INSTITUTE FOR THEOLOGICAL ENCOUNTER WITH SCIENCE AND TECHNOLOGY

BULLETIN

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I am confident that none on us need to be told that these are troubled times. It does not seem that we shall be using the term *Gay* to describe the last decade of this century.

Today's millennarists are to be found on all sides -- especially when the subject of the Middle East comes up. Armageddon is predicted every time there is even the hint of strife in that region. The sky is falling through the ozone hole. Apocalypse Now is the order of the literary day.

Science is losing its credibility in the welter of charges of fraud and falsification of data. Organized religion is rocked by scandals. Politicians are scurrying for cover and crime is on the increase. Terrorism stalks the world. Fear pervades our societies. In such a situation it is easy enough to see the end of the world. But is the world in any greater difficulty than it ever was?

Into this welter of confusion and fear comes the message: "He is risen!"

When I consider the apocalytic accent to a lot of current thought and expression, I am consoled by the fact that the Church continued to build churches and monasteries right through the decade of the 990's. I fully expect that we shall continue to build and to plan through the decade of the 1990's. After all, He has risen and He is still with us and He still goes before us. He has called us to serve Him, free from fear, all the days of our lives. He has told us that scandals will always be with us, that we shall hear of wars and rumors of wars. This decade should not be one of retreating into confusion and fear but of assessing the present and working for the future.

We should have learned before this that science is not our salvation nor is the behavior of the clergy. Jesus Christ, and Him crucified and risen, is the only one by whom we can be saved. We have known this and the decade of the '90s will call forth our belief and hope in Him.

He is Risen!

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ANNOUNCEMENTS

1. By the time you receive this issue of the ITEST Bulletin the dues-paid members should have received a copy of *The External Environment*, the Proceedings of the October, 1990 Workshop of the same title. We hope you like the new format we are using for the Proceedings. Surprisingly, this format is no more expensive than the old spiral-bound format we used in the past. The use of camera-ready copy and the price increase at the printer we used to patronize have made this new format economically feasible. Now if we could do something about postage. . . . We feel confident that you will find the contents informative. The Director had fun doing the formatting -- but then he always was weird.

2. The March, 1991 ITEST Workshop on *Some Christian and Jewish Perspectives on the Creation* was very well received by those present. We have sent the tapes of the meeting to the transcribers and we await the transcriptions. When we receive them we'll edit the discussions as quickly as we can and get the Proceedings to you. I would like to thank the essayists for their fine contributions to our understanding. I would especially thank Father Bryan Eyman for stepping in at the last moment to replace Dr. Kyriaki Fitzgerald.

3. The Board of Directors is actively considering topics for future meetings. At present some of the possibilities include a treatment of "technology out of control?" (maybe Oct., 1992), something on the media and perhaps a conference on beauty (perhaps during ITEST's 25th anniversary year in 1993). The Board would welcome any further suggestions for other topics or for essayists for the topics listed above. Our European membership in particular seems interested in the question of whether or not technology is out of control.

4. As has been stated often, the strength of ITEST and the foundation of its ability to help the Christian churches lies in its membership. Any increase in membership depends basically on each of you. We have observed over the years that membership gained from various kinds of advertizing is quite unstable while that gained through the personal "recruiting" of the membership is very solid. We should like to know the names and addresses of your friends and colleagues you deem would be interested in ITEST and its work. Better, you might mention ITEST to them. We can never have enough experience, wisdom and dedication to the Faith. May we be presumptuous to remind you of your baptismal obligation to be an apostle? Insofar as ITEST is a means, modest though it might be, of spreading Christianity, responding to the above request is a small step in fulfilling that obligation.

5. ITEST is a co-sponsor of a meeting on the Shroud of Turin that will be held at Saint Louis University, June, 21 - 23, 1991. If anyone is interested in this meeting, please contact Br. Joseph Marino, O.S.B., St. Louis Abbey, 500 S. Mason Rd., St. Louis, Mo. 63141/8500 for further details.

6. We began in the Winter, 1991 issue of the Bulletin to update the Membership Directory in each issue. As we noted then, no Membership Directory will be published in 1991 (entitled Membership Directory, 1992). These additions and changes of address can be removed from the Bulletin and saved -- there will be no other text from the Bulletin on these pages. We shall publish the next Membership Directory in the Fall of 1992.

Could we use the following description for faith/science work?

> Like a musician who has attuned his lyre, and by the artistic blending of low and high and medium tones produces a single melody, so the Wisdom of God, holding the universe like a lyre, adapting things heavenly to things earthly, and earthly things to heavenly, harmonizes them all, and, leading them by His will, makes one world and one world-order in beauty and harmony (*Contra Gentes*, 41, p. 26)

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A Jesuit Scientist in a State University
A Personal Reflection

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The usual justification for the work of a Jesuit priest in the field of the natural sciences is the presence of the Church in the scientific endeavor through him. This presence can be considered from a theoretical and a practical point of view. Let us examine each of these aspects separately.

