Graduate Theological Union

"Twentieth century scientific pictures of the cosmos are being drawn in such a way that it makes sense to ask: does God belong in the picture?"

Distinguished Faculty Lecture

"Scientific Research and the Christian Faith"

Dr. Ted Peters

Professor of Systematic Theology
Pacific Lutheran Theological Seminary

Wednesday, November 28, 7:00 pm
Pacific School of Religion Chapel

Dr. Bob Russell, respondent

Each year the faculty honors one member as the Distinguished Faculty Lecturer. Please join us for this year's lecture to be given by Dr. Ted Peters.

Faculty Publications Fair

Wednesday, November 28
immediately following the Faculty Lecture
Richard Dinner Board Room
Flora Lamson Hewlett Library

Please join us for this reception honoring Dr. Peters and those faculty members who have published books in the past six months. Faculty publications will be on display.

Lecture Draft of August 12, 1990
GTU Distinguished Faculty Lecture
November 28, 1990

SCIENTIFIC RESEARCH AND THE CHRISTIAN FAITH

By

Ted Peters *

What is the relationship between scientific research and the Christian faith? This is a multi-leveled question. At the theoretical level, where for so long we have assumed science and theology were at war with one another, we are today discovering marvelous new areas of common concern. At the personal level, we are finding increased impetus for scientists to express their faith in ways that complement rather than conflict with their study of the natural world. At the church level, however, there seems to be some ambivalence, perhaps an unspoken hostility on the part of our church leaders aimed at scientific researchers. Then, finally, at the political level we confront the moral issue of staggering importance, namely, the role of the scientist in the weapons industry.

---

* Ted Peters is professor of systematic theology at Pacific Lutheran Seminary and the Graduate Theological Union in Berkeley, California. He serves as board member and consultant to the Center for Theology and Natural Sciences and is editor of *Cosmos as Creation: Theology and Science in Consonance* (Nashville: Abingdon Press, 1989) as well as author of *The Cosmic Self* (San Francisco: Harper & Row, 1991).
This lecture is scheduled for publication in the March 1991 issue of *Thought*.

Like creek water filled with silt after a spring rain, we cannot yet see through the flow of conversation to know what is at the bottom of it all. The general direction is toward increased communication and mutual respect, perhaps even common cause. At the same time, I fear that there may exist a subtle undercurrent, a hostility on the part of church leaders toward science and scientists. It is likely that most scientists are as yet blissfully unaware of their enemy lurking behind church doors. Our clergy and theologians may be unaware as well, having blinded themselves behind cloaks of prophetic self-righteousness. If it turns out that this is indeed what is happening, then I would recommend that church leaders reexamine their posture and ask openly whether we wish to greet the scientific community with open hands or closed fists.

All this and much more enters into the complex of issues which makes up the faith-and-science agenda in our time. In this article we will look at the various levels of the science-faith relationship in turn. In doing so we will observe that what is going on is anything but dull. Overall, this is an exciting epoch for pursuing partnership between scientific research and Christian faith.

I. NEW HORIZONS OF CONVERSATION BETWEEN SCIENCE AND THEOLOGY

Exciting things are happening, especially in physical cosmology. Twentieth century scientific pictures of the cosmos are being drawn in such a way that it makes sense to ask: does God belong in the picture?

For too long in the modern world we have assumed that natural science and religious faith are either antithetical or at least insulatable. Conservative and Fundamentalist Christians have assumed that scientific method as well as certain theories such as evolution positively contradict the truth about the world witnessed to in Holy Scripture. In many cases they have forced the human mind to choose: either science or faith, but not both. Neoorthodox and liberal Christians have for the most part taken the two language

approach. They contend that science speaks about nature in empirical and rational language, whereas religion speaks about transcendent realities in poetic or symbolic language. Science speaks about fact, whereas religion speaks about value. People of faith, then, are simply bilingual. The speak both scientific and religious lingo.

Yet neither of these approaches could anticipate what is happening now. New doors are being opened so that scientific and religious thinkers can talk with each other about common domains of knowledge. Let us note a three examples.

First, *the second law of thermodynamics* has drawn attention from Christian theologians because it seems to make nature historical. The principle of entropy entailed in the second law seems to indicate that there is an arrow to time. Time runs in only one direction. Events are single and unrepeatable. And nature is composed of events, not just universal principles endlessly repeating themselves. The work of Ilya Prigogine and others on the thermodynamics of nonequilibrium systems has shown quite convincingly that on the macroscale time moves from a finite past toward a finite future. Time is irreversible (Prigogine, 1984). We may now think in terms of a history of nature.

This could be significant because theologians in this century have been thinking of God's relation to the world in terms of historical acts. God acts in history. The Exodus is a historical act. So is the incarnation, death, and resurrection of Jesus Christ. So will be the consummation. What may be happening is that temporal history may become a common category wherein both scientists and theologians will pursue their research.[1]

Second, *Big Bang cosmology* has raised again the reasonableness of talking about the

---

[1]"History is the most comprehensive horizon of Christian theology," writes theologian Wolfhart Pannenberg in his programmatic essay, "Redemptive Event and History," (Pannneberg 1970-71:I:15). Pannenberg is inspired in part by the respected German physicist, C.F. von Weizsäcker, who wrote *The History of Nature* (Weizsäcker, 1959).

Christian doctrine of creation out of nothing, of *creatio ex nihilo*.[2] The red shift noted when observing distant galaxies moving away from us and from each other have led us to conceive of the universe as expanding. As we speculate backwards in time, we envision a point--perhaps 20 billion years ago--at which everything belonged together. The second law of thermodynamics leads us to pursue the logic of finite time. The bang began hot, exploded, and is now cooling off as it expands. There must have been a very hot beginning, a point at which it all began. There must have been a point at which time began, when $t=0$.

