THE PONTIFICAL
ACADEMY
OF SCIENCES

Acta

17

The Four-Hundredth Anniversary of the Pontifical Academy of Sciences

1603

2003

The Commemorative Session of 9 November 2003

VATICAN CITY
2004

THE FOUR-HUNDREDTH ANNIVERSARY OF THE PONTIFICAL ACADEMY OF SCIENCES 1603-2003

Address:
The Pontifical Academy of Sciences
Casina Pio IV, 00120 Vatican City

PONTIFICIAE ACADEMIAE SCIENTIARVM ACTA
17

THE FOUR-HUNDREDTH ANNIVERSARY OF THE PONTIFICAL ACADEMY OF SCIENCES 1603-2003

9 November 2003

EX AEDIBVS ACADEMICIS IN CIVITATE VATICANA

MMIV

The opinions expressed with absolute freedom during the presentation of the papers of this meeting, although published by the Academy, represent only the points of view of the participants and not those of the Academy.

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PONTIFICIA ACADEMIA SCIENTIARVM
VATICAN CITY

Joannes Paulus PP. II

The Participants of the Working Groups and the Commemorative Session, 9 November 2003

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The Academy or *The School of Athens* by Raphael, in the Vatican Palace
'In those people you will have recognised your oldest predecessors in the investigation of both matter and spirit'
(Pius XII, Address to the Plenary Session of the Academy, 3 December 1939)

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ADDRESS TO THE HOLY FATHER

NICOLA CABIBBO

Holy Father,

We are grateful to be received in your presence on this occasion when the 25th Anniversary of your accession to the Pontificate happens to coincide with the 400th Anniversary of the foundation in Rome of the Accademia dei Lincei, under the reign of Clement VIII, the Pope Aldobrandini. The Lincei of Federico Cesi was the ancestor of our present Academy – your present Academy – the Pontifical Academy of Sciences, but also of all the subsequently created academies of science, many of whose leaders have joined us in our celebration. Of particular significance is the presence of the Italian Accademia dei Lincei, which shares with us a direct descendance from Federico Cesi, and of the Academy of the Third World, which was conceived a few years ago at the Casina Pio IV and has become the focal point for the discussion of science and development among the leading third world scientists. Central to the conception of Cesi and of Galilei is the disinterested search for the truth and the concern for the human condition. These are still our ideals today.

To celebrate this anniversary the Academy decided to coin a special medal where your figure is ideally associated to that of Galilei, both as a celebration of the 400 years from our foundation, and in grateful recognition of your continued effort, over the first 25 years of your pontificate, for establishing a fruitful collaboration between the world of religion and the world of science. Your effort was crowned in 1992 with the solemn conclusion of the Galilei case, an enterprise that you started in 1979.

On another level, it only remains for me to thank you for offering us, this year, the gift of the restoration of the splendid buildings which have been the headquarters of the Pontifical Academy of Sciences since the great Pontiff Pius XI gave them to this institution in 1923. 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 facili-

ties, 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, 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.

Thank you, Holy Father, for all of this that can help us achieve a future where faith and reason are fully reconciled and cohabitate peacefully.

The President of the PAS, Nicola Cabibbo,
makes his address to the Holy Father, 10 November 2003

ADDRESS OF JOHN PAUL II TO THE MEMBERS OF THE PONTIFICAL ACADEMY OF SCIENCES

Dear Members of the Pontifical Academy of Sciences,

I am especially pleased to greet you today as we celebrate the Four Hundredth Anniversary of the Pontifical Academy of Sciences. I thank the President of the Academy, Professor Nicola Cabibbo, for the kind sentiments expressed on your behalf and I acknowledge with gratitude the thoughtful gesture with which you have wished to commemorate the Silver Jubilee of my Pontificate.

The *Accademia dei Lincei* was founded in Rome in 1603 by Federico Cesi with the encouragement of Pope Clement VIII. In 1847 it was restored by Pius IX and in 1936 re-established by Pius XI. Its history is linked to that of many other Scientific Academies throughout the world. I am happy to welcome the Presidents and representatives of these institutions who have so kindly joined us today, especially the President of the *Accademia dei Lincei*.

I recall with gratitude the many meetings we have had over the past twenty-five years. They have been opportunities for me to express my great esteem for those who work in the various scientific fields. I have carefully listened to you, shared your concerns, and considered your suggestions. In encouraging your work I have emphasized the spiritual dimension always present in the search for truth. I have also affirmed that scientific research must be directed towards the common good of society and the integral development of its individual members.