1. The theory

The theoretical aspects of this problem can be stated in terms of the Church's presence in the world of science and science's presence in the Church. Both presences are necessary for many reasons. The first arises from an awareness that the modern world is broadly and deeply influenced by science. Since modern science rose in the 16th century, science and scientists have steadily increased their influence in the thoughts and lives of people. Today, science has become the court of last resort in issues that concern our society. What humankind thinks of the universe, of itself, of society, its present and future, is largely based on the results of science. Scientific knowledge is presented as the only objective knowledge and so the only knowledge that matters. Scientifically-based technology is the foundation of nearly all aspects of modern life. So, today's Church cannot be ignorant of or absent from the world of science if it wants to be faithful to Christ's mandate to preach the Gospel throughout the world.

We must also take into account the frequently uneasy relation between the Church and science over the last couple of centuries. The history of the conflicts in this relationship is well known. This has generated attitudes of distrust and suspicion in parts of the Church with regard to the progress of science. The troublesome aspects of the issues between science and faith, while formulated in different ways in each age, continue to be a factor at present. So-called scientific materialism that denies all transcendence is certainly a negative factor in the contemporary relationship between faith and science. In spite of modern Church pronouncements, there is still a popular feeling that science and religion are against each other. This makes an active presence of the Church in the scientific world more necessary than ever if we wish to dispel all suspicions.

This presence must have a double direction, allowing for a presence of science in the Church. The Church as an institution can tend to become self-sufficient in its own isolation. The Church's language is not easily understood by our contemporaries. Trained by the scientific method, scientists find the documents of the Church difficult, if not impossible, to understand. Many of our present important problems are created by the application of technological advances to human life. To discuss bioethics, ecology, the arms race, technological transfer and other problems, without a firm grasp of the underlying scientific questions, leads to a certain failure. It is clearly a task of Christian scientists to make the Church aware of the progress and limitations of today's science and technology as well as their implications for the welfare of society. Science must be present in the Church if the Church is not to lose the significance of its message in the contemporary world.

2. The Practice

The presence of the Church in the world of science must be achieved by the presence of its members in the scientific community. This will include laity, priests and religious. Since the task is important, nay critical, no one should be excluded. The more qualified the one who embodies this presence, the more efficacious his or her membership in the scientific community will be. This is specially true in reference to the inner quality of the person's Christian life. Let's consider a religious -- concretely a Jesuit -- working in science.

Where science is done today is a primary consideration. Excepting the applied aspects of science developed in industry, science is presently done primarily in universities and research institutes. The largest part of these, at least in Europe, are state institutions. Should a Jesuit work in such places? If he wants to be present in the scientific community, it is necessary for him to do so. But his doing so is not free of problems. State institu-

tions have their own rules and norms that may not be completely compatible with a truly religious life. This is specially true in the Jesuit's daily life, in teaching and research. Can we take part in the hard competitive work that frequently can create antagonisms with fellow researchers? Can publish or perish be the aim in the life of a Jesuit scientist? Can he dare to be different and still be considered a member of the scientific community?

Today, big science is dependent on big money. Unless a scientist is part of a large and important research group, his or her work will be of very little significance. Only purely theoretical work can be done without large funds. Large funds can only come from the state or large industries. Thus funding is almost always attached to political and industrial interests. Can a Jesuit devote a great part of his life working for such interests? If he is in a research group, he may end up dedicating most of his time to fund-raising and administration. Is raising money for a purely secular work, a proper occupation for a Jesuit? Securing large funds is not easy, as most of us know, and requires a large expenditure of time to establish links with the sources of money which are, in many instances, the political powers. Topics of research frequently are imposed, since only certain research projects are financed. This diminishes the independence of the research work. Is it justified to work on the projects that primarily interest certain political and industrial groups? This question is more serious when the funds come from military agencies. Can a Jesuit participate in programs that are tied at all to arms development? Indeed, how can a Jesuit scientist be sure that they are not? Research funds are often difficult to trace and one cannot be completely sure of what interests are promoting them.

Behind big money we customarily find big power. Science today is very closely linked to power. In fact, today's science is almost exclusively a possession of the First World. Political and economic power is exercised through the advancements in science and technology,. Only the most powerful nations of the world can afford the enormous expenses of modern science. For them scientific development is a source of power. It is difficult today to separate pure science from its technological applications which are closer to the exercise of power. In this association, scientists are sometimes considered to be naively manipulated by political power; at other times they are seen to be a part of the struggle for power and prestige. These days political power needs the scientific community to keep technological development advancing and scientists need political influence to ensure the financing of their very costly projects. Who benefits more from this association? Does political power benefit more? What is the role of a Jesuit scientist in this encounter? Can he keep himself distant from and uncontaminated by the temptations of power? May he by his work contribute to the expansion of power in the powerful nations with bad consequences to poorer ones?

