



Science/Technology Education in Church-Related Colleges and Universities

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Session 2: General Discussion

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Session 2: General Discussion

FORD (NY): I was asked by Fr. Brungs to do this study in a discussion that we had about a 1988 paper of mine dealing with the future of Catholic universities and the issue of our moving into the AAU classification. I extended the results of that discussion into my scientific community at New York Medical College and I've had conversations, similar to those I've had here, on the condition of undergraduate science as well as what we receive in the graduate and the professional schools in terms of the skills and the attitudes that the students bring to us.

You can see that I view this as an educator, and my recommendations need not be repeated at this point. There are four recommendations in the paper. Basically they work off the premise that we have a wonderful challenge and opportunity in the church-related college to establish yet again in some format, which respects the character of each of our institutions, an approach to bringing the scientist, the theologian, the technologist, and the philosopher together.

This is neither the time nor place for me to give you my point of view. I have a very strong view based on having developed graduate and undergraduate programs as an administrator in several institutions. I have gone through the process of trying to pull disciplines together, trying to pull together scholars with different perspectives on the nature of reality, with different languages and different mindsets. You all know the anecdotes of what happens when you put a theologian or a physicist together or a biologist and a philosopher.

I believe Fr. Brungs mentioned playing with toys. That's a good symbolic introduction to the subject. We have to overcome both the mystery and the toy. Maybe that's the theme of our comments. We have to begin to put those two perspectives together. We have to put our cards on the table as scholars and agree to find common ground for looking at the ways in which we educate our next generation of church-related college students, graduates, future professionals, clergy and citizens to address the opportunities and problems that are generated in the rapid advances in science and technology. Someone observed that these drive theology and philosophy for our generation.

Now as to the study. I went to Peterson's Guide. I think we're all in the wrong place. We should be with Peterson's, the *Chronicle* or *New York Times* because that's what makes money on higher education. But Peterson's Guide sold me the list of the church-related institutions that have so labeled themselves in the United States; that's 794 institutions, 1,215 departments of -- I used again discussion with my colleagues and Fr. Brungs -- biology, chemistry, physics, and natural sciences. That probably could be expanded for the next study, if there is one. It could probably take a different approach.

Being a New Yorker with a mean twist, I threw in all of the New York state institutions of higher learning that we all know were founded under religious auspices. So I have a folder here of comments and letters. Some of the letters are precious in themselves in their denial. Since there is no St. Augustine's College in New York, I can say very directly that the chairman of the biology department of St. Augustine's College in New York absolutely denies that there was ever any conceivable possible relationship to a church, a theological tenet, a parable, or a position. Didn't this man called dean down in Valhalla know that they founded in the tradition of Jefferson? How they got the name St. Augustine's, I don't know.

Denominationally, there were 28 -- I didn't put this in the report. One hundred and twenty-seven of the respondents omitted any reference. But there were 77 Catholic, 16 Baptist, 16 Presbyterian, 18 Lutheran, 26 Methodist of six varieties, four United Church of Christ, four Disciples of Christ, four Episcopalian, three Mormons, three Nazarene, three Brethren, three Calvinist, three Assemblies of God, two Religious Society of Friends, two Seventh Day Adventist, one Christian, one independent Protestant, two Churches of Christ, and one Seven Feeder Denomination. I think Seven Feeder Denomination is Loma Linda. I didn't try to summarize all of the institutions. I deliberately did not put that into the study. I indicated also that I had a very good national distribution. I think I've covered every state. But I didn't think that was important so I didn't list the numbers of New Yorkers and Minnesotans and so on.

I was disappointed by the percentage of response, 24.7. But as I said in the comments here and in my letter to Fr. Brungs, I was very pleased with the responses to the essay questions. I brought all of those with me including the letters -- and one has to have a thick hide -- including the letters that tell me -- and how many graduate deans are in the room -- we all are absolutely out of touch with reality to ask such a question. You can look at this folder if you want to. You'll find some very fascinating examples of how some of our colleges have addressed quite vigorously with good open spirits and open minds the problem of keeping philosophy, theology, science, technology related in the curriculum and therefore in all of the undergraduate educational experience.