Our gatherings have also enabled me to clarify important aspects of the Church's doctrine and life relating to scientific research. We are united in our common desire to correct misunderstandings and even more to allow ourselves to be enlightened by the one Truth which governs the world and guides the lives of all men and women. I am more and more convinced that scientific truth, which is itself a participation in divine Truth, can help philosophy and theology to understand ever more fully

the human person and God's Revelation about man, a Revelation that is completed and perfected in Jesus Christ. For this important mutual enrichment in the search for the truth and the benefit of mankind, I am, with the whole Church, profoundly grateful.

The two topics which you have chosen for your meeting concern the life sciences, and in particular the very nature of human life. The first, *Mind, Brain and Education*, draws our attention to the complexity of human life and its pre-eminence over other forms of life. Neuroscience and neurophysiology, through the study of chemical and biological processes in the brain, contribute greatly to an understanding of its workings. But the study of the human mind involves more than the observable data proper to the neurological sciences. Knowledge of the human person is not derived from the level of observation and scientific analysis alone but also from the interconnection between empirical study and reflective understanding.

Scientists themselves perceive in the study of the human mind the mystery of a spiritual dimension which transcends cerebral physiology and appears to direct all our activities as free and autonomous beings, capable of responsibility and love, and marked with dignity. This is seen by the fact that you have decided to expand your research to include aspects of learning and education, which are specifically human activities. Thus your considerations focus not just on the biological life common to all living creatures but also include the interpretive and evaluative work of the human mind.

Scientists today often recognize the need to maintain a distinction between the mind and the brain, or between the person acting with free will and the biological factors which sustain his intellect and capacity to learn. In this distinction, which need not be a separation, we can see the foundation of that spiritual dimension proper to the human person which biblical Revelation explains as a special relationship with God the Creator[1] in whose image and likeness every man and woman is made.[2]

The second topic of your meeting concerns *Stem Cell Technology and Other Innovative Therapies*. Research in this field has understandably grown in importance in recent years because of the hope it offers for the cure of ills affecting many people. I have on other occasions stated that stem cells for purposes of experimentation or treatment cannot come

[1] Cf. *Gen* 2:7.
[2] Cf. *Gen* 1:26-27.

from human embryo tissue. I have instead encouraged research on adult human tissue or tissue superfluous to normal fetal development. Any treatment which claims to save human lives, yet is based upon the destruction of human life in its embryonic state, is logically and morally contradictory, as is any production of human embryos for the direct or indirect purpose of experimentation or eventual destruction.

Distinguished friends, reiterating my thanks for your valued assistance I invoke upon you and your families God's abundant blessing. May your scientific work bear abundant fruit and may the activities of the Pontifical Academy of Sciences continue to promote knowledge of the truth and contribute to the development of all peoples.

The Holy Father addresses the participants in the Working Groups and in the Commemorative Session, 10 November 2003

PREFACE

It is a great honour for me to present the proceedings of the session commemorating the four-hundredth anniversary of the foundation of the Pontifical Academy of Sciences. A special celebration took place on Sunday, 9 November 2003, when Holy Mass was celebrated at the Church of St. Stephen of the Abyssinians, presided over by His Eminence Cardinal Carlo M. Martini and concelebrated by His Eminence Cardinal Georges Cottier, the Bishop-Chancellor Marcelo Sánchez Sorondo, and other consecrated Academicians. A round table on the history of the Academy was then held at the headquarters of the Academy when Prof. Carlo Vinti (Perugia) gave a paper on 'Federico Cesi and the First Accademia dei Lincei'; Prof. Antonino Zichichi (PAS, Geneva/Bologna) discussed the subject 'Galilei, Divine Man'; Prof. Andrea Riccardi (Roma III) gave a talk on 'The Restorations of Pius XI and John Paul II'; and the President of the Academy, Prof. Nicola Cabibbo, reflected on 'The Meaning of the Pontifical Academy of Sciences Today'. Together with the Academic body, experts and observers who participated in this meeting, representatives of thirty-eight internationally distinguished Academies were also present. The invited Presidents of our sister Academies commented on the paper of Prof. Cabibbo and offered their reflections on the points that he had raised. This volume contains the above mentioned papers and the contributions of these Presidents, in addition to the programme of the session, which included the working groups on 'Mind, Brain and Education' and 'Stem Cell Technology and Other Innovative Therapies', held respectively on 7-8 November 2003 and 10-11 November 2003, and a list of all the participants.