Where did this beginning come from? If there was nothing before $t=0$, can we talk again about an origin of all things out of nothing? Can we talk about *creatio ex nihilo* or about God lighting the fuse on the Big Bang? Regardless of how one answers such questions, we must recognize that the discipline of physical cosmology itself has pushed us to the edge of thinking about the world. It has pushed us to the brink of finite reality and is inviting us to look for the infinite. Physicist Stephen Hawking says that "the odds against a universe like ours emerging out of something like the Big Bang are enormous. I think there are clearly religious implications."[3]

Third, scientific discussions of *the Anthropic Principle* are raising again the prospect of a design argument for the existence of God. Two centuries ago, when the universe was thought of mechanistically and likened to the precision workings of a watch, natural theologians argued that this necessitated someone to design the world machine; i.e., it necessitated a divine watchmaker. Something similar may be happening today. As we shift

---

[2]For much of our century theologians have been tended to give up on the doctrine of *creatio ex nihilo*, presumably because it lacks scientific intelligibility. The idea of continuing creation has taken its place. Now, however, physical cosmologists are exploring the idea of creation out of nothing in a number of areas including the notion of a sudden beginning to all things. The relationship between *creatio ex nihilo* and *creatio continua* is one of the themes uniting the essays in *Cosmos as Creation* (Peters, 1989).

[3]Cited by Boslough 1985:121. Hawking recognizes the religious implications, then he moves to try to reconceive of $t=0$ so as to eliminate the need for God. Carl Sagan, a religious skeptic, tries to draw out the implications of the Hawking cosmology when introducing a Hawking book: "This is also a book about God...or perhaps the absence of God" (Hawking, 1988:x). What is important is that the question of God is unavoidable in the scientific discussion.

from the mechanical model to the historical model of the universe, the question arises as to whether or not the history of nature is subject to divine guidance. What is significant to note here, is that the question of a divine designer is being raised by scientists, not theologians.

The argument begins by noting how the facts of astronomy seem to involve an incredible combination of numerical accidents which readies the universe for the evolutionary appearance of life. Only the slightest change in the physical constants would have resulted in an inhabitable universe. Take, for example, the expansion rate. If the early rate of the expansion following the initial bang had been slower by even one part in a thousand billion, the universe would have collapsed again before temperatures had fallen below 10,000 degrees. On the other hand, if the rate had been faster by one part in a million, the universe would have expanded too rapidly for stars and planets to form. Given all the factors determining the expansion rate--such as the total mass of the universe, the initial explosive energy, the strength of gravitational forces, etc.--it appears that everything was finely tuned just to make coalescing planets hospitable for living creatures.

Similarly, the minuscule asymmetry in the ratio of particles to anti-particles is another amazing feature. For every 1,000,000,000 anti-protons in the early universe, there were 1,000,000,001 protons. The billion pairs annihilated each other, producing radiation. Only one remained. Yet these one in a billion particles made the material world possible.

In addition, we note the weak interaction force keeps the sun burning at a slow and steady rate. A slight change in strength either way would destroy the delicate relationship between sun and earth. And, further, if the strong nuclear force were slightly weaker than it is, we would have only hydrogen in the universe. If it were slightly stronger, all the hydrogen would turn to helium. In either case, stable stars and compounds such as water could not have formed. Without water, no life...at least life as we know it.

This remarkable collection of unexplained coincidences leads physicist Freeman Dyson to remark, "the more I examine the universe and study the details of its architecture, the more evidence I find that the universe in some sense must have known that we were coming" (Dyson: 1979:250; cf. Barrow, 1986 & Peters, 1989:129-131). If the cosmos is so finely tuned to life, does this mean there is a divine tuner? Regardless of how one answers it, the question is alive again.

What all this is pointing to is the revival of conversation about theological matters within the domain of scientific inquiry. There certainly remains considerable rivalry between scientists and theologians, of course. Paul Davies brags that "science offers a surer path to God than religion." Nevertheless, what is significant is that "what were formerly religious questions can be seriously tackled" by the new physics (Davies, 1983:ix).

Astronomer and agnostic Robert Jastrow created quite a stir a few years ago by arguing that "the astronomical evidence leads to a biblical view of the origin of the world." Probably intending to goad the likes of Paul Davies cited above, Jastrow wrote the now oft quoted lines:

> ...at this moment it seems as though science will never be able to raise the curtain on the mystery of creation. For the scientist who has lived by his faith in the power of reason, the story ends like a bad dream. He has scaled the mountains of ignorance; he is about to conquer the highest peak; as he pulls himself over the final rock, he is greeted by a band of theologians who have been sitting there for centuries (Jastrow, 1978:116).

Some of our church leaders are rising to the occasion. In September 1987 Pope John Paul II convened a study commission to commemorate the 300th anniversary of the publication of Isaac Newton's *Principia*. He told the physicists and theologians gathered at the Vatican that "reality is *one* and the truth is one; and we claim that there is an intrinsic call for unity of knowledge whether it comes from experimental science or from theology." Then in a preface he wrote for the commission report, the Holy Father called upon both the church and the scientific community to "intensify their constructive relations of interchange through unity" (Russell, 1988).

The Roman Catholic Church is not the only Christian group interested. Protestant and ecumenical Christians are ready as well. Institutes for the purpose of bringing scientists into conversation with theologians are being established in the U.S. and elsewhere. Princeton University has a center. The Lutheran School of Theology at Chicago has now set up the Chicago Center for Religion and Science. At the Graduate Theological Union in Berkeley, California, the Center for Theology and the Natural Sciences pursues ongoing research regarding the potential integration of the disciplines. The Presbyterians have a task force to deal with it. The former Lutheran Church in America and the Lutheran World Federation sponsored a major international conference on "The New Scientific-Technological World: What Difference Does it Make for the Churches?" at Cypress in November 1987 (Mangum, 1989). Credentialed scientists in evangelical churches have formed a society, the American Scientific Affiliation.

In sum, we find ourselves today in an exciting time, a time when natural scientists and Christian theologians are finding that they have a number of important things to talk about.

II. THE PERSONAL FAITH OF THE SCIENTIST

There is a widespread myth afoot in modern culture that a full scale war is going on between science and religion. Both disciplines are allegedly competing for the allegiance of the human mind. Sometimes the scientist is pictured as the defender of rational truth leading the forward advance of our civilization, whereas the religionist is pictured as one steeped in outdated superstition while fighting for narrow-mindedness and intolerance. At other times the scientist is pictured as the godless naturalist who is threatening to undermine religion's claim to transcendental knowledge, whereas the person of faith is pictured as devoutly defending the truths and values which make life wholesome and meaningful. Although the reality of the situation hardly even approximates the myth of warfare, there is just enough truth to the pictures to make people think they must choose sides.

