The Four-Hundredth Anniversary of the Pontifical Academy of Sciences 1603-2003

Anniversary Session

I am delighted and honoured to present the forthcoming session commemorating the four-hundredth anniversary of the foundation of the Pontifical Academy of Sciences. As has already been communicated, the celebration proper will take place on Sunday, 9 November 2003, when Holy Mass will be celebrated at the Church of St. Stephen of the Abyssinians, presided over by His Eminence Cardinal Carlo M. Martini. Afterwards, a round table on the history of the Academy will be held at the headquarters of the Academy: Prof. Carlo Vinti (Perugia) will give a paper on 'Federico Cesi and the First Accademia dei Lincei'; Prof. Antonino Zichichi (PAS, Geneva/Bologna) will discuss the subject 'Galilei, Divine Man'; Prof. Andrea Riccardi (Roma III) will talk on 'The Restorations of Pius XI and John Paul II'; and the President of the Academy, Prof. Nicola Cabibbo, will reflect on 'The Meaning of the Pontifical Academy of Sciences Today'. In addition to the Academic body, experts and observers, thirty-eight internationally distinguished Academies have been invited to participate and over twenty presidents have already announced that they will be present.

I enclose the general programme of the session, which includes the working groups on 'Mind, Brain and Education' and 'Stem Cell Technology and Other Innovative Therapies', to be held respectively on 7-8 November 2003 and 10-11 November 2003. Both meetings will be able to rely on papers of very high quality, as will be evident from the abstracts.

It only remains for me to thank first and foremost the Holy Father John Paul II not only because on 16 October he attained the twenty-fifth year of an exceptional pontificate, but also because he has wanted during this year to offer the Academy the gift of the restoration of its splendid buildings.

When that great Pontiff, Pope Pius XI, gave these buildings to the Pontifical Academy of Sciences in 1923, he was convinced that this 'jewel of art',1 which had been inaugurated by Pius IV in 1591, was a most suitable place for the location of the Pontifical Academy of Sciences. Employing the famous Latin phrase 'est omen in loco', he observed that this Casina, in the centre of the Vatican Gardens, was a place of quiet, of 'mystical quiet'.2 The quiet of this place also comes from its connections and contiguity with the cupola of St. Peter's Basilica, which contains the tomb of the Apostle Peter and where 'a supreme effort of art and science' brings thought 'nearer to the Creator', and with the Picture Gallery, the Archives, the Library, and the Museum of the Holy See, 'all a treasure of science, of art' from which 'science and art will be able for a long time to draw sustenance'.3

Naturally, the completion of the restoration has allowed Casina Pio IV not only to return to its former architectonic splendour, but has also improved its working facilities, particularly in the conference hall. Now we can really say that the Academicians who work in this Pontifical Academy will raise their minds to God through the contemplation of nature, the presence of art, the grace of St. Peter, and their own research and reflections, aided in this by the presence of state-of-the-art technology. All this corresponds to the definition of prayer offered by Thomas Aquinas, 'the raising of the mind to God' ('elevatio mentis in Deum'),4 that great saint whom His Holiness John Paul II declared Doctor Humanitatis.

I would also like the thank Cardinal Martini, Professor C. Vinti, A. Zichichi, A. Riccardi and President N. Cabibbo for the celebration of this fourth centenary. An expression of gratitude must also be extended to the organisers of the session, and in particular to A. Battro, K. Fischer, P. Léna and N. Le Douarin, T. Boon-Falleur, who have prepared meetings that will be of a level to match its tradition.

I would also like to thank in particular Cardinal K. Lehmann who went to great lengths in order to be able to participate. Our gratitude and best wishes must also be expressed to all the participants, who in various ways will enrich this meeting.

+ Marcelo Sánchez Sorondo

1 The Pontifical Academy of Sciences, Papal Addresses to the Pontifical Academy of Sciences 1917-2002 and to the Pontifical Academy of Social Sciences 1994-2002. Benedict XV, Pius XI, Pius XII, John XXIII, Paul VI, and John Paul II (The Pontifical Academy of Sciences, Vatican City, 2003), p. 21.

2 *Op. cit.*, p. 22.

3 *Loc. cit.*

4 *S. Th.*, II-II, 83, 13. Cf. Damasceno, *De fide orth.* 3:24.

Working Group on Mind, Brain and Education

The Pontifical Academy of Sciences is celebrating the 400th anniversary of its foundation at the Vatican by Pope Clement VII and Prince Federico Cesi with the name Linceorum Academia

(Academy of the Lynxes). Galileo Galilei was the most prestigious member of this academy, the oldest of Europe (1603) in the mathematical and experimental sciences. Today the Academy has eighty members from twenty-six countries. Some thirty of them have Nobel Prizes. The meetings are held at the Casina Pio IV in the Vatican Gardens, a famous palace of the Renaissance.

This meeting on Mind, Brain and Education was organized by Antonio M. Battro (Academia Nacional de Educación, Argentina), Kurt W. Fischer (Harvard University Graduate School of Education) and Pierre Léna (Université Denis Diderot, Paris) with the purpose of joining the gaping seams in the patchwork quilt that connects neuroscience findings with educationally relevant problems. Rita Levi Montalcini (Nobel Prize winner) is the honorary president of this meeting.