The problem of money and power is present at a different level in the daily activity of teaching and research. Scientific peer recognition for many the main reward, since it is linked to prestige in the scientific community. The usual vehicles for this recognition are scientific publications. To publish first, and as a first author, can sometimes become a source of tension with coworkers. Is the ideal of evangelical poverty compatible with a continuous desire for public recognition? If our work is to be conceived in terms of service, should we not renounce many ordinary practices accepted in the scientific community? The problem of power at this everyday level crops up in our occupying positions of direction and control, on committees and boards which designate appointments and assignment research funds. Should we systematically renounce these positions? Can we do this without harming our co-workers and students who depend on us for their promotions? Even when we act in strict justice, this may be misunderstood by many and our Christian testimony may be viewed in a negative light. Is it possible, then, to live a life of humility and poverty in the public exercise of many of the activities of a scientist today?

3. Conclusions

Theoretically, the presence of the Church in the world of science is both desirable and necessary. This presence must be an active one in which Christian values are incarnated in the practice of scientific work. Those present in this work cannot appropriate many practices common in the scientific community which are incompatible with the demands of the following of Christ in poverty and humility which S. Ignatius demands of every Jesuit. The Jesuit presence in science must be an active witness to these Gospel values. If we are not different from any other scientist, what kind of a testimony are we giving? But can we afford to be different and survive in the scientific community? Do our fellow scientists see something different in and about us? Does our presence in science raise

the issue of the relevancy of the Christian faith in the world of science? I have tried to show that this is a difficult presence in which some aspects of our daily activity has to be questioned. I have broached many questions which have no easy answers. Still, it remains true that the scientific world is an important field in which the Christian message must be made present. Jesuits have a long tradition in this field which is unequaled by any other *group* in the Church. This is an argument in favor of the position which maintains that these difficulties can be overcome. But today's scientific work has characteristics quite different from conditions which prevailed in the past. This, however, is more a challenge than a reason to abandon such apostolic work. Serious reflection is needed to make the presence of a Jesuit in the scientific world truly significant scientifically and truly Christian, as was the work of Jesuits who achieved such an integration of their science and their faith in Christ.

On The Relative Importance Of Natural Versus Human-induced Climate Changes

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Climate probably exerts a more profound influence on human history and nonhuman ecosystems than any other single environmental factor. Many scientists now warn us that the buildup of greenhouse gases (carbon dioxide (CO_2), chloroflourocarbons (CFCs), nitrous oxide, methane and ozone) from industrial activities has begun to increase the atmosphere's natural greenhouse effect, causing a global warming. In particular, burning of fossil fuels (coal, oil, and natural gas) adds about 5.6 billion tons of carbon per year to the atmosphere and is thought to be responible for most of the $C0_2$ buildup, as well being a major source of nitrous oxide, methane, and ozone. Climatologists note that the Increase of atmospheric $C0_2$ from about 290 to 350 ppm between 1860 and the present coincides with a 0.6 C increase in average global temperature. And they predict that, barring a natural cooling trend, our continued burning of fossil fuels and destruction of forests could cause a doubling of atmospheric $C0_2$ (to 700 ppm) in the next several decades. Computer models suggest this $C0_2$ doubling could result in an increase of average global temperatures of 1.5 to 4.5 C and up to 10 to 15 C near the poles. obviously, this amount of warming would alter temperature and precipitation patterns and produce higher sea levels (by 0.5 to 1.5 m), severely disrupting modern societies.

There are problems with this scenario, however. First, our understanding of the nearly infinitely complex climate system is still very incomplete. Thus, we can't be sure that the 0.6 C warming of the last century isn't attributable to natural climate perturbations, perhaps resulting from solar variability, tidal forces, changes in volcanic activity, migration of air pressure belts and ocean circulation systems, or some combination thereof. Indeed, historic evidence indicates that temperatures fluctuated by 0.6° C or more during several intervals in the past 2000 years. These include the Medieval warm period (8th to llth centuries AD) and the "Little Ice Age" (16th to 19th centuries AD). And natural climate changes during the past several million years have been far more dramatic than anything we have seen this century or have projected for the next, indicating that natural processes have had far greater effect on climate than human activities.

