SCIENCE WITHOUT FAITH IS DEAD

Preferred Title:

"Science without Faith Is Myth"

A Paper Delivered at Three Different Nigerian Conferences

Basic Thesis:

Science, like all human endeavours, is based on beliefs and assumptions.
It is never a question of faith vs science.
It is merely a question of *which* faith.

Institute of Church and Society/Northern Area Office
(Christian Council of Nigeria)
P.O. Box 6985 Jos, Nigeria

First Printing: 1991
Reprinted: 1993
Third Republication as ebook by Lulu.com—2010
Fourth Republication 2014 on this website

TABLE OF CONTENTS

Science without religion is lame;
religion without science is blind.
--Albert Einstein

I. INTRODUCTION

My purpose is to discuss the role that faith plays in science. I will pursue this purpose in basically three stages. First, I will trace some historical developments relevant to the question. I will then discuss a few basic Biblical teachings. Finally, I will summarize some recent discussions on the issue.

But first something about the title. I have been playing with changing it from "Science without Faith Is Dead" to "Science without Faith Is Myth." The latter would be more correct, but in the end I decided to stick with the original. The original is a take-off from the Biblical statement "Faith without works is dead." I like that parallel. Besides, this essay has enjoyed considerable circulation and popularity. Therefore I judge it more strategic to retain it in the form it will be recognized. However, the "Myth" version would be more correct.

When I speak of "faith," I am not referring to official church creeds. I have in mind the deep-down commitment or set of beliefs that every person has stored away in his heart and which guides him in his activities. I am thinking of the values, ambitions and hopes, whether privately constructed or culturally inherited, that influence our decisions and choices. These beliefs may be Christian or otherwise. They may be consciously held or not, but they are there, always and inevitably. Though at this point I simply make this assertion, the rest of this paper should corroborate it. My concern is whether or not such beliefs play a role in science or not. My second concern is whether or not they *should* play a role.

Science can be understood in various ways, but I refer you to the perhaps somewhat outdated but classic conception of science as summarized by Robert Hanbury Brown:

Science, viewed as a process, is a social activity in which we seek to discover and understand the natural world, not as we would prefer or imagine it to be, but as it really is. The characteristic method of science is the rational, objective, and as far as possible impersonal, analysis of problems based mainly on observational data and experiment (Shinn, p. 31).

It is this conception of science still held by many practising scientists, that has so frequently been seen as hostile to religious interest, that I am concerned

with. Has this science really been as rational, objective and impersonal as its advocates have traditionally claimed? Have faith or belief played no legitimate part in it? That is my question.

Though at first glance the discussion will seem rather theoretical, I trust that we do not identify theory with impracticality. Bertrand Russell rightly insists that the question of scientific neutrality is a very practical one (p. 91). We have only to think of the innumerable Christian students in universities the world over who, in their pursuit of science, lose their Christian faith, because they are not equipped to analyze the grandiose claims made by some scientists. They fall victim to the alleged superiority of the so-called "neutral" or "objective" way to truth. Other Christians respond by separating their faith and science in such a way that in one area they accept the *assumptions* of a neutral science, while they also reserve for themselves an area where they give free reign to their religious commitment. The two are not allowed to interfere with each other but co-exist without influencing each other, at least in theory! In effect, though they may proclaim the demand of Christ to serve Him in all our work, they exclude Christ from their main occupation. These situations arise when Christians capitulate to the postulate of neutrality.

The practical nature of the question of neutrality has also cropped up in the socio-economic aspects of science at the *Conference on Faith, Science and the Future*, held at Massachusetts Institute of Technology in 1979 under the sponsorship of the World Council of Churches. At that conference, the neutrality of science or scientists, i.e. their freedom from beliefs, ambitions and other subjective elements, was bitterly challenged especially by participants from the so-called Third World. Ruben Alves, a professor of political philosophy from Brazil, was so adamant against the traditional claim of scientists to be neutral that he warned, "And if you want to know about science, beware of the explanations provided by scientists…. Most of the explanations that science proposes about itself are not only untrue; they are dangerous." (Shinn, p. 41) Jerome Ravetz, a reader at the University of Leeds, even dared refer to scientists as corrupt and deceitful! (Shinn, p. 90) The Indian Paulos Mar Gregorious, Metropolitan of the Delhi Orthodox Syrian Church of the East and Moderator of the Conference, summarized the objections of Third World participants to science's imagined neutrality as follows:

(a) Science's claims to objectivity and value-free pursuit of knowledge could be interpreted as an *alibi offered by scientists to free themselves from their sense of guilt* about the damage done to people by science-technology.

(b) Scientists and technologists are guilty of having lent their services to war-establishments and quick-profit oriented, exploiting transnational corporations and other business enterprises.

© Scientists and technologists in general have not developed any ethical commitment to the welfare of humanity and the anticipation of the oppressed and exploited. Christians in science and technology have pursued success and glory and money for themselves, not the way of the Son of Man who lived and died to serve the poor.

(d) Many scientists and technologists are quasi-illiterate and unreflective when it comes to the economic and political implications of their work, and even about the nature of science and technology itself (*Sane*, p. 12).

Obviously, scientific neutrality is under fire. It is no longer assumed without question--and that, in my estimation, is great gain.

Though Gregorious reports that most scientists did not accept these socio-economic, basically Marxist-inspired, attacks on scientific objectivity (*Sane*, p. 3), the official reports make it quite clear that the great alleged divide between science and religion is being scaled down considerably. Scientists are becoming more aware of the limitations of their pursuit. Many now see themselves as less in opposition to non-scientific avenues to the truth than they have done traditionally. There is a greater modesty. Some are realising also something of the limitations to their objectivity. The professionals no longer see science as the sole arbiter of truth, destroying one religious doctrine after another, and subjecting all of them to a monolithic scientific method that threatens to destroy them one by one. No longer do they see science claiming to possess final truth or piecing together a comprehensive and impervious picture of the world (Shinn, pp. 14-16).

It would appear then that the battle about neutrality is shifting to a new front, namely, to the socio-economic. Marxists have long insisted that science is in the service of politico-economic powers, but now this assertion is heard loud and clear also within the Christian community. While a lot of Christian dust is thus raised at this new front, at the old front, the religious one, there appears to be a growing together. This growing together is the result partially because of the mutual give and take that has been going on through the last few decades, but possibly even more because scientists themselves are increasingly impressed with the complexity of reality and are finding that their former categories are no longer adequate. If the old conflict is not yet altogether defused, in many quarters passions are cooling and suspicions being allayed. This development makes for a more conducive atmosphere in which our present discussion can take place. But while the atmosphere is cooling somewhat, there are those who are not yet aware of that blessed fact.

II. DEVELOPMENTS IN SCIENTIFIC THOUGHT[1]

A. Greek Thought

Though *modern* science received its *main* impetus during the 16th and 17th centuries, it will be useful for our purposes to summarize basic elements of earlier scientific thinking. Our first step is to examine Greek scientific thinking. I am concerned here more with underlying ideas - philosophy, if you like - than with specific scientific theories of theirs. We do not apologise for this historical digression, for Greek thought has played a crucial role in the development of scientific thought, both positively and negatively. Much of our science depends upon implicit or explicit definitions of nature, man and God. The Greeks have deeply influenced these definitions.