Usually during the years of higher education, the student begins to sense that he or she is coming to a fork in the road where the choice is one or the other but not both. For some, of course, the fork is identified as a mirage and the student proceeds to embrace both the principles of scientific research and religious faith. The split is by no means inevitable; yet many of us operate with the assumption that scientists are non-religious if not downright anti-religious.

A psychometric study was performed by Bernice T. Eiduson on the generation of experimental physicists who broke open the twentieth century mind with such discoveries as relativity and quantum mechanics, the same generation which pooled its mental resources to produce the atomic bomb. They had a surprising number of characteristics in common, such as almost all were first-born sons of professional fathers.[4] The IQs of experimental physicists clustered around 150, whereas the theoretical physicists clustered at 170. Numerous factors were taken into account. Relevant to our discussion here is a section of the composite portrait of the male scientist at the prime of his career:

> ...He works hard and devotedly in his laboratory, often seven days a week. He says his work is his life, and he has few recreations....The movies bore him. He avoids social affairs and political activity, and *religion plays no part in his life or thinking*. Better than any other interest or activity, scientific research seems to meet the inner need of his nature (Rhodes, 1988:142, italics added).

Note: "religion plays no part in his life or thinking." It appears that scientific research is thought to replace religious devotion because it better meets the needs of our inner nature. It particular, science allegedly meets more adequately our need for truth. Perhaps Albert Einstein represents the composite best. As a student in a German *Gymnasium* reading the works of Kant and Darwin, he reported "I soon reached the conviction that much of the stories in the Bible could not be true" (Clark, 1971:36). With this as the operative

---

[4]Some of the major contributors to the scientific advance have been women, of course, such as Marie Curie, Irene Joliot-Curie, and Lise Meitner. The particular study noted here finds that generally American male physicists came from Protestant or Jewish background, not Roman Catholic, and were sickly in their youth. It also found that scientists think about problems in much the same way artists do.

stereotype, it is understandable that people today entering research may assume that they must choose between science and faith.

In one of his early movies, *Heavens Above*, famed comedian Peter Sellers played the role of a village vicar who diligently but somewhat naively was calling the people in his parish back to a personal trust in God. Among other things he asked the rich to share their wealth with the poor. This got him into trouble with the business community and a forced transfer away from his vicarage. His new post was that of chaplain to Britain's space program. In one scene near the end of the movie, a number of scientists and technicians are sitting at their stations to monitor a rocket launch. One reports that the chaplain--Peter Sellers--has refused to make the official Church of England blessing of the rocket ship. "Why won't he do it?" they ask. Because, the chaplain was reported as saying, he wants to bless people, not machines. Furthermore, he is concerned about their relationship with God. "What," one scientist exclaims, saying in effect, "doesn't he know that we don't believe any more."

Some scientists, of course, do believe. They embrace both a personal faith in God as well as a commitment to a life of research. A sterling example is Vincent P.K. Titanji, Senior Lecturer of Biochemistry and Molecular Biology at the University of Yaounde in Cameroon. A man of firm Christian faith, Dr. Titanji believes he has been called by God to pursue biochemical research into the causes of river blindness. This disease affects forty percent of the population of Cameroon, causing some to die and many to live their senior years without benefit of sight. The discovery of a cure could revolutionize health in his homeland. He works year in and year out both on site as well as in laboratories in Sweden to find the answer. This is his life's vocation (Mangum, 1989:85-89).

But understanding such research as a divine call was not easy to maintain. Like so many young Africans who show promise in missionary boarding schools, there was no money for him to advance his education in North America or Europe. So he accepted a full scholarship to the University of Moscow where he eventually earned his doctorate. During

every year of his seven year stint in Moscow, he was obliged to hear weakly lectures on atheism and dialectical materialism. The anti-religious propaganda was strong and incessant. This puzzled him. Even after a half century of communist rule, the Soviet Union still perceives religion to be such a threat that there is no letting up on the pressure. Why such a reaction? he quizzed himself. Later, through contacts set up by the Lutheran World Federation, he met some biologists in Sweden who have continued to support him in his work in central Africa. They also support him in his self-understanding as a scientist who is working in the service of God.

Dr. Titanji is a scientist who is a faithful Christian layman. There are many like him. The American Scientific Affiliation is an organization of Evangelical (not fundamentalist) Christians who are trained scientists. In addition to lay people, at the present time we are seeing a growing number science-theology hybrids, i.e., individuals who are taking the matter so seriously that they are combining scientific credentials with theological training and in some cases even ordination. William R. Stoeger, S.J., is a priest and physical cosmologist doing research at the Vatican Observatory. Stanley L. Jaki at the Princeton Center for Theological Inquiry is a physicist and a Benedictine monk.[5] Lindon Eaves, genetics researcher at the University of Virginia, is also an Anglican priest. Robert Russell, who directs the Center for Theology and the Natural Sciences in Berkeley, holds a doctorate in physics and is an ordained minister in the United Church of Christ. Oxford scholar Arthur R. Peacocke is a biochemist as well as a theologian and heads a recently founded order for hybrids called the Society of Ordained Scientists.

Just how the individual integrates the two disciplines into a single life is an ongoing agenda. It was said a century ago of physicist Michael Farraday, who was a strong Christian believer, that when he went into his laboratory he forgot his religion and when he came out

---

[5]Stanley L. Jaki argues that what science and Christian faith have in common is the demand for intellectual honesty. "In fact," he writes, "science is as closely related to religion, and especially to Christian religion, as a child is to the womb out of which it came forth and with full vitality" (Jaki, 1987:851).

again he forgot his science. "I hope that is not true," pines John Polkinghorne, Cambridge professor of theoretical physics and Anglican priest. He says "...despite the obvious differences of subject matter, the two disciplines have in common the fact that they both involve corrigible attempts to understand experience. They are both concerned with exploring, and submitting to, the way things are" (Polkinghorne, 1986:97).

What all this means, I think, is that we are entering a period where the mirage of the conflict between science and faith is being penetrated. If we allow ourselves the time and effort to get beyond the stereotype of the non-believing scientist, the opportunities for an integration of research and faith may appear.