Thus my summary of the study, the arithmetic notwithstanding, speaks for itself for what it's worth. I see no point in debating whether people are happy with their resources or not, but I think we should talk about what the undergraduates bring to the enterprise. I deliberately highlighted the scale of the knowledge of sci/tech issues, ranging all the way from tropical rain forests through AIDS and drugs. You'll see what's closer to home gets the highest level of response.

The other very interesting point, as you saw in some of the essays and in the gamut of limited numbers, is the strong conviction that there was no room for the two views of reality to come together and that the scientists had better head in this direction and the philosophers and theologians better head in that direction. I think that that's very important and very critical to our discussion.

BUNDSCHUH: The College of Arts and Sciences at Saint Louis University is 171 years old. I'm the third non-Jesuit to be dean. I'm the first scientist ever to be dean. If I might use the words of Fr. Panuska from last night when he said that his mere presence at Emory had an effect, sometimes I feel that being a scientist as the dean at Saint Louis University has its effect. I'm going to make three points and then elaborate.

First, I don't believe in two cultures, or at least I don't believe in using two cultures as an excuse for the fact that humanities faculty and science faculty can't speak or get along or do meaningful things together. There may have been a time when that was more the case than it is now, and there are several reasons why that can't be used as a crutch in today's university.

One of them is the fact that computing has become so well used by everyone on campus. The humanities faculty jumped on computers even faster than the science faculty. Once they found out that you could put a footnote on a paper without measuring with a ruler, computing went critical. I've never seen training sessions for secretaries more effective than simply showing them how WordPerfect could perform this simple task -- simple by WordPerfect standards, but not so simple if you were typing on an old correcting IBM. Humanities faculty talk about megabytes, hard disks and storage capacity. I know theologians with the Bible on their hard disks. They access, network and they do everything that the scientists do. So there's a common language. That's something we might talk about, computer language across the curriculum.

Also, we're in an era where interdisciplinarity has become integrative. The word interdisciplinary has been replaced by the word integrated. Everyone in this country wants to see an integrated curriculum. Interdisciplinarity has some bad connotations, particularly to the scientists, because it came to us as meaning weak or watered down. We're more likely to accept the word integrated. First of all, it sounds like calculus, doesn't it?

Secondly, it means that we don't have give up any lectures to a philosopher. It doesn't mean that we have to participate in a team and make up texts. Integrated has become a very important term in our thinking.

Saint Louis University has just created a mission statement, and here's the longest sentence you've ever heard in a mission statement. This could have been written by a German author. It's a lofty statement, but let's not turn our backs on it as scientists because it's quite meaningful if you think about it. Oftentimes we scientists have turned our backs on mission statements. As long as the mission statement doesn't say "throw the sciences out of the curriculum," we'll let the philosophers have what they want. This was written by a philosopher. I'm going to read it, so bear with me.

“The university’s undergraduate curriculum makes use of the resources of humanities, social sciences, natural sciences, and technology in a unified effort to challenge students to make appropriate use of what each area has to offer, enabling them to understand themselves, their world, and God to prepare intellectually and professionally for the career of their choice and to make critically informed moral judgments.” That’s a mission statement in itself. I think we should take it seriously and not merely say, “Well, there’s nothing offensive. Fine, it’s a great mission statement.”

As scientists we have to play a more active, aggressive role in curriculum and in this process that we call integrating. Integrating means that we try to understand what other people are doing, to make them understand what we’re doing and try to build some sense of things across the curriculum. I’m a strong proponent of that.

I’ve also been inspired this past year by a speech by Fr. Peter Hans Kolvenbach, the general of the Jesuits, who spoke to us at Georgetown. I was quite moved by his talk. He talks about integration as well, but he doesn’t use the word. He uses the word interdisciplinary, but what he’s really talking about is what we think of as integration these days. I was a bit disturbed when he said “even the hard sciences.” Even the hard sciences! I’m worried about “even the hard sciences,” and I think we ought to be careful about that and not let people get by with that. The rest of the talk was magnificent, but I worry about phrases like “even the hard sciences.”