The Academy must express its particular gratitude to the Holy Father John Paul II not only because of his gift of the twenty-five years of an exceptional Pontificate (reached on 16 October 2003), but also because of the constant interest and attention he has demonstrated towards the Academy since his election. Indeed, John Paul II has made some forty addresses to the Academy, during an epoch when science strongly condi-

tions the experience of contemporary man, and has offered his valuable reflections on the relationship between faith and reason, the central importance of the human person and the common good, the role of the Catholic Church in the world of science and technology, and the mission of our Academy within the international scientific community. These addresses were published in the special commemorative volume, *Papal Addresses*, which formed a part of the anniversary celebrations.[1] The most recent of the Pope's addresses, which was given during this special session, is published in these proceedings.

Following a tradition of the Holy See and in order to express its gratitude to the Holy Father, the Academy produced a commemorative medallion bearing on its obverse a representation of God setting alight the torches of reason and faith held by two maidens, and on its reverse the images of the Holy Father John Paul II and Galileo Galilei, this last in recognition of this Pope's desire to promote a positive relationship between science and religion based upon mutual illumination and enrichment and an ending of the misunderstandings historically associated with the Galileo case. This medallion was given to all the participants at the meeting, together with a new edition, with the first English translation, of Federico Cesi's essays proposing the original foundation of the Academy at the beginning of the seventeenth century.[2]

During this special year the Holy Father also wanted 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',[3] 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'.[4] The quiet of this place also comes from its connections and contiguity with the

[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) pp. LIV-526.

[2] F. Cesi, *Il natural desiderio di sapere. The Natural Desire for Knowledge* (The Pontifical Academy of Sciences, Vatican City, 2003) pp. 159.

[3] *Papal Addresses*, *ed. cit.*, p. 21.

[4] *Ibid.*, p. 22.

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'.[5]

Naturally, the completion of the restoration has not only allowed Casina Pio IV 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 advanced technology. All this corresponds to the definition of prayer offered by Thomas Aquinas, 'the raising of the mind to God' (*elevatio mentis in Deum*),[6] that great saint whom John Paul II declared *Doctor Humanitatis*.

The Academy would also like to thank the Presidents and representatives of its sister Academies; the President of the Academy, Prof. Nicola Cabibbo; the Academicians; His Eminence Cardinal Lehmann; numerous ambassadors; the invited experts and observers, and the many others who helped to make this event so memorable and so enriching.

Lastly, this volume also contains a facsimile of the letter that Mrs Dora Janssen, the widow of the recently deceased Academician, Prof. Paul Adriaan Jan Janssen, who finished his days in Rome during his presence at this meeting, wrote to the Chancellor. This letter indicates that in this great loss we may perhaps perceive the mystery of human life and the sensitivity of the love of God: during the visit of Prof. Janssen to Rome and his audience with the Holy Father this distinguished scientist received a special grace, that of wishing to draw nearer to God. I myself, who talked to Prof. Janssen after the audience with the Holy Father, received a very similar impression. Let us in our prayers commend the soul of this great scientist to God the Father, remembering as we do all those Academicians who have preceded him.

✠ Marcelo Sánchez Sorondo

[5] *Loc. cit.*
[6] *S. Th.*, II-II, 83, 13. Cf. Damasceno, *De fide orth.* 3:24.

GENERAL PROGRAMME

Working Group on:

MIND, BRAIN AND EDUCATION
(7-8 November 2003)

Honorary President:
Prof. Rita Levi-Montalcini (PAS, Rome)

Coordinators:
Prof. Antonio M. Battro (PAS, Buenos Aires)
Prof. Kurt W. Fischer (Harvard)
Prof. Pierre J. Léna (PAS, Paris)

FRIDAY 7 NOVEMBER

9:00 Prof. Nicola Cabibbo (President)
Welcome

Prof. Antonio M. Battro (PAS, Buenos Aires)
Introduction

MIND, BRAIN AND EDUCATION:
A NEW FIELD OF RESEARCH AND PRACTICE

Chair: Prof. Antonio M. Battro (PAS, Buenos Aires)

9:30 Prof. Kurt W. Fischer (Harvard)
Mind, Brain and Education: Developmental Cycles of Brain and Skill

10:10 Prof. Wolf J. Singer (PAS, Frankfurt)
Brain Development and Education

10:40 Discussion

11:00 Coffee Break

11:30 Dr. John T. Bruer (McDonnel Foundation, St. Louis)
Scientific Bridges Between Brain, Mind and Education