III. THE SCIENTIST AND THE CHURCH

Although the scientist may have achieved a harmonious integration between work and personal faith, his or her relationship to the church may be ambiguous. It is the case, of course, that professional scientists in our congregations are lay people and as such have much in common with all other lay people. Yet, there may be some characteristics of the scientist *as scientist* which affects his or her relationship to the church. On occasion, that relationship may lead to frustration. Let us explore just how and why (Peters, 1988).

In 1982 I heard a Lutheran research geneticist from Boston describe his laboratory work as the "passion" of his life, as the place where he puts his heart, mind, body, and soul. He has invested years in postgraduate education and in grant applications, and he drives himself to stay at the frontier of new developments. "But when I go to church," he pines, "the pastor asks me to pass out bulletins. No one in my congregation has the slightest idea what I do. My passion is not expressed or even acknowledged there."

"Why is it this way?" I queried.

"Well, it's not that my pastor doesn't care. I think he's intimidated by science. So, he doesn't risk talking on my turf. I guess asking me to hand out bulletins is all he dare do."

This is a mild but significant criticism of pastor and congregation. The problem here we might call a failure in pastoral care. Whenever the deepest passions of a Christian individual's life are ignored by the Christian community, there is something wrong. Of course, practically speaking, we must recognize that it would be difficult to integrate such a highly specialized discipline as genetics research into the common life of a parish. Nevertheless, the sense of alienation expressed by this lay person needs to be heard.

Yet, there is more to it than just this. There just may exist a subtle hostility on the part of church leaders aimed at scientists. I find it significant that when the geneticist is in church he is asked to pass out bulletins. Regardless of his personal background, he like everyone else in the congregation is asked to express his stewardship according to the list of activities we identify as church activities. When in church, do as the church people do. He is operating on the pastor's turf so he conforms to the pastor's routine understanding of what church is all about. This way the scientist *as scientist* cannot influence congregational life.

Is this enough evidence of hostility against scientists? No, not in itself. But if we combine this observation with what we know about the training of our clergy over the last few decades, perhaps a pattern of antipathy may become visible. Let me offer a couple observations.

First, the senior generation of today's clergy and theologians went through seminary when neo-orthodoxy was dominant. We learned about the power of The Word, about preaching the kerygma, and about the centrality of faith. We learned to pit faith *against* knowledge of things in this world. We agreed with the modern atheists that scientific knowledge should be secular and neutral and objective and divorced from any taint of a faith perspective. The neo-orthodox theologians showed a healthy respect for the natural sciences, but they put up a high wall of separation between lab stool and pew. Many of us pastors have simply grown accustomed to this separation.

We take it for granted that Soren Kierkegaard is the grandparent to neo-orthodox and existentialist theology. We inheret from this great Dane more than a mild antipathy

toward science. "It is no good trying to cope with natural science," he wrote; "one finds oneself standing there defenceless and is in no position to control. The researcher immediately begins to dissect with his details...now it is time to use the telescope now the microscope; who the hell can stand that!" What Kierkegaard feared was the steady advance of the scientific mind which would eventually reduce matters of spirit to matters of matter. "Physiology will eventually be so comprehensive that it swallows up ethics as well," he pined. It is a combination of respect but also fear of science which led neo-orthodox theology to distance itself from the modern enemy.

Second, the most recent generation of today's clergy has been more influenced by liberation theology than by neo-orthodoxy. This group may be overtly negative toward scientists. Whereas the neo-orthodox had respect for science, the liberation theologians do not. There are two reasons. The first reason is that liberation theology is anti-theoretical. The emphasis on praxis--on changing the world instead of understanding it--leaves the scientific researcher--whose primary task is to understand the world--out in the cold. The second reason is that that those first world theologians who try to tie the ecology movement with third world liberation end up making the scientists their enemy. They conflate technology with science--in some cases deliberately refusing to distinguish the two--and then condemn technology for (a) destroying the environment and (b) becoming a weapon whereby the first world exploits the third world. So, the scientists become identified as the enemies of oppressed humanity as well as mother earth.

We might call this liberation based antipathy a 'moral' or 'prophetic' argument against science. This moral argument is not limited to clergy, however. It is broader. This brings us to the third cause of anti-scientism. There is widespread in Western culture a growing disenchantment with research science. After all, science produced the bomb! Whereas a century ago we believed that science along with industry would soon create utopia on earth, we now worry that nuclear war may leave us with an earth which is uninhabitable. And even if we never get to nuclear annihilation, we know that many

scientists earn their living by working on government contracts; and government contracts mean weapons' research; and weapons' research means not only war but also the unnecessary diversion of funds which could go to aid the poor. In effect, research scientists are integral to the structures of social evil.[6]

We clergy, of course, always want to stand up for what is moral. We want to oppose war and economic injustice. This is proper, I suppose. Yet I wish to pause and ask: is it possible that we have created an atmosphere of moral self-righteousness such that, whenever we engage scientists on scientific matters, we carry the air of moral condemnation? Do we tacitly blame the individual scientists we know for the socalled structures of evil in such a way that an intangible tension creates a separation, a separation which makes pastoral ministry impossible? Does it appear that we have reserved our ministry to the rightous among us and that scientists do not fit that category?

I am reminded here of Kurt Vonnegut's *Cat's Cradle*. The narrator is a journalist interviewing the director of a nuclear research laboratory. He writes,

> "every question I asked implied that the creators of the atomic bomb had been criminal accessories to murder most foul."
>
> [The director] Dr. Breed was astonished, and then he got very sore. He drew back and grumbled, "I gather you don't like scientists very much" (Vonnegut, 1963).

No clergyperson is likely to say publicly that she or he does not like scientists. It may not even be admittable to the pastor herself or himself. Yet the message comes through to the scientist. To be liked by the pastor, the scientist needs to pass out bulletins, that is, the scientist needs to play the game on the pastor's turf.

What can we do to remedy the situation. One suggestion comes to mind: use the church as a forum for discussing the implications of the scientific research in which our people are engaged. Whether in an individual congregation or in consortia of

---

[6]We will see in section "V. Church Statements on the Ethics of Nuclear War" that official statements by church leaders do not overtly blame scientists for the evils of the bomb. The logic of ecclesiastical condemnations of the bomb, however, cannot but help implicate the scientists. What we are exploring here is the possibility that such condemnation is an undercurrent in church life.

congregations or at special conferences designated for this purpose, we ought not to continue leaving things unsaid. We need to open doors, so to speak, so that the scientists among us can express their concerns and perhaps guide the church into new realms of responsibility. Such open discussion may meet some of the personal needs of the scientists as well as serve the mission of the church as a whole.