Secondly, there is an administrative difference between the humanities (social sciences) and the sciences; it’s one of the resources. If there’s a difference between the business school and the college of arts and sciences we’re willing, or at least presidents seem to be willing to accept the difference in salaries, the market driven salaries in business and the AACSB. There’s a difference in the resources between humanities and the sciences. But we simply can’t sit back as scientists and say, “Well, we can’t do research. We can’t do this because we don’t have an accelerator,” and all this sort of thing. We can get major pieces of equipment from the National Science Foundation. We have to try and we continue to try to do that. But I don’t think we take enough advantage of the national laboratories. Argonne Labs has a high energy proton source with, I think, 70 beams with 70 different experiments going on at the same time. Fermi Lab isn’t far away. You can be a high energy physicist and be at a small college. You can work out arrangements to do some of your experiments at Fermi Lab or at Argonne or wherever. Sometimes you can even get on line when you’re not present. Getting on line now is much easier than getting on an airplane.

Nevertheless, sometimes presidents take more pleasure in rebuilding a sidewalk than they do in buying 20 microscopes for the biology laboratory. We have continually to make the point that indeed science requires resources. The good news is that solid state equipment stays around a lot longer. Solid state equipment is easier to use. You can store data and compare that data with dictionaries. The emphasis isn’t as much on sample preparation as it was when I was a student. So some of the art has been removed. We’re entering a new era with respect to equipment and instrumentation. At Saint Louis University this week we were notified by the National Science Foundation that we’re going to get a 300 megahertz NMR. I did my dissertation on NMR. It’s a shame because it makes anything I ever did look very trivial. I’m embarrassed to tell an undergraduate what I actually did because they can sit at a terminal now and never even see a magnet. They just push a few keys and do 20,000 times what I did over a period of four years.

The third point is a reflection on what I heard last night. My colleague Charles Ford (St. Louis) asked why there aren’t church-related schools in the top 100 research universities in the country. Let me approach an answer historically. When I first came to Saint Louis University as dean, someone gave me a tape of a movie that was made in the mid-1960s. It was narrated by Jack Buck and he talked about Saint Louis University emerging as a world class university. We had a Nobel Prize winner, Doisy, who did his work at Saint Louis University. There was every reason we would emerge as a world class university. We had 75 doctoral students in physics. We had an engineering school, we had a well known medical school and doctoral programs in all the sciences; we sustained the Jesuit tradition of being very strong in geophysics. We were also a member of Argonne Universities Association which was part of a tripartite operation that ran Argonne National Laboratories-the University of

Chicago, AUAN, and AEC at that time. We were there with the Big 10 universities.

When the 1970s hit, there were tremendous budget cutbacks, particularly by the federal government. The federal grants dried up. We pulled back to our strength. That meant pulling back to our strength in the humanities. Many of the science programs were cut and the school of engineering was closed. By the late 1970s, along with many church-related universities and colleges, we began to secularize -- and I use that word very carefully. To a certain extent, we began to apologize for our church-relatedness. In the 1980s, as an institution of higher learning, we began to emerge again. We found out that our constituency didn't want to secularize Saint Louis University. They wanted a Catholic Jesuit university; that's what we are now. That's what we said in our mission statement, and that's what we hope to be in the future.

It's going to be difficult to rebuild the sciences and we will never rebuild, at least in my lifetime, a doctoral program in physics. We've always been very strong in pre-medicine and in undergraduate research, but it's going to be very difficult to rebuild. Maybe we shouldn't rebuild all these doctoral programs in the sciences. I merely offer you a historical perspective.

BERTRAM: There are two cultures. One of the gaps is between a theologian who announces that the next speaker will speak for five minutes and the speaker, a chemist, who transposes that by some mathematical magic I don't understand into 20 minutes. But it was worth every minute of it.

CONNELL: I come from the other Catholic institution of higher education in the St. Louis area. Only Saint Louis University and Fontbonne claim to be Catholic. I've been through a lot of the things that Dr. Bundschuh mentioned. I've been through the years of interdisciplinary teaching. I was influenced early on in my higher education, even while I was teaching in high school and going to Notre Dame summers, by the work of Teilhard. At Fontbonne in the late '60s, when Dr. Ford (NY) was part of our administration, we had a course on Teilhard with a philosopher, a theologian and myself. We had hardly gotten this course underway when we had calls from the chancery about why we were teaching this kind of a course and who was teaching it. Somehow or other, it went on and we did it for quite a few years.

The budget cuts and things that happened in the 70s cut down on what we could do. We could no longer justify having three people to teach a course. The Teilhard course went by the way. Two of us taught bioethics and then I found myself doing it alone. So I've lived through the kinds of changes that occurred.