12:10 Dr. Fernando Vidal (Max-Planck Institute, Berlin)
Brainhood and the Mind/Brain/Education Project

12:40 General Discussion

13:00 Lunch

NEUROPHYSIOLOGY AND COGNITION

Chair: Prof. Wolf J. Singer (PAS, Frankfurt)

15:00 Prof. Daniel J. Cardinali (Buenos Aires)
Chronoeducation: How the Biologic Clock Influences the Learning Process

15:40 Prof. Hideaki Koizumi (Hitachi, Saitama)
Developing the Brain: An Approach Towards Learning and Educational Sciences by Functional Imaging

16:20 Dr. Fiona Doetsch (Columbia)
The Origin of New Neurons: Stem Cells in the Adult Mammalian Brain

17:00 Coffee Break

17:30 Prof. Maryanne Wolf (Tufts)
A Triptych of the Reading Brain: Evolution, Development, Pathology and its Intervention

18:10 Dr. Robert J. White (PAS, Cleveland)
The Isolated Brain

18:50 General Discussion

19:00 Dinner

SATURDAY, 8 NOVEMBER

Chair: Prof. Pierre J. Léna (PAS, Paris)

9:00 Dr. Stanislas Dehaene (Inst. National de la Santé, Orsay)
Pre-emption of Cortical Circuits by Calculation and Language: The Hypothesis of a Cultural 'Neuronal Recycling' Process

9:40 Prof. Paul van Geert (Groningen)
Dynamical Models and the Assessment of Individual Learning and Development

10:20 Prof. Michael Posner (Oregon)
Brain Mechanisms and Learning of High Level Skills

11:00 Coffee Break

11:30 Prof. Jürgen Mittelstrass (PAS, Konstanz)
Mind, Brain and Consciousness

12:10 General Discussion

13:00 Lunch

BRAIN AND LANGUAGE

Chair: Prof. Kurt W. Fischer (Harvard)

15:00 Prof. Laura-Ann Petitto (Dartmouth)
Revolutions in Brain, Language, and Education: Examples from Spoken Language and Silent Languages on the Hands

15:40 Prof. Eraldo Paulesu (Milano-Bicocca)
Language, Bilingualism and Bilingual Education

16:20 Prof. Usha Goswami (Cambridge, UK)
Reading and the Brain: A Cross Language Analysis

17:00 Coffee Break

17:30 Antonio M. Battro, Kurt W. Fischer, Juliana Paré-Blagoev (Los Alamos)
The 'International Mind, Brain and Education Society' and the 'MindBrain and Education' Journal

18:00 The Presidents of the Academies and the Participants are kindly invited to discuss and join these initiatives

18:30 Final Discussion

19:15 Guided visit to the Vatican Museums (Apollo, Laocoon, Belvedere Torso)

THE SESSION COMMEMORATING THE 400TH ANNIVERSARY OF THE FOUNDATION OF THE PONTIFICAL ACADEMY OF SCIENCES (1603-2003)

SUNDAY, 9 NOVEMBER

9:30 Holy Mass celebrated by His Eminence Card. Prof. Carlo M. Martini, Church of St. Stephen of the Abyssinians (Vatican City)

10:45 Round Table on the *History of the Academy*:

– Prof. Carlo Vinti (Perugia)
Federico Cesi, the First Accademia dei Lincei and the Moral and Methodological Commitment of the Researcher

– Prof. Antonino Zichichi (PAS, Geneva / Bologna)
Galilei, Divine Man

– Prof. Andrea Riccardi (Roma III)
The Restorations of Pius XI and John Paul II

11:45 Coffee Break

12:00 Prof. Nicola Cabibbo (President of the Academy, Rome 'La Sapienza')
The Meaning of the Pontifical Academy of Sciences Today

12:45 The Presidents of the Academies and the Academicians are invited to discuss and offer suggestions

13:15 Lunch at the Academy

15:15 Guided visit to the Vatican Museums (Sistine Chapel)

Working Group on:

STEM CELL TECHNOLOGY AND OTHER INNOVATIVE THERAPIES (10-11 November 2003)

Organising Committee: N. Le Douarin (PAS, Paris), T. Boon-Falleur (PAS, Brussels)

MONDAY, 10 NOVEMBER

9:00 Prof. Nicole Le Douarin (PAS, Paris)
Introduction

9:30 Card. Karl Lehmann (Mainz, President of the Bishops' Conference)
Human Rights and Bioethics

