAUSES OF THEIR CONFLICT

- Feldhay, Rivka. 1995. *Galileo and the Church: Political Inquisition or Critical Dialogue?* Cambridge: Cambridge Univ. Press.
- Harré, Rom. 1992. *The Philosophies of Science: An Introductory Survey*. Oxford and New York: Oxford Univ. Press.
- Harrison, Peter. 1998. *The Bible: Protestantism and the Rise of Natural Science*. New York: Cambridge Univ. Press.
- Hollinger, David A. 1996. *Science, Jews, and Secular Culture: Studies in Mid-Twentieth-Century American Intellectual History*. Princeton: Princeton Univ. Press.
- Wertheim, Margaret. 1995. *Pythagoras' Trousers: God, Physics, and the Gender Wars*. New York: Random House.
- Westfall, Richard S. 1980. *Never at Rest*. Cambridge: Cambridge Univ. Press.
- Yovel, Yirmiyahu. 1989. *Spinoza and Other Heretics*. Princeton: Princeton Univ. Press.

ON SOME BENEFITS OF A CONSTRUCTIVE RELATIONSHIP  
BETWEEN SCIENCE AND RELIGION

- Barbour, Ian G. 1990. *Religion in an Age of Science: The Gifford Lectures, Vol. One*. San Francisco: HarperCollins.
- Brooke, J. H. 1991. *Science and Religion*. Cambridge: Cambridge Univ. Press.
- Dennett, Daniel C. 1995. *Darwin's Dangerous Idea: Evolution and the Meaning of Life*. London: Penguin Books.
- Hefner, Philip. 1993. *The Human Factor: Evolution, Culture, and Religion*. Minneapolis: Fortress.
- Polkinghorne, John C. 1994. *The Faith of a Physicist*. Princeton: Princeton Univ. Press.
- . 1998. *Belief in God in an Age of Science*. New Haven: Yale Univ. Press.
- Rosenzweig, Franz. 1985. *The Star of Redemption*. Trans. William Hallo. Notre Dame, Ind.: Univ. of Notre Dame Press.
- Russell, Robert John, Nancey Murphy, and C. J. Isham, eds. 1996. *Quantum Cosmology and the Laws of Nature: Scientific Perspectives on Divine Action*. Vatican City State: Vatican Observatory, and Berkeley: Center for Theology and the Natural Sciences.
- Samuelson, Norbert. 1994. *Judaism and the Doctrine of Creation*. Cambridge: Cambridge Univ. Press.
- Whitehead, Alfred North. 1978. *Process and Reality*. New York: Free Press.