In the current Age of Biology, society is looking to neuroscience, genetics, and cognitive science to inform and improve education. To create better research and practice, we must build a reciprocal relationship of educational practice with research on learning and development, analogous to the relationship between biology and medicine. In this relationship, research informs practice, and simultaneously practice informs research.

The workshop on Mind, Brain and Education will search for convergent trends in the fields of Epistemology (Bruer, Mittelstrass), History (Vidal), Language (Paulesu, Petitto), Mathematics (Dehaene), Brain images (Koizumi), Neurobiology (Doetsch, Singer, White), Reading (Goswami, Wolf), Dynamical models (Fischer, van Geert) and Chronobiology (Cardinali). The results of this workshop will be published in a book, and a new International Mind, Brain and Education Society (IMBES) and a Journal, (Battro, Fischer & Paré-Blagoev) will be launched at the end of the sessions.

Remarkable progress in the knowledge of the human genome is leading to new therapies based on a precise understanding of the gene alterations that cause the diseases and the characteristics of the diseased cells. Assessment of the genes expressed by patients both in their normal and diseased cells will lead to treatments that will be more efficient at correcting the defect of diseased cells or at eliminating these cells, while being better tolerated by the patient.

In the field of cancer treatment, important new approaches are based on very specific inhibitors of precisely defined over-active gene products. Another therapeutic modality that benefits from a precise knowledge of the genes abnormally activated in cancer cells is immunotherapy. Cancer cells bear antigens that are not present in the normal cells of the human body, because the genes that code for these antigens are only active in cancer cells. These antigens are recognized by T lymphocytes. A large number of clinical studies aimed at vaccinating cancer patients with tumor-specific antigens, are presently ongoing. Significant tumor regressions are observed in about 10% of the patients, in the absence of any significant toxicity. The factors that limit the efficacy of these treatments are under intense study.

Another area to be discussed will be gene therapy targeting hematopoietic stem cell defects. Severe combined immunodeficiency will be taken as a model. Evidence will be presented that retroviral mediated gene transfer can target stem cells and provide sustained development of a functional immune system. The risks and consequences of an adverse effect caused by insertional mutagenesis will be described and discussed. How to improve and extend the usage of this strategy will be presented.

Working Group on Stem Cell Technology and Other Innovative Therapies

Significant advances in our knowledge of the early development of the mammalian embryo were made when fertilization of the mammalian ovocyte became possible in vitro. The development of the egg could then be directly studied up to the blastocyte stage. Moreover, in 1981, it was shown that the inner cells of the mouse blastocytes could be maintained in culture in a multipotent and proliferative state. From then on, lines of embryonic stem cells were derived from embryos and cultured for long periods of time. A transient stage of normal development could thus be 'captured' in vitro by culturing the early cells of the blastocyst in appropriate conditions. Even more important is the fact that these multipotent cells can be induced to differentiate into various cellular phenotypes if they are subjected to definite sets of growth and differentiation factors. These results suggested that embryonic stem cells (ES cells) could be used for therapeutic purposes in various diseases. Experiments currently carried out in mice confirm this prospect.

In 1998, ES cells were derived from human embryos by a research group in the United States. Several human ES cell lines are now established and the possibility that they are used for cellular therapies in humans is being discussed. However, utilisation of human embryos for such purposes raises ethical issues that have to be carefully considered before these techniques are developed.

Another advance that came from the work of Cell and Developmental Biologists concerns stem cells present in most tissues and organs of the adult body. These cells are endowed with potentialities that are broader than previously thought and may become a source of cells for replacement therapies.

In the Symposium organized on November 10-11, 2003 at the Pontifical Academy of Sciences, an account of the state of the art in the field of stem cell biology will be given by the leading experts in the field. Their possible use in human therapy on the basis of experiments that are carried out on the mouse model will be particularly discussed.

Prof. N. Le Douarin, from the Collège de France (Paris), will introduce the subject. Prof. I. Weissmann, from Stanford University (USA), who has a longstanding experience in the field of hemopoietic and other kinds of stem cells will provide the attendants with an overview of the stem cell field and Prof. Ron McKay will compare the properties of stem cells from diverse sources: embryonic, foetal and adult. Certain cells remain undifferentiated during embryonic development and become, in the adult, the source of the gametes. They constitute a permanent link between generations. Germ cells possess characteristics that are also found in stem cells. This important subject will be discussed by Prof. Azim Surani from Cambridge (UK).

The actual potentialities of adult stem cells will be reviewed by Prof. Helen Blau from Stanford University and Prof. Rudolf Jaenish from the MIT (Cambridge, USA) will give a survey on possible applications of the nuclear transfer technique. The data provided by the experts will be the subject of a general discussion chaired by Prof. Ann McLaren, one of the top international specialists in the field of mammalian development. Prof. McLaren is in charge of high responsibilities in the field of ethics in the United Kingdom.

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