I've spoken with Tom Gilbert. Formerly a research chemist with Argonne National Laboratories, Tom now along with Phil Hefner directs the Center for Religion and Science at the Lutheran School of Theology at Chicago. He said he once was a Methodist. He would sit in worship Sunday after Sunday listening to innanities from the pulpit that seemed to be forcing him into a *sacrificium intellectus*. So he quit. He dropped out of church activities all together, thinking of himself as an atheist (although he wants to give a very specific meaning to his kind of atheism). He knew religious questions were very important, but he was not sure how to bring them to articulation. Sometime later a few of his friends who were engineers and research scientists invited him to a Presbyterian church to talk about these matters. A discussion group formed, and this made the difference. Tom became a Presbyterian.

Tom is now a Lutheran and carrying on what he consideres to be important conversations regarding the relationship between God and the world. I find Tom's biography significant, because he tells us one thing which the church can do, namely, provide a place where these matters can be explored in an intelligent fashion.

I asked Lindon Eaves, an aforementioned researcher in human genetics at the Medical College of Virginia and an Anglican clergyman, what he wants out of his church. "First," he says, "I want good liturgy. Second, good preaching. Now the preacher need not be sophisticated in science, but he or she should not say things which are palpably false." He went on to add that when matters of science and faith are discussed within church circles, we should address issues which are already on the minds of the scientists. "Thank God," he exclaims, "we don't have to talk about evolution versus creationism any more!"

IV. SCIENCE AND THE STATE

Scientists are citizens. Their incumbant moral imperatives are for the most part shared with every other citizen. There may be certain notable exceptions, however. These exceptions center around weapons research. One issue is this: should scientists in the pursuit of truth sell their skills to national governments for the purpose of developing new weapons for destruction? A closely related but distinguishable issue is this: should scientists, whose morality of knowledge requires the open sharing of information in behalf of the pursuit of truth, engage in secrecy?

Many scientists, just like philosophers and theologians, are idealists for whom world peace is the primary goal of statesmenship. The vision of world peace is a universal vision, of course. Yet the universality of that vision is challenged if not compromised when the scientist's daily employment is aimed at providing a military advantage of one nation over all the others.

Perhaps the most horrible chapter in the story of World War I was the development of poison gas. The German army introduced chemical warfare against Canadian and French African troops on April 22, 1915. It was chlorine gas, caustic and asphyxiating. Soldiers clawed at their throats, stuffed shirttails and scarves into their mouths, and buried their faces in the dirt. Writhing in agony, five thousand died and another ten thousand were damaged for life. A similar attack was launched against the Russians in June, a complete success.

Soon the allies appeared in the field wearing gas masks. Then things began to escalate. The French, who had already used tear gas, retaliated with phosgene artillary shells. These were ten times more toxic than chlorine. The Germans accelerated the development of ever more lethal gases, using chlorpicrin (*Klop* in German) against the Russians. Then, during an artillary bombardment against the British on the night of July 17, 1917 they introduced dichlorethyl sulfide. It had a horseradish- or mustard-like smell and

so became known as 'musard gas'. It penetrated the gas masks. The victims began vomiting. Then their skin reddened and blistered. Finally their eyelids inflamed and swelled shut. Blinded, they were no longer able to fight.

The director of chemical warfare research for the German military command was Fritz Haber. Haber justified his work, saying that "it was a way of saving countless lives, if it meant that the war could be brought to an end sooner." As the casualties began to mount and the atrocities became so horrendous, Haber's wife Clara Immerwahr, also a chemist, became melancholy. She complained to her husband that the production of poison gas was a perversion of science as well as a sign of barbarism. She demanded that her husband abandon his work. He refused, saying that a scientist belongs to the world in times of peace but to his country in times of war. Then he went to the Eastern front to supervise a gas attack. Dr. Clara Immerwahr Haber committed suicide that night (Rhodes, 1988:90-95).

I find the Haber philosophy haunting: a scientist belongs to the world in times of peace but to his or her country in times of war. This seems to have been the fate of the researchers who layed the groundwork for the Manhatten project and the raising of the curtain on the dramas of the nuclear age. Hungarian expatriot Leo Szilard believed the liberation of atomic energy could actually save humankind. It would save us from confinement on earth and open up space travel (Rhodes, 1988:14;25;107;442). It was he along with Edward Teller and Eugene Wigner who spearheaded the move to persuade Albert Einstein to write the famous letter to then President Franklin Roosevelt, the letter which began the government subsidized work on the atomic bomb. These scientists realized full well that should atomic weapons be developed, no two nations would be able to live in peace with each other unless military forces were controlled by a common higher authority. And, further, if such an international control could abolish atomic warfare, it would be effective enough to abolish all other forms of warfare as well. In short, they hoped that the

production of weaponry made from uranium would in itself hasten the advent of world peace (Rhodes, 1988:308).[7]

Szilard along with Teller helped the prestigeous Einstein to compose the letter on August 2, 1939. They gave it to Alexander Sachs, a confidant of the president, for delivery. Sachs was not received by the president until October 11. Sachs opened with a story about a young American inventor, Robert Fulton by name, who wrote a letter to Napolean. The inventor was proposing to build the emperor a fleet of ships that carried no sail but could attack England in any weather. With such engine driven ships Napolean's armies could travel to and from England without fear of wind or storm. Napolean scoffed: ships without sails? "Bah! Away with your visionists!"

Roosevelt laughed.

Then Sachs cautioned the president to listen carefully as he presented the Einstein letter requesting the United States government to support research into energy drawn from uranium. Sachs handed over the letter wrapped around a bottle of Napolean brandy. After two glasses of brandy were poured, the president began to pay concentrated attention.

"Alex," said Roosevelt finally, "what you are after is to see that the Nazis don't blow us up."

"Precisely," Sachs said (Rhodes, 1988:314).