10:30 Prof. Irving Weissmann (Stanford)
Stem Cells: Overview

11:30 Coffee Break

12:00 Prof. Ronald McKay (Nat. Inst. Neurological Disorder and Stroke, Bethesda)
Comparing the Properties of Embryonic, Fetal and Adult Stem Cells

13:00 Lunch

14:30 Prof. Azim Surani (Cambridge, UK)
Germ Cells: The Eternal Link Between Generations

15.30 Prof. Helen Blau (Stanford)
Repair of Adult Tissues by Adult Bone Marrow Derived Stem Cells

16:30 Coffee Break

17:00 Prof. Rudolf Jaenisch (MIT, Cambridge)
Nuclear Cloning and Embryonic Stem Cells

18:00 Prof. Ann McLaren (Cambridge, UK), Chair
General Discussion

TUESDAY, 11 NOVEMBER

9:00 Prof. Thierry Boon-Falleur (PAS, Brussels)
Therapeutic Vaccination of Cancer Patients

10:00 Prof. Alain Fischer (INSERM, Paris)
Gene Transfer in Hematopoietic Stem Cells: Perspectives, Results and Problems

11:00 Coffee Break

11:30 Prof. François Sigaux (INSERM, Paris)
From Genes to Therapy

12:30 Lunch

LIST OF PARTICIPANTS

President of the Bishops' Conference:

H.E. Card. Prof. Karl LEHMANN
Bischofplatz 2a
D-55116 MAINZ
(Federal Republic of Germany)

Presidents of Academies:

Prof. Giovanni CONSO, President
ACCADEMIA NAZIONALE DEI LINCEI (founded in 1603)
Via della Lungara, 10
00165 ROMA
(Italy)

Prof. Dr. Volker TER MEULEN, President,
and Prof. Dr. Benno PARTHIER, Former President
DEUTSCHE AKADEMIE DER NATURFORSCHER LEOPOLDINA
(founded in 1653)
Postfach 110543
D-06019 HALLE (SAALE)
(Federal Republic of Germany)

Prof. Julia HIGGINS, Representative
THE ROYAL SOCIETY (founded in 1660)
6-9 Carlton House Terrace
LONDON, SW1Y 5AG
(United Kingdom)

Prof. Etienne-Emile BAULIEU, President
ACADÉMIE DES SCIENCES (founded in 1666)
23, quai de Conti
F-75006 PARIS
(France)

Prof. Yuri S. OSIPOV, President
THE RUSSIAN ACADEMY OF SCIENCES (founded in 1724)
Leninsky prospekt, 14
117901 MOSCOW, V-71
(Russia)

Prof. Birger MUNK OLSEN, President
THE ROYAL DANISH ACADEMY OF SCIENCES AND LETTERS
(founded in 1742)
H.C. Andersens Boulevard 35
DK-1553 COPENHAGEN V
(Denmark)

Prof. Guillaume WUNSCH, President
THE ROYAL ACADEMY OF SCIENCE,
LETTERS AND FINE ARTS OF BELGIUM (founded in 1769)
1, rue Ducale
B-1000 BRUSSELS
(Belgium)

Prof. Helena ILLNEROVÁ, President
THE ACADEMY OF SCIENCES OF THE CZECH REPUBLIC
(founded in 1784/1992)
Narodni 3
117 20 PRAGUE 1
(Czech Republic)

Dr. Michael E.F. RYAN, President
THE ROYAL IRISH ACADEMY (founded in 1785)
19 Dawson Street
DUBLIN 2
(Ireland)

Prof. Hans STICHER, Representative
SCHWEIZERISCHE AKADEMIE DER NATURWISSENSCHAFTEN
(founded in 1815)
Bärenplatz, 2
CH-3011 BERN
(Switzerland)

Prof. Dr. Hans TUPPY, Representative
ÖSTERREICHISCHE AKADEMIE DER WISSENSCHAFTEN
(founded in 1847)
Dr.-Ignaz-Seipel-Platz, 2
A-1010 WIEN
(Austria)

Prof. Ismael Clark ARXER, President
ACADEMIA DE CIENCIAS DE CUBA (founded in 1861)
Capitolio Nacional
10200 LA HABANA
(Cuba)

Prof. Michael T. CLEGG, Representative
THE NATIONAL ACADEMY OF SCIENCES (founded in 1863)
2101 Constitution Avenue, NW
WASHINGTON, DC 20418
(U.S.A.)