A basic element in Greek thought was the *deification of nature*, though the exact form of this deification differed from philosopher to philosopher. Nature was seen as "an eternal being continuously regenerating itself" (Hooykaas, p. 1). For Plato, the universe, including the stars, sun, moon and earth, were "visible and created gods" whose task it was to form the bodies of men and animals, while their souls were created by the highest God Himself. That the highest God Himself should create mortal or physical beings was unthinkable; the physical was held in too much contempt for Plato to suggest such an idea. For Aristotle, God was the Prime Mover who did not care for the world, but who engaged in self-contemplation. The essence or "Form" of an object was the end of its individual development, its full potential. That was its "nature" or its "physics." The degree of divinity of natural things was determined by their closeness to the highest Form and therefore objects such as stars and planets were considered intelligent and eternal divine beings, even imperishable. Aristotle spoke of Nature--and note the capital here--as making things. Galen, the Greek physician who had much influence on the Christians of the Middle Ages, also asserted such an identification of Nature with the gods.

Not only was Nature divine and capable of creating things, it was also rational. After all, if it is able to produce rational things, Nature must herself be rational. Nature thus came to be regarded as subject to "the dictates of reason" (Hooykaas, p. 29). There was a *logical necessity* working itself out in Nature that had a direct impact on Greek science. No real changes could take place, it was thought, except *logical* developments. Science therefore came to rest on reason, not on observation. In fact, Plato laughed at some astronomers and others who were using their physical senses to discover aspects of Nature. And though Aristotle had more respect for our senses, his science developed basically by *deductive reasoning*. Among other things, he maintained that women have fewer teeth than men. Russell humorously comments that though Aristotle was twice married, "it never occurred to him to verify this statement by examining his wives' mouths!"[2]

Science was to be conducted on basis of rational deduction, not observation. After all, reality followed logical necessity.

This conception of Nature as divine and ruled by logical necessity led to the notion that it was impossible and even illegitimate to compete with Nature or to harness it for human purposes by applying human art or technology to it, for that would amount to man's claiming divine prerogatives. It would amount to a violation of the eternal logical world order and could be punished by the gods. Mechanics who would devise methods of lifting loads by small forces were considered to be magicians who cheated Nature. Thus Greek philosophy deprived its adherents of their freedom to subject nature for their use.

Another relevant aspect of Greek thought was their *contempt for manual labour*. There was a general disdain for physical work; it should be left to slaves. Contemplation was the highest human activity, for while contemplating, man came closest to being like God, who Himself was considered to be engaged primarily in self-contemplation. This attitude carried over into science. Mathematicians and theoretical mechanics thought it below their dignity to consider the practical applications of their science. Platonists considered preoccupation with the material inferior to that with the spiritual. When some of Plato's friends began to apply their science with the aid of logic not only but with physical instruments, he chided them for having spoiled the beauty of geometry! He accused those who were using tools in geometry of using language that "smells of slavery," simply because the use of tools involved manual labour, however minimal. Under the pressure of such disdain for practicalities and experimentation, the practical applications attempted by some engineers who rejected such philosophy "remained disappointingly far below potential capacity" (Hooykaas, p. 81).

B. Medieval Thought

Greek philosophy did not disappear with the spread of Christianity; its influence can without great difficulty be detected in the writings of Christian theologians and philosophers from the early days on. However, no one did more to seek a *legitimate* place for Greek philosophy, especially that of Aristotle, in Christian thought than did Thomas Aquinas (1225-1274). He sought to achieve "the expression of the Christian ideology in Aristotelian terms" and to utilize "Aristotelianism as an instrument of theological and philosophical analysis and synthesis" (Copleston, p. 303). Thomistic philosophy, or Scholasticism, as it is called "is unified by the application of fundamental Aristotelian principles," (Copleston, p. 423) though this is not to say that he accepted Aristotelianism without reservations (Copleston, p. 427). Aquinas was first of all a Christian, while Aristotle was a Pagan. Thus Aquinas had to devise a system that could

incorporate both strands of thought and minimize the points of tension between the two. This he attempted by constructing a dualistic system, giving a legitimate place to both, but basically separating them into two compartments. On the one hand, there was philosophy or science that relied "simply and solely on the natural light of reason" for both its data and method. On the other hand, there was theology, the basic data for which was not human reason--though reason also became its method--but divine revelation. Here faith was important. The one area was concerned with "nature" and the other with "supernature" (Copleston, pp. 312-313). Philosophy or science was thus declared basically independent from theology not only, but from revelation itself. The former area was declared autonomous (Copleston, pp. 429-430). Thus faith and science were separated from each other. They were so far removed from each other that Copleston raises the question "whether the same man can at the same time believe (accept on authority by faith) and know (as a result of rational demonstration) the same truth." He summarizes Aquinas' answer as follows:

that it is impossible for there to be faith and knowledge concerning the same object, that the same truths should be both known scientifically (philosophically) and at the same time believed (by faith) by the same man (pp. 314-315).

Aquinas, according to Hooykaas, "considered one of the useful functions of natural philosophy to distinguish that which belongs to God (for example miracles, or the origin of things) from that which belongs to nature" (p. 13). Philosophy or science are ascribed neutral qualities with respect to faith. Faith is not supposed to play a role in our knowledge of nature, only of supernature, the area of religion and the church.

Van Riessen, a scientist and philosopher of science, summarizes that development succinctly. In order to make the compromise or synthesis between Greek and Christian thought possible, faith and reason had to be made independent of each other. Thus

it became necessary to constitute two levels of life, as Thomas Aquinas did: the *natural* where reason rules independently of faith and by its own light, and the *supernatural* where faith guides the way. The territory of reason is that of philosophy and science. And its autonomy means explicitly neutrality with regard to faith, and, in fact, neutrality with respect to science. And its autonomy means explicitly neutrality with regard to faith, and, in fact, neutrality with respect to God. ("Relation," p. 11).

But note some of the *assumptions* underlying this dualistic system. For one thing, there was the Greek exaggerated view of reason in human life otherwise known as rationalism. Directly related to it was the *belief* in the basic soundness of human reason. Aquinas "acknowledges theoretically the weakness of the human intellect in its present condition, though not its radical perversion" (Copleston, p. 321). The

content of this belief has been a bone of contention throughout most of church history. But my real point here is that this was a *belief* about human rationality that undergirded his supposedly neutral realm of reason-philosophy-science, a *belief* that was proven by reason itself. In the words of Van Riessen, "Sin is the loss of the supernatural, not a corruption of nature and reason. Therefore grace is not the restoration of nature and reason, but the gift of the supernatural. Sin and grace have nothing to do with nature" ("Relation" p. 11). In short, sin, such a central concept in Christian thought, did not basically influence human activity in nature or reason. Human reason, it was *believed*, was capable of independently finding truth in the area of nature.