Eventually Roosevelt became convinced and supported the research. He then needed to enlist the scientific community in the war effort. In a conversation with Edward Teller the president said: "If the scientists in the free countries will not make weapons to defend the freedom of their countries, then freedom will be lost" (Rhodes, 1988:336). He was

---

[7]When in March 1944 Robert Oppenheimer was deciding on the use of the code word 'Trinity' to name the test site for the first nuclear explosion, he had in mind a poem of John Donne, "Hymne to God My God, in My Sicknesse." It was a poem about death and resurrection held in paradox. Death is the path to resurrection. Oppenheimer, along with Niels Bohr, were trying to affirm the paradox that the invention of a weapon of massive death might actually win the war and redeem the human race for world peace (Rhodes, 1988:571f).

offering absolution in advance to those researchers whose consciences might be challenged by making weapons of death.[8] How does this compare with the position of Fritz Haber: the scientist belongs to the world in times of peace but to his or her country in time of war?

In addition to the humanitarian isssue as to whether scientists should invent machines of death, there is a closely allied issue regarding secrecy, of doing research behind "closed doors." In principle, scientific research--if it is to be true to its very nature--should be open and public. Knowledge advances more rapidly when discoveries are shared among the community of scholars. Each builds upon the other.

This certainly was the case among physicists around the world up to 1939. Communication was maximized. Whether a successful experiment was executed in Germany by Lise Meitner and Otto Hahn, in England by Ernest Rutherford, in Denmark by Niels Bohr, in Italy by Enrico Fermi, in the Soviet Union by Georg Flerov, or in America by Albert Einstein or Ernest Lawrence, it was written up and published in an international journal such as *Physical Review*. Conferences gathered these scientists together annually, usually in Copenhagen at Niels Bohr's invitation. When in 1940 Igor Kurchatov, a nuclear physicist in the U.S.S.R., noted how the names of prominent physicists, chemists, metallurgists and mathematicians had disappeared from international journals, he deduced that bomb research was well underway. Secrecy itself gave secrecy away. This in turn accelerated the Russian research on nuclear explosives which had begun in 1939.

---

[8]Absolving scientists of their possible guilt seems to be the accepted norm in public discussion even today. In his bestselling bombshell denouncing the nuclear threat, *The Fate of the Earth* (Shell, 1982:103), Jonathan Shell writes: "although it is unquestionably the scientists who have led us to the edge of the nuclear abyss, we would be mistaken if we either held them chiefly responsible for our plight or looked to them, particularly, for a solution." Well, if we cannot blame the scientists, then whom do we blame? Shell faults the applied scientists who make technological application of what the pure scientists discover plus the political decision-makers. He says that "the scientists in the Manhattan Project could not decide to make the first atomic bomb; only President Roosevelt, elected to office by the American people, could do that" (Shell, 1982:105). And finally says, "all of mankind threatens all of mankind" (Shell, 1982:107).

The achievement of secrecy in the United States was not easy to come by. The idea of secrecy arose once the idea became implanted that German research on nuclear weaponry was proceding toward strengthening the Nazi war machine. People such as Enrico Fermi and Edward Teller advocated secrecy--meaning that fission research results would no longer be published--in an attempt to isolate German physics. People such as Leo Szilard and Niels Bohr insisted that secrecy must never be introduced into the discipline of physics. Bohr argued in behalf of complete openness as an operational necessity. Openness, fragile as it might be, is as essential to scientific progress as freedom of speech is to democracy. The scientist should publish *all* his or her results, favorable and unfavorable, where all could read them, making possible the ongoing correction of error. The advent of secrecy would not only retard the growth of science, it would subordinate science to someone's poltical system.

Once the war had arrived on America's doorstep, so did secrecy. At first it took the form of an informal code. Plutonium became known as copper. U235 was called magnesium and uranium generically was dubbed tube alloy. The attempt at Columbia University to create a chain-reacting pile was known as "the egg-boiling experiment." Eventually secrecy became official policy, and some scientists suspected of espionage were followed by undercover agents.

The issue of who enforces secrecy--whether it is enforced by the scientists themselves or by the military--only extends the concern. When Robert Oppenheimer was traveling the country recruiting scientists to join in the research at Los Alamos in 1942 and 1943, a potential conflict arose. General Leslie R. Groves wanted the scientists commissioned into the military. This would help to insure security. Very few of the scientists were attracted to the notion of joining the Army. Some revolted. Science should remain autonomous, they argued. The execution of secrecy and security could be left to the military, they said, but decisions as to what should be applied in the laboratory must remain strictly in the hands of the laboratory. Oppenheimer feared a rebellion would delay the work and so convinced

Groves to compromise. The Army would administer the facility and surround it with a fence. But freedom of speech was retained within the laboratory itself (Rhodes, 1988:454).[9]

Much has changed over the past half century. Much has also stayed the same. It appears that nuclear weapons have not brought us world peace. They certainly have not eliminated non-nuclear war, and we believe we are threatened daily by nuclear holocaust. What has not happened is the rising of a common higher authority to insure protection from such weapons. In its place we have substituted the policy of deterrence, the policy of control through fear.

V. CHURCH STATEMENTS ON THE ETHICS OF NUCLEAR WAR

Fear abounded in the decade between Ronald Reagan's first presidential campaign in the late 1970s--when he stated that the United States could win a limited nuclear war--and the dramatic Societ shift toward rapprochement in 1989. The whole world asked: if our political leaders think we can survive a limited nuclear war, might they try it? Anxiety was high. Self-appointed prophets flailed about, looking for someone to blame.

Church leaders came out squarely in opposition to nuclear war.[10] In 1984 the Twelfth Biennial Convention of the Lutheran Church in America, a predecessor body to the Evangelical Lutheran Church in America, approved a statement on peace which said: "we

---

[9]Oppenheimer along with Szilard and Bohr in their own respective ways defended the sharing of scientific knowledge even amidst the pressures of making war decisions. They believed that the U.S. could not maintain a monopoly on nuclear knowledge and that other nations, especially the U.S.S.R., would soon catch up. They could foresee an arms race. So, they argued for a preemptive sharing of knowledge with the U.S.S.R. to help reduce suspicion and competition (Rhodes, 1988:529-538; 620; 644).