I've also lived through the creative ideas that people like Dr. Ford got us to do. We didn't have then what I would term rather collaboration than integration, because we could not get three departments to work together. I see collaboration as the thing that could bring people together either on a campus or across campuses. Saint Louis U. may never have a physics department with 75 doctoral students, but maybe in this day and age Saint Louis U. and Washington U. can begin to do some things together because I don't think Washington U. has 75 doctoral students but they do have some. I'm talking about a local kind of situation.

I think that to some extent the two cultures still exist. I don't find it as much with the theologians and the philosophers as I find it with the people in literature and languages and even people in social studies. We must try, computers aside, to get across what science is about and why one should have at least a minimal education in science.

The other thing that I stressed pretty heavily in my paper was that we have a lot of freedom. I think that's true and it's been true for a long time. I first realized at a meeting at Southern Illinois University at Carbondale many years ago. Father Reis and I were the only two people from private institutions. It's been a while since Fr. Reis was the chairman of the department of biology at St. Louis U. But we were the only two people who had any freedom about our curriculum. Everybody else came from a public institution and they were told what they had to teach. We could create a course and do all kinds of things, with some control and also a lot of leeway.

While I was working on this paper, we were in the process of hiring a new faculty person. In one day we interviewed four people. One was anxious to move from the institution in which he teaches because he was being rather subtly persecuted in this institution. It was a very fundamentalist denomination controlling that institution. I had not experienced that before. The people I associated with were biology teachers who had gotten the liberal arts tradition in the midwest and were primarily either Catholic or Lutheran or had lost whatever religious affiliation they had once had. As Lindenwood College states: they come out of the Presbyterian tradition but they no longer have anything to do with the Presbyterian church. But this really struck me.

Another was a young man who, brought up as a Catholic and graduated from a Catholic university, had joined a fundamentalist religion. I asked: "Well, if you didn't just teach anatomy and physiology, if next year the schedule was changed and you had to teach general biology, what would you do about evolution?" He said, "I don't know," because he really is very much into creationism. Yet I know he was not taught that kind of thing as an undergraduate.

One last item! In the spring of 1988 in *Liberal Education* there was a whole series of articles on creative science teaching. All but one of the schools represented were church-related liberal arts institutions. They were the ones which were arguing about and doing the creative kinds of things.

BURCH: As I was writing this paper I was impressed by the problems we face as people who know more than one model. Being scientists we tend to think and talk about models. In our schools we teach two kinds of students. We have students who take science as a core curriculum requirement, and students who are preparing to be professional scientists. In the social area we talk with people concerned with things like environmental problems. We speak with people in the church. In all three situations we are dealing with people who, on the one hand, have very little skill and knowledge about science and, on the other hand, with skilled scientists who perhaps have little dealing with the more liberal disciplines, or with co-religionists, or with those who have concerns about the environment, or with other activists and politicians. And in all these cases those of us who are familiar with more than one set of models have a tremendous opportunity and obligation to help the people on both sides.

It was mentioned last night that truth is truth. There is one truth, and we see different parts of it in various perspectives. All of the different disciplines, all the different perspectives should be complementary. They should not contradict each other. Nonetheless, they come from very different directions. I tried to concentrate on two models that were perhaps as far apart as I could get. The one set of models would be the models by which we live. It has an urgency to it, it must be complete for us to live and die. It will answer questions like the meaning of the world, its intelligibility, where we fit in it. The other is the scientific model which asks questions about the world, concentrating on how best to describe this or that, the relationships between the parts, and even how nature can be manipulated to give us a technology.

There is no reason why these things should clash. It's very difficult, however, to talk about them so that they do not clash, unless we keep our models very clear in our own mind, and unless we are able to explain the difference between the two sets of models to others.

Again let me go to extremes to describe the two types of students we face in the classroom. One is the student who is there to meet a core requirement. Though not all, they come from an elementary and a secondary school where they either did not have the opportunity to take a scientific curriculum or where they could easily avoid it. They come without the basic mathematics, the basic vocabulary, or the elementary introduction to scientific thought. Many of them have very unrealistic ideas about what someone else can do for them through science and technology. If their immediate problems are not solved right away, they are likely to attribute this to some corrupt suppression of knowledge. They are badly in need of a great deal of remedial work, if they are ever to do anything approaching a real science. At the same time, they need science on a rather high level -- that is the understanding of what a scientific model is, how a scientist uses it, what it may be reasonably expected to produce -- so that they may understand enough science in order to integrate it into their own social and religious model.