Reverence for Pagan philosophy, Hooykaas suggests, led to acceptance of Pagan science (p. 20). Though throughout the Middle Ages, as we shall soon see, there were those who entertained reservations with respect to Greek science (Hooykaas, pp. 32, 57-58, 86), the recognized orthodox scientific method was basically a *rationalistic* one. God, the Greeks had taught them, was bound to the law of *logical necessity*. No real innovations were possible, since there could not be any basic change in the supreme cause (God). The comparative disdain for manual labour continued in favour of the alleged superiority of contemplation and religious vocation. Even when there was mention of experimentation, it was mainly *mental* experimentation. Hooykaas comments:

Medieval textbooks contained many thought experiments, but they were never scientifically tested and they were not even intended to be tested. Scientific demonstrations always ran "when A and B are true," then C and D must follow. Thus the same phenomena … are treated by different authors on the assumption of different hypotheses, but no effort was made to decide between alternatives as a consequence of performing an experimental test. The best one could say of this method is that it trained the mind and developed the skill of precise formulation (p. 87).

Emphasis on reason and disdain for manual labour had led science into captivity. Greeks thought of Nature, it will be remembered, as gods that created the physical aspects of men and animals. The Bible was too clear for Christians to accept Greek deification of Nature, but they designed a Christian compromise here as well. Nature was regarded as a semi-independent power that followed a rational pattern according to Greek thought. It was no longer deified in the Greek way, however, but it was now seen as God's vice-gerent or lieutenant. It had a kind of intermediate status between God and the world. Some even introduced a kind of hierarchy of beings between God and the world on the basis of an assumed logical necessity. There had to be an intermediate between the absolute simplicity of the supreme God and the multiplicity of creatures. It should be understood that, to his credit, Aquinas rejected such a necessity (Copleston, p. 364).

C. Emergence of Modern Science

The impressive theoretical system devised in the Middle Ages had its challengers amongst both scientists and theologians. We want to summarize just a few of these objections. In the process of so doing, a clearer picture will emerge of medieval obstacles to the development of science, including the practical impact of Greek philosophy.

In reaction to the Medieval tendency to straightjacket God into a system of logical necessity, Bishop Etienne Tempier of Paris, under the instigation of Pope John XXI, published a condemnation of no less than 219 theses, many of which supported this logical necessity that limited God's power to the dictates of human reason--of course, only in the minds of men! Tempier was interested basically in the theological issue of God's freedom that was being restricted, but in the process he also undermined the limitations this rationalism imposed upon scientific enquiry. He rejected such notions that God could not make empty space or new species. "Not only the theology of necessity was at stake," comments Hooykaas, "but also the natural science of necessity" (p. 32). A century later, nominalists began to reject rationalistic deductions from the nature of things. Voices were heard that insisted that God in His freedom could have created things that would not conform to our rational expectations. For example, contrary to tradition, God *could* have created a void, for such things depend on God's will.

The Greek hesitation to imitate or improve upon nature also became subject to attack. Alchemists claimed that their imitation of nature was perfect. They claimed to be supporting natural processes and thus speed up the process of objects realizing their perfect form. They received aid from the academic Paracelsus in the 16th century who explained that all artificial procedures are founded on natural ones, including those of alchemists and bakers. Nature, it had been thought, could be surpassed only by magic. Roger Bacon in the 13th century argued that seemingly impossible feats are possible, but admitted that this is done by placing the powers of Nature at the service of man. Bacon felt such natural magic to be legitimate, but his contemporaries considered him a sorcerer. Any attempt to equal or improve upon the activities of nature herself were still regarded generally as impious.

It is understandable, in view of these obstacles, that it was difficult for science to take off. The philosophy of the age, inherited from the Pagan Greeks, functioned as an effective barrier to development. Some scientific experiments were conducted, even by clergymen, but those engaged in them required more courage and independence of spirit than is presently the case. Today science enjoys the moral support of society; then, it had to go *against* the deepest grains of society.

Most interested parties would not have been able to muster the necessary courage. It was the basic *beliefs, assumptions* of the age, philosophical and theological, that directed science along rationalistic patterns, that regarded tampering with Nature as impious and that considered contemplation superior to using one's hands.
All this was to change with the Reformation.
The Reformation was not simply an ecclesiastical and theological happening only: It was a very complicated movement with repercussions in all areas of human endeavour, including science. Scientifically, it represented basically a revolt against the limitations of Scholasticism. Facts were now freer to speak for themselves and no longer seen as subject to the dictates of rationalistic traditions. Traditional scientific ideas were now allowed to crumble under the influence of new discoveries, some of them by non-scientists. Navigators, partners in the new commercial expansion, discovered that the tropics, contrary to traditional dogmatic science, were inhabited by people. Rationalistic inhibitions against experimentation lost their force. On basis of an 8-minute experiment, Kepler rejected the established doctrine that movement in space could only be uniform and circular. Facts previously suppressed or misrepresented because they did not conform to the expectations of orthodoxy, now were accepted whether or not they conformed to reason. Even first-rate scholars were becoming involved in manual experiments. And all of this was now taking place with the basic approval of all segments of society.
The revolt against Scholastic limitations on science was aided by a change in a number of doctrines. Theories about Nature changed drastically so as to take the capital out of it; a process of demythologizing set in that "un-deified" creation. In the Bible there is no room for an autonomous or semi-autonomous Nature; there is only a creation directly dependent upon the creator. This did not escape the new theorists. Everything that was previously ascribed to nature was now attributed directly to God's vice-gerent. During the late 1600s, Robert Boyle considered the classic doctrine of Nature an insult to God and an impediment to investigation. During the 18th century, Berkely rejected Nature also: what Pagans and philosophers ascribe to Nature he wrote, "Scripture attributes directly to God." Boyle, Berkely and their fellows rejected the notion of God needing intermediaries between Himself and His creation. God is a free agent, it was argued. Newton insisted that God is Lord and thus not bound by any logical necessities or Nature. Hooykaas comments, "Newton's empiricism, like that of Bacon, Pascal, Hooke and Boyle, had a theological background" (p. 49).
Another stimulus for science was the new idea of work and calling. The traditional disdain for physical work and admiration for spiritual contemplation eroded. Physical effort was receiving a new respect by being considered within man's divine calling. Both Luther and Calvin emphasized very much that ordinary work

was not something inferior, but a divine mandate. This helped deliver the deathblow to contempt for physical experimentation in science.

Another important ideological change was the new insistence on the priesthood of all believers. While previously the clergy were the recognised guardians of the truth, their role of guardian in science was now rejected by many. The doctrine of general priesthood not only gave believers the right to study the Scriptures directly without depending on the authority of tradition and hierarchy, but also that other book, General Revelation, otherwise known as creation. The authority of scholasticism was rejected at this front.

The combination of these new doctrines spelled a tremendous liberation for scientists. All the restrictions imposed upon them by Scholasticism were now lifted. In fact, the study of nature--note the small letter--was now considered mandatory and honourable for Christians. After all, there was the cultural mandate of Genesis 1. Calvin said the study of nature, conceived of in the new light, was necessary because it led to a knowledge of God and life. Those who had the talents, it was said, should not neglect the empirical study of nature. There was freedom also because man was now considered to have dominion over nature.