[10]Along with church leaders, many scientists have engaged in public protests against flirting with the nuclear threat. The March 4th Movement, begun on that date in 1969 at the Massachusetts Institute of Technology, initially focused on the Vietnam war but then expanded to express concern toward general abuses of science and technology. This led to the formation of two groups dedicated to confronting the responsibilities of scientists in the weapons industry, the Union of Concerned Scients and Science for the People. The task here, says Robert Jay Lifton, is "to separate science from scientism and technology from technocism," and to break the collusion between the scientists "with the nuclear deity--so that they can reconstitute themselves into an open brotherhood and sisterhood committed to the survival and growth of human beings." (Lifton, 169).

declare without equivocation that nuclear war, with its catastrophic devastation of the earth, is contrary to the good and gracious will of God for the creation" (LCA, 1984:5).[11] Given this global repudiation of nuclear war, we need to ask what *this* means for research scientists employed by the government sponsored weapons industry.

When we take a look at what our church leaders have been saying specifically about deterrence and its relationship to the threat of nuclear war, certain implications for scientists working in the weapons industry can be dimly discerned. These implications are not always drawn out. But the logic, I think, is identifiable. It goes like this:

What is said:

On the basis of both the pacifist and just war traditions, it would be immoral to engage in strategic nuclear war under any conditions, even in self-defense.

If we on our side should declare never to use a nuclear weapon under any condition, then we would no longer pose a nuclear threat to our enemy.

If we are no longer a nuclear threat to our enemy, then we must give up on (or at best, give only conditional approval of) the policy of deterrence.

What is not usually said yet seemingly implied:

If we commit ourselves never to employ a strategic nuclear weapon and thereby abandonthe policy of deterrence, then we would no longer need scientific researchers who are trying to improve on these weapons.

Or, as a corollary, engaging in such scientific research would itself be immoral.

The logic hinges on the acceptability or unacceptability of the policy of deterrence. Let me cite a couple of examples.

On May 3, 1983 the National Conference of Catholic Bishops issued its controversial *Pastoral Letter on War and Peace*. First, it condemns totally any strategic use of nuclear weapons against population centers because such use would kill millions of innocent people.

---

[11]Although the LCA social statement covers many aspects of the nuclear threat, it does not directly speak to the role played by scientists engaged in weapons research. Neither does a corresponding statement in 1982 by the Eleventh General Convention of The American Lutheran Church, "Mandate for Peacemaking." The closest it comes is to say that "the ALC encourage exploration of economic conversion in regions dependent on defense-related industries" (ALC,1982).

> Under no circumstances may nuclear weapons or other instruments of mass slaughter be used for the purpose of destroying population centers or other predominantly civilian targets (NCCB, 1983:vi).

What the bishops oppose here is "total war." More specifically, it is opposition to nuclear weapons for strategic warfare on the grounds of the just war theory regarding proportionality, according to which the damage to be inflicted must be proportionate to the good expected by taking up arms. Because of the massive destructiveness of today's weapons, no proportional goqd could possibly emerge from their use. The opposition is based in addition on the principle of discrimmination, according to which we should discrimminate between combatants and non-combatants. Thus the bishops may be silently approving of the tactical use of nuclear weapons directed solely at combatants, but the strategic use is clearly condemned.

> Response to aggression must not exceed the nature of the aggression. To destroy civilization as we know it by waging a "total war" as today it *could* be waged would be a mostrously disproportionate response to aggression on the part of any nation....To wage truly "total" war is by definition to take huge numbers of innocent lives. Just response to aggression must be discrimminate; it must be directed against unjust aggressors, not against innocent people caught up in a war not of their own making (NCCB, 1983:79).[12]

What this leads to is "a strictly conditional moral acceptance of nuclear deterrence."[13] Insofar as deterrence actually functions to prevent the outbreak of war, the bishops can accept it. But insofar as it functions to encourage the arms race with its ever increasing

---

[12]The problem with an outright endorsement of tactical use of nuclear weapons is that innocent civilians in the vicinity would get caught up in the conflagration. The U.S. has named 60 military targets within the city limits of Moscow alone. Thus, "even with attacks limited to 'military' targets, the number of deaths in a substantial exchange would be almost indistinguishable from what might occur if civilian centers had been deliberately and directly struck" (NCCB, 1983:78).

[13]Ibid., p.79. 'Deterrence' is defined as "dissuasion of a potential adversary from initiating an attack of conflict, often by the threat of unacceptable retaliatory damage." Ibid., p.69. The Lutherans add a risk calculus and a principle of reciprocity to the concept of deterrence, saying: "it is of vital importance for the near future that nuclear deterrence be stabilized at the lowest possible level of risk. Such stabilization requires the political recognition by both parties of the reciprocity of the deterrence situation. Reciprocity means that what is to be deterred is not only the other's capacity for aggression, but also one's own. Each side must restrain its own capacity for aggression to the satisfaction of the other." "Peace and Politics," p.7.

refinement and stockpiling of weapons of destruction, they reject it. Or, more precisely, they view deterrence as an interim strategy for peace in a time when there exists no international authority strong enough to defuse international hostilities.

> The moral duty today is to prevent nuclear war from ever occurring *and* to protect and preserve those key values of justice, freedom, and independence which are necessary for personal dignity and national integrity. In reference to these issues, Pope John Paul II judges that deterrence may still be judged morally acceptable, "certainly not as an end in itself but as a step on the way toward a progressive disarmament" (NCCB, 1983:74f).

Now, in light of this wholesale rejection of strategic nuclear warfare and partial rejection of deterrence as national policy, what do the bishops say about scientists and others working in the defense industries? Not much. They leave professional, financial, and moral choices up to the individual. They "recognize the possibility of diverse concrete judgments being made in this complex area" (NCCB,1983:129). To the sceintists specifically, the bishops write:

> We appreciate the efforts of scientists...Modern history is not lacking scientists who have looked back with deep remorse on the development of weapons to which they contributed, sometimes with the highest motivation, even believing that they were creating weapons that would render all other weapons obsolete and convince the world of the unthinkableness of war. Such efforts have ever proved illusory. Surely, equivalent dedication of scientific minds to reverse current trends and to pursue concepts as bold and adventuresome in favor of peace as those which in the past have magnified the risks of war could result in dramatic benefits for all of humanity (NCCB, 1983:130).

One might have expected more from the bishops. Given the premises of the argument, it would seem to follow that it would be morally unacceptable for scientists to continue to refine nuclear weapons if such refinement has potential for going beyond the temporary need for deterrence. But the bishops stop short of rendering such a judgment, turning moral responsibility over to the scientists themselves.