On the other hand, we are dealing with students who intend to be professional scientists. They will leave our program as very, very sophisticated technical people. For them the danger is that an inadequate or poorly integrated core curriculum will leave them with social and religious models that are far less sophisticated than their scientific model. They too will have a problem trying to integrate their science with their social concerns, philosophy or religion.

In the political arena, it is much the same. There is a group of people very concerned with, for instance, acid rain and the greenhouse effect. They are very unsatisfied with the answers they get from scientists which often honestly are: "At the present time more data is needed before we can give you an honest evaluation of the effects of what you want to do." The scientists in this area sometimes confuse their own scientific models and social models and they are not clear in interpreting for others what they are saying and where they're coming from.

I would note here that the federal government is and will enforce a certain integration between the scientific models and the models that government has of social and civil concerns. You only need to mention the various committees and various policies a university must have if it is going to get federal funds -- animal care, radiation safety, biological hazards, human subjects, misconduct, and scholarship and, very soon, conflict of interest.

In the religious arena, history has taught us that science and religion interact often unfortunately when they do not understand each other. It is clear that questions of the meaning of the human being, the human mind, the universe, of how a human should behave towards other humans or towards the world around him or her are going to be greatly influenced by science. There's a danger that the church will abdicate its right to debate these questions in a broad forum. It's our responsibility to see that this does not happen. If the church is going to have an input into science, it must be through the Catholic colleges. If other religions are going to have this input, it must be through their colleges.

This is where the church, the bishops, the clergy, and the nonscientific laity will find out about science. We can instruct. We can help prevent bad mistakes or great surprises. We have a great potential and an equally great responsibility to try to get people to understand the two different kinds of thought and the models that they come from.

SEIBERT: Since Sr. Virginia (Orna) and I wrote this as a Huntley-Brinkley attempt, we're going to try to make a presentation in that way. So we may interrupt one another. I'll begin. I have been a member of ITEST almost from the beginning. I attended very conscientiously a conference a year until about 12 years ago. I'm back now for the first time since then. I'd like to point out the timeliness of this particular conference. I've always noted that ITEST seems to be a step ahead of many organizations, and I wanted to congratulate the planners and Fr. Brungs for calling this group together. I am delighted to have been able to be present as a kind of retired scientist.

ORNA: We've heard a lot, even in the very short time that we've been meeting, about limited resources. We've heard a lot about limited budgetary resources. What I hear coming forth from this group now is limited personnel resources.

I question whether we want to imitate the large research institutions. Or should we set a goal for this meeting and maybe for future ITEST meetings, namely, looking at our own particular goals with respect to our particular brand of science education? I do not mean that we would pursue a "lesser" science, but that we would pay attention, as we said last night, to the undergraduate curriculum, that we would pay particular attention to the research component of that undergraduate curriculum. There are some other things that we might be able to do even better than the large research institutions. For example, we could pay attention to values education; we could teach our students to wonder, teach our students the way to conduct themselves to honor the humanity of other persons.

Then the question becomes how we do this on a practical level. How do we translate these efforts into our courses and discussions? How do we permeate our curriculum with some of these goals? I would submit that we can't do it with just one course. We simply can't say, "Oh, we're going to have a science and technology and values course in order to do this." Our challenge is to see how this can permeate the entire curriculum.

I've had some limited experience in this area with my work in science and art. I have worked very closely with our art department and tried to integrate chemistry and art in the curriculum. I found, in doing this over the past ten years, that scientists across the board are very interested in doing this kind of integration, but I have not received very much response from the artistic community. We have a great deal of work to do. We have a great deal of education to undertake with respect to integrating with the humanities people on our own campuses.

I feel stretched to the limit in what I am being asked to do on my own campus. I'm confident that you have the same feeling. If you're scientists, you have to do your science. You also have to integrate and interface with many other areas on your campus. We say one thing in many instances on our own campuses and end up doing something else. I'm caught in the crunch there. Let me say, maybe with a little bit of shame, that I'm the chair of the Division of Natural Sciences and Math at the College of New Rochelle. That includes biology, chemistry, physics, math, and computer science. The biology faculty is pressing me to start a new course in the philosophy of science as a required course for biology majors. Perhaps to my shame, I'm trying to keep that at a low level because we cannot, for budgetary reasons, proliferate courses and have low enrollments.