It is important to realise that the *science of the Reformation was not an attempt to free science from religion, but, rather from a particular form of religion*, namely, Scholasticism. This was expressed repeatedly. Nicole Malebrache, a priest, wrote that "vulgar philosophy (scholasticism) had mixed up Christian religion with pagan philosophy…" (Hooykaas, p. 20). Francis Bacon was conscious of what he was fighting. His attitude has been summarized as "Out with Aristotle and in with the Bible." He considered rationalism the root of all evil in science (Hooykaas, p. 39). Boyle considered science and religion as allies. Science, according to him, has quarrels only with "speculative metaphysics." In short, while defenders of Scholasticism accused the new breed of undermining religion, the latter saw themselves free not from the Christian faith, but from "the human authority of theologians and philosophers and from the oppressive burden of its idols, named Forms and Ideas" (Hooykaas, p. 50). Returning to Bacon, Hooykaas wrote:

He blew the trumpet in the war against the signs of laziness, despair, pride and ignorance and he urged his contemporaries, for the sake of God and their neighbours, to re-assume the rights that God had given them and to restore that dominion over nature which God had allotted to man. It was not the love of philosophical novelties, but moral indignation, which inspired his crusade against the scholastics. Their old "science" did not bear fruit, it did not alleviate the burden of life, because it separated art from nature and put the Forms beyond the reach of man. But as in Bacon's opinion a natural philosophy that stuck to words and did not lead to works was as dead as a faith without works, so too should science be directed towards the benefit of man, for "though I speak with the

tongues of men and angels and have not charity, I am as a tinkling cymbal." His idea was a science in the service of man, as the result of the restoration of the rule of man over nature. This to him was not a purely human but a divinely inspired work: "The beginning is from God … the Father of Lights." He concluded the preface to his *Historical Naturalis* with a prayer: "May God, the Founder, Preserver, and Renewer of the Universe, in His love and compassion to men, protect the work both in its ascent to His glory and its descent to the good of Man, through His only Son, God-with-us."

Hooykaas concludes, "Thus modern technology … found its most eloquent advocate in a man who placed it on a decidedly Christian basis…" (p. 72). In 1622, Nathanael Carpenter wrote *Free Science* against "the superstitious cults of Aristotle" and he ended his plea for freedom of scientific research with the triumphant exclamation: "I am free, I am bound to nobody's work except to those inspired by God." H opposed Aristotle as the "pope in philosophy" and that included science (Hooykaas, p. 113). The new science was everywhere backed up by insistence on essentially Biblical notions of divine freedom, human dominion over creation and the dignity of labour. Some even interpreted technological improvements as part of the restoration the Bible holds out for us, since it reduced the burdens of hard labour to which most people were subject (Hooykaas, pp. 69, 93).

It is hardly necessary, after all this, to draw attention once again to the deeply religious background and the theological argumentation that underlay so much of the struggle for the new science. Of course, we are not suggesting that it was only a theological affair; there were other factors, social, economic, etc. However, we are concerned to indicate the role of faith and belief in these developments. Theological and philosophical arguments abounded on both sides of the fence. Issues such as the relation between faith and reason, between God, man and the world, the capability of reason, the nature of the cosmos, the value of physical labour--all of these were crucial issues in the emergence of modern science, but they were all decided by the participants at a pre-scientific or non-scientific level. Whatever position one took on any of these issues could never be proven in a scientific way; they were determined on basis of belief. I emphasize this not to discredit science, but to undermine the *myth* under which scientists have traditionally been labouring, namely that science and faith are separate entities and that they should not intrude on each other's territory. Modern science was born partially out of religious and philosophical ferment--pre-scientific concerns, faith concerns. Decisions and choices were made that have since, with a number of modifications along the way, continued to guide science. The assumptions then disputed have become such common stock-in-trade for the modern person that we operate with them without questioning them or thinking about them. They *now*

appear like common sense to us, "natural" or "neutral." However, originally these assumptions had to be fought for on the basis of faith and belief, very consciously so.

D. Subsequent Developments

So far, the discussion would make it appear as if Scholasticism had been dealt a serious blow in science. The pioneers of modern science rejected the division proposed by Aquinas and others that science depends only on reason, while Scripture deals with the province of religion and faith. Yet, modern science has generally been more amenable to placing science and faith in separate realms than these early developments would lead one to expect. A recent article in *Time* expresses the general modern view well. Writes Lance Morrow, "Faith defies proof; science demands it." He quotes Isaac Asimov, "Science works by persuasive reason. Outside of science, the method is intuitional, which is not very persuasive. In science, it is possible to say we were wrong, *based on data*" (Feb. 5, 1979, emphasis mine). This sounds more like Aquinas than the early modern scientists. What happened?

The explanation, I believe, lies in Copleston's remarks about the precarious nature of Aquinas' construction. Copleston writes "the charter granted philosophy tended to become a declaration of independence." Eventually philosophy and science went their own way, at first merely seeking peace with theology, but later taking over the area originally reserved for faith and theology (Copleston, pp. 424, 428-430). This process was aided by the fact that the children of the Reformation soon once again accepted much of scholastic thought. Luther himself proclaimed that there are two kingdoms that closely parallel the areas of faith and reason in Aquinas' scheme and served much the same function. Dooyeweerd comments, "This Protestant reform of scientific knowledge cut a miserable figure when it again took up the dualistic maxim: For faith one must go to Jerusalem; for wisdom one must go to Athens" (Dooyeweerd, "Secularization," p. 11). The consciously Biblical thinking of the first modern scientists disappeared under the force of this new form of dualism. Not only was there a division of faith and science, but they grew increasingly farther apart--at least, that is how historians and philosophers tend to explain it. Eventually, religion and science came to be regarded as mutually exclusive and sometimes even as hostile to each other, competing with each other as contrasting avenues to truth.

New schools of philosophy and scientific thought came and went, but they invariably were based on the notions of a neutral science, autonomous nature and of the basic soundness of human reason. To be sure, certain occurrences for which no natural explanation was available were still frequently ascribed to God, but as

science increased its understanding, the area "allowed" for God and faith was progressively reduced until men began to feel that God was hardly necessary any longer, certainly not in science. There was "the concept of an ever-growing field called 'nature,' where science ruled supreme, and consequently an ever-shrinking field of religion where faith guided man" (Van Riessen, 1960, p. 12). The God of the gap was slowly but surely gobbled up by science. For all practical purposes, God was dead, or at best irrelevant, and faith was replaced by objectivity and neutrality--or so it was said.

III. BIBLICAL CONSIDERATIONS

I have looked at some historical data that have indicated the fact that the beginnings of modern science were based on ideas men derived consciously from the Bible, ideas pioneers *believed*, but could not prove scientifically and were not interested in so proving. Some of these ideas still are among the main assumptions underlying contemporary science. They have become so ingrained in modern thought that we think of some of them as "natural" to man, as "common sense" -- if we think of them at all. Modern science may since then have rejected the religious basis of these assumptions, but it cannot be denied that they are *assumptions*, articles of *faith*, without which modern science would not have developed as it did.