In 1986 the United Methodist Council of Bishops followed with a similar statement with similar arguments. But rather than embrace conditional acceptance of deterrence, they totally repudiate it. The logic seems to be that if we commit ourselves to avoid using

nuclear weapons, then we have no ground for threatening their use through a policy of deterrence. In addition, the Methodist bishops accuse the American establishment of idolatry on the grounds that we place our trust in weapons instead of in God. Deterrence equals idolatry.

> Deterrence has too long been reverenced as the unquestioned idol of national security. It has become an ideology of conformity too frequently invoked to disparage dissent and to dismiss any alternative foreign policy proposals...Our vulnerability is mutual. Our security must be mutual....Deterrence must no longer receive the churches' blessing, even as a temporary warrant for the maintenance of nuclear weapons (UMCB, 1986:46;48).

With regard to specific implications for scientists who engage in weapons research and manufacturing, the advise of the Methodists parallels that of the Roman Catholics.

> We know that scientists, engineers, and other workers in defense industries face difficult questions of conscience. We want our churches to help such persons confront these questions ethically; we urge the churches to provide a supporting fellowship for such persons in whatever vocational choices they make (UMCB, 1986:87).

Now, after having condemned the whole of society for a national idolatry, one might have expected something more specific to be said regarding the contribution of scientists to deterrence. Yet, both groups of bishops appeal finally to the individual conscience of the scientist in question rather than to the same broad principles appealed to earlier.

Having discussed these church pronouncements with chemists, physicists, and engineers working in the weapons industry, I offer some preliminary and as yet informal observations. I note three reactions among scientists who are committed members of Christian congregations. Some scientists are willing simply to ignore what church spokespersons say about such matters. Another group is willing to reject what church leaders say on the grounds that--in the words of one woman chemist--"they just don't know what they're talking about. They are such asses they don't deserve the waste of our energy." A third group pines pathetically that they have been betrayed. In the words of a plasma physicist: "it hurts to think that our own church leaders consider us as contributors to national idolatry."

What is needed here, I think, is a couple of things. First, church leaders need to investigate the situation to find out just what our scientists are thinking and feeling. Second, we need to examine our pastoral responsibility toward the scientists among us. I wonder if the strength of our prophetic pronouncements regarding God's will for world peace might have so focused our vision that the pastoral needs of this important group of people may have escaped our purview.

CONCLUSION

The coming decade could be an exciting one. If we remain on the present trajectory, we will find more and more conversations taking place between natural scientists and Christian theologians. The mood will be one of genuine openness, characterized by the free play of imaginations that wish to explore new frontiers. Creative opportunities abound. Unless this movement is cut short by a sudden return to rigidity by church theologians or a similar return to rejection of religion by the scientific milieu, we may soon wake up to some new and exciting convergences of thought.

On another front--the relationship between the prophetic and pastoral responsibilities of the church--I believe we need to examine a bit more closely the nature of the present situation. Perhaps the current dismantling of the Soviet empire and the declaration by Mikhail Gorbachev that the cold war is over will permit us a brief interlude in which to make some reassessments. The nuclear crisis is by no means over. It remains the single most potent threat to human and natural existence on the planet. Yet the factors that define the crisis may be undergoing a shift. During this period of shifting, we will have to readjust our prophetic posture. This may give us as well an opportunity to readjust our pastoral posture; and the church's relationship to the scientists within and without should be on this agenda.

REFERENCES

ALC

1982 "Mandate for Peacemaking." The American Lutheran Church.

Barrow, John

1986 with Frank Tipler, *The Anthropic Cosmological Principle*. New York: Oxford University Press.

Boslough, John

1985 *Stephen Hawking's Universe*. New York: Quill/William Morrow.

Clark, Ronald W.

1971 *Einstein*. New York: Avon.

Davies, Paul

1983 *God and the New Physics*. New York: Simon and Schuster.

Dyson, Freeman

1979 *Disturbing the Universe*. New York: Harper & Row.

Hawking, Stephen

1988 *A Brief History of Time From the Big Bang to Black Holes*. New York: Bantam.

Jastrow, Robert

1978 *God and the Astronomers*. New York: W.W. Norton.

Jaki, Stanley L.

1987"Science: From the Womb of Religion" *The Christian Century* 104:28 (October 7)

Lifton, Robert Jay

1987 *The Future of Immortality and Other Essays for a Nuclear Age*. New York: Basic Books, Inc.

LCA

1984 "Peace and Politics," Division for Mission in North America, Lutheran Church in America.

Mangum, John M.

1989 ed., *The New Faith-Science Debate*. Geneva: WCC & Philadelphia: Fortress.

NCCB

1983 *The Challenge of Peace: A Pastoral Letter by the National Conference of Catholic Bishops*. Washington, DC: United States Catholic Conference.

Pannenberg, Wolfhart

1970-71 *Basic Questions in Theology*. 2 Volumes: Philadelphia: Fortress Press.

Peters, Ted

1988 "The Scientists Among Us," *Lutheran Partners*, IV:5 (September-October 1988) 18-22.

1989 ed., *Cosmos as Creation: Theology and Science in Consonance*. Nashville: Abingdon.

Polkinghorne, John

1986 *One World: The Interaction of Science and Theology*. Princeton: Princeton University Press.

Prigogine, Ilya and Isabelle Stengers

1984 *Order Out of Chaos*. New York: Bantam.

Rhodes, Richard

1988 *The Making of the Atomic Bomb*. New York: Simon and Schuster.

Russell, Robert

1988 with William R. Stoeger, S.J. and George V. Coyne, S.J., *Physics, Philosophy, and Theology: A Common Quest for Understanding*. Notre Dame, IN: University of Notre Dame.

Shell, Jonathan

1982 *The Fate of the Earth*. New York: Alfred A. Knopf.

UMCB

1986 *In Defense of Creation: The Nuclear Crisis and a Just Peace*, by the United Methodist Council of Bishops. Nashville: Graded Press.

Vonnegut, Kurt

1963 *Cat's Cradle*. New York: Dell.

Weizsäcker, C.F. von

1959 *The History of Nature*. Chicago: University of Chicago Press.