I'm caught in these administrative binds which have to be solved in some other way; I think that's a great challenge. It's not something we can shy away from. We must try to look at this challenge and be creative about the ways we solve these problems.

Also, I'm interested in and working very closely with a new project that has just been funded by the National Science Foundation called Chemsources. Chemsources is going to be a resource for chemistry high school teachers who are under-prepared or who are cross-over teachers. That makes up about 85% of the present high school chemistry teachers in the country. One of the things that we're going to try to work into this is values education. I'm going to push for this particular component in those resources. I would also predict that, if we do our job right, this resource will be used by high school teachers and by introductory college chemistry professors. Much of the curriculum or materials that are developed by the Division of Chemical Education for high school is actually cross-over material that helps one get into the college curriculum as well. I plan to try to be at the forefront of that kind of thrust and I'd be very happy to have any of you interact with me in that regard.

SEIBERT: I want to add one more point to the last one just made. Very modestly, Sister did not mention that she wrote the grant for this and was awarded a million dollar contract through the College of New Rochelle to do this work with universities all over the country.

I have been interested in the philosophy and theology of science for many years. Twenty years ago I complained that the church was far behind in doing anything about this. I've heard this complaint often. Now we are getting closer to being more with it. Some of the indications are the existence of ITEST which has been involved for a long time and the Pope John XXIII Medical Moral Research Center in Braintree, Massachusetts. I've just spent ten months there doing research in medical ethics. This particular organization, for example, sponsors a week long conference every year for the bishops from the United States, Canada, the Philippines, and the Antilles. This is a tremendous improvement to the thinking of the hierarchy of our country.

Despite the fact that many of us, including myself, think that at times our church is very conservative, I see a growth toward a common understanding. Pope John Paul II wrote to scientists in June of 1988. Some of the things that he said in that particular letter are tremendously important for us in terms of this country. Let me quote from that letter of Pope John Paul: "The significance of theology for humanity will be reflected in the theologian's ability to incorporate the findings of science." This is part of what we are trying to do here. I think the church is beginning to do more and I hope that this group can be used to help the church incorporate theology with the sciences.

I would like to mention one other indirectly related thing here. Many of you may not be familiar with it. Last year an organization came into life called the Brookland Mission. This is a mission formed by a group of women religious under a rather substantial grant from the Lilly Foundation to study the relationship of the intellectual

life and the spiritual life, particularly as it concerns Roman Catholic sisters in the United States at the turn of the century. I'm proud to be a member of that Commission. I think that the study that they are doing is going to help us understand not only what has been happening in this one narrow area of women religious in intellectual life, but also in what we can do to broaden that as we go into the future.

SKEHAN: Part of the paper that I presented on the role and importance of research and publication in church-related institutions has to do with things that we are already familiar with in detail. One of the things that I've been concerned with over the years is that the sciences and scientists have felt that they don't have much to contribute that is specific to a church-related institution. As a result they have, perhaps, lacked motivation that relates to activities in a church-related institution.

As I noted in my paper, I was at a symposium honoring my thesis director at Harvard. A number of people presented accolades on behalf of his scholarship and his teaching. He had not published extensively, and this was a bit of a problem throughout his career. But his few publications were important landmarks in the field. One of the speakers, a former student and a very distinguished researcher, pointed out that other speakers had correctly identified some of his outstanding characteristics but he felt that the most important characteristic of Professor Thompson's career was his integrity.

That means something to me because of an interest in the writings of Bernard Lonergan. I can't profess to be completely conversant in detail with Lonergan's writings, but I first became interested in Lonergan's writings through Harvey Egan who teaches mystical theology at Boston College. In his little book, *What Are They Saying about Mysticism?*, Egan, in referring to the mysticism of the future, links Lonergan's writings to it. He indicates that scientists and mystics have much in common. He relates that to integrity, to a fidelity to the transcendental precepts, namely, to be attentive, intelligent, reasonable, responsible and in love. Lonergan points out that in order for the theologian to be a top scholar he or she must not only be skilled as an academician but also has to have integrity in his or her life. In other words, he or she must relate what he or she is personally to what is going on in his or her scholarship.