I now wish briefly to discuss a number of ideas that have played a significant role in the development of science and, perhaps, throw somewhat a different light on them. The first is the question of the nature of *religion*. If we are to come to some conclusions regarding the role of faith in science, we must come to terms with religion, for our concept of religion is determinative for our view of faith.

How can one arrive at a responsible definition of religion? Note that I asked for a "responsible" concept, not for a "scientific" one. Though religion can be scientifically studied, this attempt has produced many different definitions. Yinger, William James, Royce, Whitehead, Kant, Feurbach, Fromm, Dooyeweerd--all of them have advanced quite different ideas about religion. How does one choose? On what basis? On basis of science? Though science can study religious phenomena, I doubt that it can discover the essence of religion, for, as history has already showed us, *science itself has a foundation of faith. It does not appear possible to discover the nature of religion or of faith in an objective and scientific way*, for that science is already based on certain non-scientific or pre-scientific assumptions. Hence I think it best to operate *consciously* with my own assumptions and turn to the basis of my faith, which is found in the Bible.

The Bible indicates that religion is not one area of life alongside others, in spite of the long-standing philosophical, scientific and even popular assumption that would

so compartmentalize it. In the Bible we find man standing directly before God in a covenantal relationship that is totalitarian. Man is mandated to care for the world. Because of his fall, man no longer understood his position and so God saw to the publication of His will for man in the Bible. It is quite clear from the Old Testament that God's intentions for human obedience covered all of life. This is obvious especially from Mosaic legislation for a specific people, God's concerns over politics, hygiene, economics, marriage, sex, etc. In the words of Eccles. 12:13--"Fear God, and keep his commandments; for this is the whole duty of man." Or take Deut. 10:12-13--

And now, Israel, what does the Lord your God require of you, but to fear the Lord your God, to walk in all his ways, to love him, to serve the Lord your God with all your heart and with all your soul, and to keep the commandments and statutes of the Lord….

Anyone familiar with Old Testament terminology will readily recognize the totalitarian claims of God upon His people. This totalitarian claim is reiterated by Christ in what is known as the Great Commandment of Mat. 22:37-40. Christians are expected to "be transformed by the renewal of your *mind* (Rom. 12:2). They are to "take every *thought* captive to obey Christ" (II Cor. 10:5).

To be sure, many, if not most, men fail to be so renewed. They either have not heard or they have rejected this total claim upon them--or they may have reduced it to conform to the latest fashions in (scientific) thought. But does that make them less religious?[3] According to the Bible, hardly. Just because men do not know the will of God does not mean they have lost their created nature or that they are no longer confronted by Him. God has created man to obey and serve Him in this world, to develop this world to His glory. It is the created inalienable nature of man to so serve and work. And when his heart is turned away from the living God, either in whole or in part, he will fill the resultant void in his heart and mind by devoting his creative energies to some aspect of creation instead of the Creator Himself. According to Romans 1:25, "…they exchanged the truth about God for a lie and worshipped and served the creature rather than the Creator…." Bluntly contrary to the humanistic faith in the grandeur of human rationality, the Apostle Paul declares that "they became futile in their thinking and their senseless minds were darkened. Claiming to be wise, they became fools, and exchanged the glory of the immortal God for images resembling mortal man or birds or animals or reptiles" (Rom. 1:21-23). The point of these quotations is not to insult modern man - though he probably deserves it! -- but to indicate that from the Biblical perspective man always confronts God in one way or the other. He is forced by the very nature of his created make-up to respond. If he does not serve the living God, he *inevitably*--not merely invariably--will fill the void with some other goal, idea or god. *He never becomes less religious. He simply exchanges one religion for*

another, one loyalty or idea or commitment for another. It thus is never a question of science or religion, reason or faith, but of which religion or loyalty or commitment it is that guides one in his pursuit of life as a whole and of science specifically.

We have stated the Biblical teachings about God's totalitarian claims on our lives as well as the inescapability of religion. There is another aspect to Biblical anthropology that militates against the compartmentalization of faith and science. The Bible posits a basic unity to a person that has its concentration point in what is frequently called "heart." The Bible, according to G.C. Berkouwer, uses especially the term "heart" to refer to man in his "concentrated unity." "Keep your heart with all vigilance; for from it flow the springs of life" (Prov. 4:23). The Lord looks first of all at a man's heart (I Sam. 16:7), because that is the centre of a person where all other issues are basically decided, good and evil. "My heart instructs me" (Ps. 16:7). God tries men's "minds and heart" (Ps. 7:9; 26:2; Jer. 11:20; 17:10; I Thess. 2:4). All our sins come "from within, out of the heart of man" (Mk. 7:21). God knows a man's heart (Acts 1:24; 15:8; Lk. 16:15; Rom. 8:27; Rev. 2:23). No wonder then that the speaker in Prov. 23:26 asks his son to give him his heart, for once that heart has been captured, so will all else in a person's life follow. What a man is in his heart will influence all his works, also his science. If that heart is fully committed to God (*all* your heart, *all* your soul, *all* your mind, *all* your strength), one's work, including scientific work, will tend to direct him in the service of God. If some other ultimate loyalty has captured that heart, one's work, including scientific work, will take him into a different direction. Thus the structure of created reality, both without and within man, forces him to be a religious person. As Abraham Kuyper put it, "not the head but the heart is the means of knowledge." The heart is "the place in a man where God works, and from out of which He exercises an influence also upon the head and the brain." (Runner, "Sphere," p. 66). This is another way of saying that all our activities have a religious foundation, consciously so or otherwise. *We are all of us, first of all believers, not thinkers,* not scientists (Runner, "Scientific," p. 18).

Having considered the Biblical teachings about the inescapable religious substratum to human life, we are confronted with the question whether we can really divide a person into neatly separated compartments of faith and reason, religion and science, subjectivity and objectivity. Is the scientist really such a completely different person when he crosses the threshold into his laboratory? To ask the question is to answer it. On both sides of the threshold he is a man confronting reality, a man with a basically religious constitution. He takes with him his feelings, joys, ambitions, anxieties, hopes and beliefs--above all, his heart, the focus where God works within him. The scientist is first of all a person and all

that we have just proposed about human beings applies to him, also while in the laboratory.

IV. ADDITIONAL CONFIRMATION

In this section I adduce additional evidence and opinions with respect to the active role that beliefs, convictions and other subjectivities play in science to further indicate that the idea of neutrality is largely a myth. There are different schools of thought about science in general as well as within each science. As to different philosophies of science as a whole, one can turn to any number of works devoted to a professional treatment of what one can rightfully call "denominationalism" in science. Gregario's treatment of this feature is enlightening. He speaks of "the English-speaking school," the "German language debate," and of "Marxist views of science." Such phenomena in the world of science are sufficient an indication not only of weighty differences, but also of the fact that these differences cannot possibly be reduced to scientific differences (*Sane*, pp. 104-118). They are determined by basic pre-scientific beliefs and assumptions. I find it interesting to observe that while in Western science the role of philosophy and faith are regarded as illegitimate intruders in science, as standing in the way of true objectivity, Marxism seeks openly to integrate the two (Gregarios, *Sane*, p. 116; Shinn, p. 50) in the name of objectivity! Different denominations, indeed!