Paleoclimatologists reconstruct the earth's climatic history on the basis of "proxy" evidence, including distribution of fossils, pollen, glacial deposits and soils, lake and deep-sea core records, coastline features, tree-rings, etc. Collectively, this evidence suggests that the earth's average temperature for most of it's history has been about 10 to 15 degrees C warmer than the present 15 C. However, approximately every 200 to 250 million years, the earth's heating system has "broken down," resulting In a relatively brief glacial episode. We are presently living in one of these glacial periods, termed the Quaternary, which began in earnest about 2 to 3 million years ago and has included about 10 glacial/interglacial cycles within the last approximately 1 million years. For the past approximately 10,000 years, we have been in a relatively warm "interglacial" stage called the Holocene.

We can get a sense of the magnitude of the earth's climatic variablity by looking at climates of the

past 65 million years. Near the end of the Mesozoic (=middle life, age of dinosaurs) and the beginning of the Cenozoic (= new life, the age of mammals) about 65 million years ago, world climate was much warmer and moister than present, land covered only about 15% of the earth (as opposed to 30% now), and sea level was about 500 m higher than present. Conditions were semi-tropical worldwide and eucalyptus trees thrived on Greenland. Climate cooled gradually during the Cenozoic and by 30 million years ago, small glaciers had begun developing in Alaska and Antarctica. By about 2 million years ago, glaciers in the northern hemisphere began to reach continental proportions and Icelandic fauna began appearing in the Mediterranean. Since then, cold glacial conditions have alternated with relatively warm interglacials, with glacials and interglacials both becoming progressively towards the present. During the last interglacial, about 125,000 years ago, average temperatures were as much as 3 to 4 degrees C higher than today, average sea levels were about 5 m higher than present, and warmth-loving critters (including giant tortoises and alligators) migrated far north of their present habitats. During the last glaciation, the Wisconsinan, which culminated about 18,000 years ago, huge glaciers one to two miles thick covered Canada and the northern U.S. and northern Europe and Eurasia, while smaller glaciers capped the world's mountainous areas. Due to the tremendous buildup of ice on land, sea levels dropped by 100 m and there was 12% more land than today. The expansion of glaciers and land masses caused average temperatures to plummet by 8 to 20 C over land and 3 to 6 C over sea. Climate belts shifted southward by 20 to 30 degrees latitude and plants and animals, too, migrated far south of their present range. The rapid warming which caused deglaciation between about 15,000 and 10,000 years ago was accompanied by catastrophic flooding, rapid rise of sea levels, and massive extinctions of large mammals.

My own research on (subtropical-type) soils and periglacial deposits in Montana and Alberta suggests that average temperatures during interglacials about 2 million years ago were at least 6 to 8 C (and probably 10 or more) *warmer* than present, whereas average temperatures during the last glaciation were at least 10° C colder than today. Hence, average temperatures in this midcontinental region seem to have fluctuated by *at least* 16 to 18 C over the past 2 million years. A similar and even greater magnitude of climate change is recorded by fossil plant and animal remains and periglacial features in Eurasia.

What causes climate to change? The most favored theory today holds that glacial periods are initiated by uplift and poleward movement of the continents whereas glacial/interglacial fluctuations within glacial periods result from variations in the earth's orbit around the sun. These calculated astronomic periodicites (100,000, 40,000, and 20,000 years) coincide with dated climate cycles identified in deep-sea sediments and loess-soil sequences in Europe and China. In general, the 40,000 year obliquity cycle seems to predominate at high latitudes, the 20,000 precession cycle predominates at low latitudes, and the 100,000 eccentricity cycle coincides with the length of a full glacial/interglacial cycle. Some scientists also detect higher frequency cycles which may correlate with (lunar) tidal force cycles, which peak every 1700 years, and have 1100, 550, and 275 years subcycles. In addition, the well-known 11year sunspot cycle, first identified in tree-ring records in the American southwest, has recently been shown to correlate with winter temperature fluctuations in the northern hemisphere. Recent research also suggests that the "solar constant" is not constant after all, but rather can vary by up to 0.2% within weeks. A 0.1% change can trigger up to 6 C temperature changes in polar regions. These findings suggest that solar variability might eventually prove to be a fundamental cause of climate change.

Hence, I suggest that many global warming experts today dramatically overestimate the effects of human activity on climate and that most or possibly all twentieth-century climate variability could be the result of natural climate fluctuations. Nonetheless, the global warming debate itself is still highly efficacious because it forces us to recognize that the earth environment -- including human, nonhuman, and inorganic members -- is one interconnnected system. We are now becoming increasingly aware of the many and myriad ways in which our human economy profoundly and adversely affects the environment, God's economy. Hence, we can now begin to envision the development of a "sustainable society" which operates within the limitations of our "allowance" of renewable resources -- solar, wind, geothermal, etc. -- rather than on the wasteful consumption of nonrenewable resources such as fossil fuels. This would have many other advantages as well, including a reduced risk of world war in the Middle East.

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