This gets into the spirituality of scientific research and the whole scientific enterprise. In many respects, it relates very closely to what Teilhard de Chardin presents in his voluminous writings. Tom King, a Jesuit professor of theology at Georgetown, has written a couple of excellent books, one of which is *Teilhard's Mysticism of Knowing*. The real significance of Teilhard seems to be his claim that in the very act of scientific achievement the scientist knows God. I relate that back to the concept of integrity. While this isn't something that we teach necessarily or can give courses in, nevertheless, this whole theme has been so well enunciated by Lonergan, Egan and Gregson. I would recommend to those interested in following up on this Lonergan's *Spirituality and the Meeting of Religions*.

The document that was mentioned by Sr. Angelice, is a message to Fr. George Coyne by his Holiness. It is reproduced in *Physics, Philosophy, and Theology: A Common Quest for Understanding*. His Holiness stresses quite heavily that theologians, philosophers and scientists have much to gain from each other. His particular interest in developing new theological models that come out of scientific research is exceedingly important in the modern church, just as it was in the Middle Ages. He mentions, for instance, the concept of hylomorphism and its importance to understanding the Eucharist. He urges theologians, philosophers and scientists to get together and to develop new models that can serve as vehicles for further understanding of theology.

SHERMAN: This is a heady experience for someone in a secondary school to be in your august company. Sr. Loretta (Findysz) and I are the only two here who are teaching in secondary schools. If you want to find out how it is in a boys' school, talk to her. If you want to find out how it is in a girls' school, talk to me.

There are three points I want to make in regard to the short paper that I wrote. It is not meant to be complete.

First, you're going to get students in your colleges in the next few years who will have experiences in STS (Science, Technology, Society) programs. What are you going to do about it? Some of the things involved are

new chemistry curricula, such as chemistry in the community, usually called Chemcom. It emphasizes the values and the societal implications of chemistry. Also, there is a big emphasis on molecular engineering and genetic engineering now. You can't even consider that without considering its social implications.

There are a great many resources such as a thing called SIRS (Social Issues in Research) which covers all kinds of scientific issues such as earth science, life science, physical, medical, and applied science. These things are all available. They all have great values built into them. Each one of these issues has about 100 recent articles, and they're all in many high school libraries.

I also put down some suggestions since I'm not one to stand up and predict the future or criticize anybody without giving you some constructive suggestions. I made some suggestions there for how the colleges could continue to build upon what you're going to be getting in the future. The students will have some experiences, such as outreach in the communities, coalitions between industry and universities on one hand and between the universities and the high schools and/or grade schools on the other hand. That's very important. Then especially we must encourage women and minorities to go into science.

Finally, I subscribe to the Christopher philosophy that it's far better to light one candle than to stand around cursing the darkness, so I'll tell you some of the things that I've been involved in. One is to work with the Math Science network in St. Louis. It sponsors a large meeting every year. We invite young women who are role models in science and they meet with about 600 to 800 girls in grades 8 through 12 at an all day conference. They interact within small groups. They get to do some hands on experiments. We have very fine speakers such as young women from NASA or various places like that who come in to be our keynote speakers. This has been a very popular program here in St. Louis. It's also done many other places in the country.

I've also been involved in going out and doing chemistry shows for the grade schools. So far I have done over 80 shows. It's reached the point where I feel like a long running Broadway play. My main problem is to keep it sounding spontaneous and off the cuff. So I don't use a written script. I follow an outline and do different things. I have a whole set of overhead projections that we've made up. The first one has chemistry in the center, with a lot of different occupations radiating like the spokes on a wheel. Of course, you can't get all the various occupations in there, but I include a lot of them. I emphasize to the students that chemistry is absolutely basic to all these other sciences. I say: "If you haven't taken it in high school, kids, it's murder when you get to college." So I really push the idea that they must take some chemistry in high school. Additionally, it may be the only chance they'll have to take chemistry. So I really push that.

The last overhead says, "Chemistry is the key to understanding God's creation."

BRUNGS: Before you step down, may I ask you a question. What awards did you get in the past year?

SHERMAN: Well, the most recent one was a national award from the American Chemical Society in polymer education at the high school level. There were three national winners, and I was one of the three. It was very nice because they provided a free trip to Miami Beach for a week.

BRUNGS: I think we're in heady company.

BERTRAM: That was a fitting climax I would say to that section of luminaries. Thank you for setting her up for saying that.

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