Then there are, of course, differences within specific scientific disciplines. It is not only in theology that there are schools like liberals, conservatives, Roman Catholics, Protestants, existentialists, neo-orthodox etc. In psychology, we have, among others, behaviourism, Freudianism and existentialism. Even the science long regarded as the bastion of safety from all human subjectivities, mathematics, is plagued with different schools of thought. Though I am rather illiterate when it comes to mathematics, I have the impression that even the basic question as to whether mathematics deals with logical constructs only or with an objective reality continues to bedevil its practitioners. Runner refers to a "whole series of tortured theoretical attempts… that go by such names as interactionism, parallelism, occasionalism, ennoetism, impetus theory, hylemorphism, etc." (*Relation*, p. 125). The published proceedings of the conference "A Christian Perspective on the Foundations of Mathematics" is a clear indication of the subjective elements that go into the process of determining basic answers within mathematics. One writer on science even uses the "religious" term of "conversion" that is needed often for a scientist to change from one school to another (Brouwer, p. 1). Runner attributes this phenomena to the previously discussed innate necessity of man to devote himself to some ultimate truth, belief, or loyalty. If one does not place God at the centre, he will turn to some aspect of creation and absolutize it as his ultimate

explanation. Men will "take one particular *aspect* of created reality for the *whole* of it, thereby reducing all the other aspects to so many modes of the one they have just absolutized." This is due not simply to a slip in their logic or to a vacuum in their scientific knowledge; it is a distortion that will occur inevitably when one turns his heart away from the Creator ("Relation," p. 138). Freud did it with sex and Marx with the economic.

The church is often (dis)credited with obstructing science by her dogmatism, the most celebrated case in point being that of Galileo. However, Wolterstorff adduces evidence that similar pre-scientific *dogmas* have played an active role also in the openness of scientists to innovations. They have served as strong *controls* over their acceptance and/or rejection of theories. He presents examples relating to Newton, Ernst Mach and logical positivists, all of which advanced new theories on basis of pre-scientific ideas and all of which were opposed--in the case of the first two, at least--on similar basis. He writes, "The faith which the positivists displayed in natural science was not itself arrived at scientifically. On the contrary, it resembles in striking ways the confidence of the Congregation of the Inquisition in the veracity of Holy Scripture" in the case of their opposition to Galileo (pp. 11-16). It is due to this ever-present underlying faith-basis that men have time and again judged old and new theories alike in science and technology--though, not *only* because of this reason, we should add. Tiner's popular accounts of such incidents are, in addition to being humorous, most instructive when placed in the light of our present discussion.

Today an increasing number of scientists are beginning to question the validity of the claim to neutrality. Robert Vander Vennen quotes a number of scientists who in fact reject the claim. Thomas Kohn has argued that scientists work on basis of a pre-theoretical viewpoint. This is inevitable, he writes, and without it "even scientific observation becomes impossible." Facts, he insists, depend on our conceptual framework. Social scientist Clyde Kluckhohn has written, "All discourse proceeds from premises and… is limited by these premises. This is equally true of physical and biological science." Historian Herbert Butterfield insists that facts do "not themselves thrust upon the scientist conceptual patterns of interpretation that are univocal and necessary. Instead the scientists need to choose deliberately which alternative conceptual framework to use for his interpretation." R.N. Hanson asserts that observation is "theory-laden" (Vander Vennen).

It was particularly at the multi-cultural Conference on Faith, Science and the Future in 1979 that the role assumptions play in science was emphasized. Participants from different cultures emphasized that modern science is *obviously* under the influence of a particular culture and strikes people from other cultures as alien (Abrecht, p. 10). The "definition of truth in science varies from culture to culture," writes Gregarios (Shinn, p. 50). To him it was painstakingly obvious that

at that conference the predominant values were those of Western Protestantism (*Sane*, p. 68). That mentality is defined by a religious bias not only, but the scientist has also been "imbued with a whole orientation… developed in the Western world…." One is an adherent to a specific religion or set of values, he is a citizen of a specific country, member of a specific race and class. He has his own personality and personal biases. All of these appellations suggest characteristic sets of beliefs which, in the appropriate circumstances, may function as control within his theory-devising and theory-weighing (Wolterstorff, pp. 78-79). Ideas that appear "common sense" to members of one community or "neutral" are recognised by members of other cultures as not so neutral and hardly as common sense.

Marxism, which was in the background of some of the criticism of scientific neutrality at the 1979 conference, has, of course, never accepted the claim that Western science was ever conducted in a neutral fashion. It has always charged that Western science is a tool in the hands of capitalists and directed by their economic interests and thus hardly neutral. On the other hand, Marxism claims that *its* science *is* neutral and objective, based as it is on objective economic observation. I agree with Marxism that much of Western science has been in the service of those in power. I do not agree, however, that Marxist science is any more objective or neutral. It is based on the Marxist view of man as basically materialistic and economically determined. This Marxist anthropology itself is based not on objective analysis, but on unproven belief.

The point I have been trying to make in this section is, again, that whichever way one turns in the debate about science, one runs into the ever present role of faith, beliefs, assumptions that themselves have never been proven scientifically. The earlier scholars recognize this fact, the more honestly they can pursue their science, science without myths.

V. SPECIFIC ROLE OF ASSUMPTIONS IN SCIENCE

I now wish to indicate briefly some of the functions that assumptions or beliefs should legitimately play in science, with a special emphasis on Christian faith. Wolterstorff argues that "the Christian scholar ought to allow the belief-content of his…Christian commitment to function as control within devising and weighing of theories." This is a radical turn away from the traditional quest for neutrality and objectivity. We have seen, however, that all along scientists have been guided by pre-scientific or non-scientific assumptions, usually unconsciously. It would appear far better to be *aware* of one's assumptions and to act upon them *consciously*, than to *pretend* to be neutral and make the resultant grandiose claims that have deceived so many. Wolterstorff's reason is that it is a paramount tenet of

the Christian faith that "following Christ ought to be decisively ultimate" in one's life; all of one's life "ought to be brought into harmony with it." In general, this means that the Christian scholar ought to reject theories if they truly conflict with the basic tenets of the faith. Positively the Christian scholar "ought to devise theories which comport as well as possible" with these doctrines (p. 72). For example, the Bible teaches that God has given man responsibility for his neighbour and for creation. This presupposes that man is by nature free to carry out this responsibility. Any scientific theory, therefore, that denies human freedom--e.g., behaviourism and Freudianism--ought to be rejected, either entirely or at the specific point of conflict. Christians ought to replace such theories with others based on their faith or, at least, in conformity with it (Wolterstorff, p. 73. Brouwer, p. 9). Thus, Christians are encouraged to do *consciously* in science what has long been practised *unconsciously*, even surreptitiously. They are here called upon to return to the conscious practice of the pioneers of modern science, not by returning to their rather primitive scientific theories, but by consciously giving a role to their Christian faith.

The Christian faith has a contribution to make in our understanding of the place of science in human affairs, its motivation and direction. We have seen that modern science did not really begin to get a foothold until Biblical notions as to the value of work broke through. Genesis teaches that it is a deeply religious task of man to develop the earth. Science is predominantly the attempt to do just that. It is an expression of the created urge of man to do so. Scripture thus implies that *science is man's modern response to that divine call* and helps us understand the origin of our scientific urge and to regard it with proper respect. Similarly, we are given some instruction in the Bible as to the *direction* science should take. Man is to develop the earth, yes, but in the context of servanthood to both God and neighbour. This means that exploitation for the benefit of certain classes or countries at the expense of others is illegitimate. In view of the fact that science has been mostly in the service of industry and government with their specialized and often short-term interests. Biblical pointers as to direction should weigh heavily in Christian contributions to science.

The Biblical teaching about the all-pervasiveness of sin ought to set us on our guard against entertaining expectations from science that are too high. Rationalism is a myth not only because in fact it is a faith, but also because reason is not free from the devastating effects of sin. Our reasoning is guided by our hearts from the devastating effects of sin. Our reasoning is guided by our hearts that contain mixtures of motives, ambitions, goals, beliefs, hopes, etc., all of which are subject to sin. When we apply our logic to science, it is thus a logic that can take us into wrong directions. The allegiance of our hearts may lead us to develop science for the benefit of certain classes or ideologies and to choose research programmes that

may not be in the interest of most of our neighbours or to the glory of God. This allegiance will help us determine what is important to have theories about (Wolterstorff, p. 66). This allegiance can lead to the oppression of one class or people by another--precisely the cry of the Third World participants at the 1979 conference. It can lead to a partial liberation and a *temporary* one, never more. Thus the Biblical injunction to depend on no one but God for salvation is especially relevant for our attitude towards science: it will not bring salvation and it will not solve all our problems. We will need to continue to depend upon God precisely because science is usually in the hands of sinful and egoistic groups or groups that may have the best of intentions but are so class-bound in their vision that they will still not know how to apply science to the interest of all. The Christian faith then helps to restore science to its proper limits.

One very important area where much confusion has reigned is the relationship of the scientist to facts. It is generally assumed that facts are objectively true, beyond doubt. The subjective counterpart to fact is thought to be value. It is the former that has a place in science, while the latter is a question of beliefs, according to the classic scheme.

There are reasons to question this view. For one, there is the denominationalism within science we have already mentioned. Furthermore, it is increasingly realized that fact and value can no longer be separated in that traditional sense. Although the objects or situations we refer to as "facts" may have an independent existence apart from our observation of them, as soon as the observer begins to pay attention to a phenomenon, he is by that token immediately involved in some subjective way. Facts are all around us, but we cannot consider them all. Thus, we select some and ignore others. As soon as we have made our selection, we begin to interpret them. The selecting and interpreting scientist involves himself, "his likes and dislikes, his ideas and prejudices" (Van Riessen, "Relation," p. 15). One James Newman illustrated this point by the example of a "biology student who saw long, curved, black lines in every object which he examined under his microscope because his eyelashes always got in the way" (De Vries, p. 12). The answers one derives from facts are largely determined by the question one puts to them. Van Riessen summarizes recent developments in physics that have to do with discoveries that "the same object could have different length for two observers. The same event could take place at different times for two observers." Such and related developments, according to Van Riessen

have shattered the belief that science is objective and that it is possible to isolate the event to be known from the observer. Modern man has been compelled to admit that the observer can never be removed from the facts. In other words, we never get at the event itself. We only know a mixture, consisting of the event we like to know, but cannot, and the subjective influence we introduce into the act of

observing or measuring. Man always influences the process of a moving election by trying to know about the process; he can never know the process itself. All this adds up to the simple statement that man, particularly in physics and generally speaking in all science, can never arrive at objective truth. He cannot exclude the subjective elements in his knowledge. That is his principal limitation ("Relation," p. 27).

Though Van Riessen bases this argument on developments *within* science, it is basically his pre-scientific anthropology that has liberated him sufficiently to reject the traditional dichotomy between fact and value not only, but has also led him to select that particular fact for special attention. Van Riessen's argument here is a good example of the role of faith or assumptions consciously held in science. It has liberated him from the procustream bed of neutrality, made him more open to reality and led to a specific emphasis. It has always been that way in science, except that it was mostly done unconsciously. Facts and values cannot be separated as classic science has attempted. The Biblical anthropology presented earlier militates against it and now scientific evidence itself is turning against such separation.

VI. CONCLUSION

In conclusion, I emphasize that this paper does not represent an attempt to discredit science or its practitioners. My aim has merely been to refute the myth of neutrality. I have sought to indicate on both historical and Biblical grounds that science and faith are not enemies but that science invariably and inevitably has a religious substratum, whether recognised or not. The assumptions of a scientist intrude into his pursuit of science at many different points, not as an alien negative influence that we should seek to banish, but as a basic component of all human endeavours, including science.

The reason for my pointing this out is that it takes science off its pedestal of neutrality. Modern science and modern universities tend so to emphasize objective scholarship that anything called faith, including religion, is at best tolerated. It is not allowed to play a real role in either. This trend has unnerved many Christians and has encouraged them to reduce their Christian experience and service to non-academic aspects of their lives. Their *Christian* faith is thus eliminated from their major occupation, while the non-Christian myth of neutrality takes its place. It makes for an impoverished Christian life. It tends to make Christians apologetic for entertaining a faith at all.

My hope is that this exposure of the role of faith will serve to give Christians greater courage, while it should free scientists from a false myth. I should also mention that our main arguments can be applied to politics, economics, arts and

every other area of human endeavour where men are guided by the myth of religious neutrality. In all of these areas man is always there as a *religious* being, either serving his Creator or creature. Nowhere is there neutrality. Neutrality is something men have come to believe in but have never proven. *Christians, Muslims and adherents of other religions do not face the secular scientist as believer versus objective or neutral scholar, but they face them as one believer versus another believer.* We are all in the same boat; we are all believers. It is never a question of faith against science, of faith against reason. It is always a question of one faith versus another.

[1] Our main source for this historical section is Hooykaas' study. I acknowledge specific pages only after direct quotations.
[2] Russell, p. 17. Please refer to the same place for additional humorous examples.
[3] For more detailed discussion of the following, see Boer, pp. 484 ff. (1979) and pp. 148 ff. (1984).

BIBLIOGRAPHY

Abrecht, P. (ed.). *Faith, Science and the Future: Preparatory Readings for 1979 Conference of the World Council of Churches.* Geneva: World Council of Churches, 1978.

--- *Faith and Science in an Unjust World. Report of the World Council of Churches' Conference on Faith, Science and the Future.* Vol. II: Report and Recommendations. Geneva: World Council of Churches, 1980.

Boer, J.H. *Missionary Messengers of Liberation in a Colonial Context: A Case Study of the Sudan United Mission.* (Amsterdam Studies in Theology, Vol. I) Amsterdam: Rodopi, 1979.

------. *Missions: Heralds of Capitalism or Christ?* Ibadan: Daystar Press, 1984.

Brabenec. R. et. al. *A Christian Perspective on the Foundations of Mathematics: Proceedings of the Conference held at Wheaton College, April 18-30, 1977.* Wheaton: Dept. of Mathematics, Wheaton College, 1977.

Brouwer, W. "Christian Commitment and Scientific Theories." Stenciled Article distributed by Association for the Advancement of Christian Studies, Toronto, (n.d.).

De Vries, J. "Calvinism in the Exact Sciences." Unpublished lecture.

Dooyeweerd, H. "The Secularization of Science." Trans. R.D. Knudsen. Stenciled notes distributed by the Association for the Advancement of Christian Studies, Toronto, (n.d.).

Gregarios, Paulus Mar. *Science for Sane Societies: Reflections on Faith, Science and the Future in the Indian Context.* Madras: The Christian Literature Society, 1980.

Hart, H. and Olthuis, J.H. "Theses on Science and Revelation." Stenciled article distributed by the Association for the Advancement of Christian Studies, Toronto, (n.d.).

Hooykaas, R. *Religion and the Rise of Modern Science.* Grand Rapids: Eerdmans, 1972.

Morrow, L. "In the Beginning: God and Science." *Time*, Feb. 5, 1979.

Runner, H.E. "The Relation of the Bible to Learning." *Christian Perspectives,* 1960. Also published in Runner, H.E. *The Relation of the Bible to Learning.* Toronto: Wedge Publishing Foundation, 1970.

--- "Scientific and Pre-Scientific" and "Sphere-Sovereignty." *Christian Perspectives*, 1961. Toronto: Association for the Advancement of Christian Studies, 1961. Also published in Runner 1970--see above.

Russell, B. *The Impact of Science on Society.* (Unwin Paperbacks). London: Unwin, 1976.

Schrotenboer, P.G. *The Nature of Religion.* (Christian Perspective Series, 1964). Toronto: Association for the Advancement of Christian Studies, 1964.

--- "The Christian Student in the Modern University." Stenciled paper distributed by the Association for the Advancement of Christian Studies, Toronto (n.d.).

Shinn, R.L. (ed.) *Faith and Science in an Unjust World: Report of the*

World Council of Churches' Conference on Faith, Science and the Future. Vol. 1: Plenary Presentations. Geneva: World Council of Churches, 1980.

Stob, H. "Calvinism and the Philosophy of Science." Unpublished notes.

--- "The Ideological and Theological Debate about Science." *Anticipation,* January, 1979.

Tiner, J.H. *When Science Fails.* Grand Rapids: Baker, 1974.

Van Riessen, H. The Relation of the Bible to Science." *Christian Perspectives*, 1960. Toronto: Association for the Advancement of Christian Studies, 1960.

---*Mens en Werk.* Christelijke Perspectief, Vol. II. Amsterdam: Buijten & Schipperheijn, 1962.

Vander Vennen, R. "Is Scientific Research Value-Free?" *Journal of the American Scientific Affiliation,* September, 1975.

Wolterstorff, N. *Reason within the Bounds of Religion.* Grand Rapids: Eerdmans, 1976.

[1] Our main source for this historical section is Hooykaas' study. I acknowledge specific pages only after direct quotations.
[2] Russell, p. 17. Please refer to the same place for additional humorous examples.
[3] For more detailed discussion of the following, see Boer, pp. 484 ff. (1979) and pp. 148 ff. (1984).

BIBLIOGRAPHY

Abrecht, P. (ed.). *Faith, Science and the Future: Preparatory Readings for the 1979 Conference of the World Council of Churches.* Geneva: World Council of Churches, 1978.

--- *Faith and Science in an Unjust World. Report of the World Council of Churches' Conference on Faith, Science and the Future.* Vol. II: Report and Recommendations. Geneva: World Council of Churches, 1980.

Boer, J.H. *Missionary Messengers of Liberation in a Colonial Context: A Case Study of the Sudan United Mission.* (Amsterdam Studies in Theology, Vol. I) Amsterdam: Rodopi, 1979.

------. *Missions: Heralds of Capitalism or Christ?* Ibadan: Daystar Press, 1984.

Brabenec. R. et. al. *A Christian Perspective on the Foundations of Mathematics: Proceedings of the Conference held at Wheaton College, April 18-30, 1977.* Wheaton: Dept. of Mathematics, Wheaton College, 1977.

Brouwer, W. "Christian Commitment and Scientific Theories." Stenciled article distributed by Association for the Advancement of Christian Studies, Toronto, (n.d.).

De Vries, J. "Calvinism in the Exact Sciences." Unpublished lecture.

Dooyeweerd, H. "The Secularization of Science." Trans. R.D. Knudsen. Stenciled notes distributed by the Association for the Advancement of Christian Studies, Toronto, (n.d.).

Gregarios, Paulus Mar. *Science for Sane Societies: Reflections on Faith, Science and the Future in the Indian Context.* Madras: The Christian Literature Society, 1980.

Hart, H. and Olthuis, J.H. "Theses on Science and Revelation." Stenciled article distributed by the Association for the Advancement of Christian Studies, Toronto, (n.d.).

Hooykaas, R. *Religion and the Rise of Modern Science.* Grand Rapids:

Eerdmans, 1972.

Morrow, L. "In the Beginning: God and Science." *Time*, Feb. 5, 1979.

Runner, H.E. "The Relation of the Bible to Learning." *Christian Perspectives,* 1960. Also published in Runner, H.E. *The Relation of the Bible to Learning.* Toronto: Wedge Publishing Foundation, 1970.

--- "Scientific and Pre-Scientific" and "Sphere-Sovereignty." *Christian Perspectives*, 1961. Toronto: Association for the Advancement of Christian Studies, 1961. Also published in Runner 1970--see above.

Russell, B. *The Impact of Science on Society.* (Unwin Paperbacks). London: Unwin, 1976.

Schrotenboer, P.G. *The Nature of Religion.* (Christian Perspective Series, 1964). Toronto: Association for the Advancement of Christian Studies, 1964.

--- "The Christian Student in the Modern University." Stenciled paper distributed by the Association for the Advancement of Christian Studies, Toronto (n.d.).

Shinn, R.L. (ed.) *Faith and Science in an Unjust World: Report of the World Council of Churches' Conference on Faith, Science and the Future.* Vol. 1: Plenary Presentations. Geneva: World Council of Churches, 1980.

Stob, H. "Calvinism and the Philosophy of Science." Unpublished notes.

--- "The Ideological and Theological Debate about Science." *Anticipation,* January, 1979.

Tiner, J.H. *When Science Fails.* Grand Rapids: Baker, 1974.

Van Riessen, H. The Relation of the Bible to Science." *Christian Perspectives*, 1960. Toronto: Association for the Advancement of Christian Studies, 1960.

---*Mens en Werk.* Christelijke Perspectief, Vol. II. Amsterdam: Buijten & Schipperheijn, 1962.

Vander Vennen, R. "Is Scientific Research Value-Free?" *Journal of the American Scientific Affiliation,* September, 1975.

Wolterstorff, N. *Reason within the Bounds of Religion.* Grand Rapids:

Eerdmans, 1976.