Prof. Naum YAKIMOFF, Representative
THE BULGARIAN ACADEMY OF SCIENCES (founded in 1869)
1, 15 Noemvri Str.
BG-1040 SOFIA
(Bulgaria)

Prof. Andrzej B. LEGOCKI, President
THE POLISH ACADEMY OF SCIENCES (founded in 1872)
Palace of Culture and Science
Plac Defiland 1
PL-00-901 WARSAW
(Poland)

Eng. Arturo J. BIGNOLI, President
ACADEMIA NACIONAL DE CIENCIAS EXACTAS, FÍSICAS Y NATURALES (founded in 1873)
Av. Alvear 1711, 4º piso
(1014) BUENOS AIRES
(Argentina)

Prof. Eiichi HOSHINO, Representative
THE JAPAN ACADEMY (founded in 1879)
7-32 Ueno Park, Taito-ku
TOKYO 110-0007
(Japan)

Dr. Howard ALPER, President
THE ROYAL SOCIETY OF CANADA (founded in 1882)
283 Sparks Street
OTTAWA, Ontario K1R 7X9
(Canada)

Prof. Eduardo M. KRIEGER, President
ACADEMIA BRASILEIRA DE CIÊNCIAS (founded in 1884)
Rua Anfilófio de Carvalho, 29
20030-060 RIO DE JANEIRO
(Brazil)

Prof. Anthony KOUNADIS, President
Section of Positive Sciences – THE ACADEMY OF ATHENS (founded in 1926)
Odos Panepistimiou, 28
ATHENS
(Greece)

Prof. Jacob ZIV, President
THE ISRAEL ACADEMY OF SCIENCES AND HUMANITIES (founded in 1959)
Albert Einstein Square – P.O. Box 4040
91040 JERUSALEM
(Israel)

Prof. Teki TARTARI, Representative
THE ACADEMY OF SCIENCES OF ALBANIA (founded in 1972)
Sheshi 'Fan Noli' 7
TIRANË
(Albania)

Prof. Jürgen MITTELSTRASS, President
THE ACADEMIA EUROPAEA (founded in 1988)
31 Old Burlington Street
LONDON 1S 3AS
(United Kingdom)

Academicians:

Prof. Nicola Cabibbo, President
H.E. Msgr. Prof. Marcelo Sánchez Sorondo, Chancellor
Prof. Werner Arber
Prof. Antonio M. Battro
Prof. Paul Berg
Prof. Enrico Berti
Prof. Günter Blobel
Prof. Thierry Boon-Falleur
Prof. Bernardo M. Colombo
Card. Georges M.M. Cottier
Rev. Prof. George V. Coyne, S.J.
Prof. Paul J. Crutzen
Rev. Prof. Raffale Farina, S.D.B.
Prof. Antonio García-Bellido
Prof. Paul Germain
Prof. Raymond Hide
Prof. Fotis C. Kafatos
Prof. Vladimir I. Keilis-Borok
Rev. Prof. Stanley L. Jaki, O.S.B.
Prof. Paul J.A. Janssen
Prof. Nicole M. Le Douarin
Prof. Tsung-Dao Lee
Prof. Pierre J. Léna
Prof. Rita Levi-Montalcini

Rev. Prof. Jean-Michel Maldamé
Card. Carlo M. Martini
Prof. Govind Kumar M. Menon
Prof. Jürgen Mittelstrass
Prof. Marcos Moshinsky
Prof. Rudolf Muradian
Prof. Ryoji Noyori
Rev. Prof. Sergio Pagano, B.
Prof. Yves Quéré
Prof. Chintamani N.R. Rao
Card. Joseph Ratzinger
Prof. Peter H. Raven
Prof. Michael Sela
Prof. Maxine F. Singer
Prof. Wolf J. Singer
Prof. Andrzej Szczeklik
Prof. Charles H. Townes
Prof. Hans Tuppy
Prof. Rafael Vicuña
Prof. Robert J. White
Prof. Antonino Zichichi

Experts:

Prof. Helen M. BLAU
STANFORD UNIVERSITY SCHOOL OF MEDICINE
Department of Microbiology & Immunology
Baxter Laboratory in Genetic Pharmacology
CCSR Room 4215, 269 Campus Drive
STANFORD, CA 94305-5175
(U.S.A.)

Dr. John T. BRUER, President
THE JAMES S. McDONNELL FOUNDATION
1034 South Brentwood Boulevard, Suite 1850
ST. LOUIS, MO 63117
(U.S.A.)

Prof. Daniel P. CARDINALI
UNIVERSIDAD DE BUENOS AIRES
Facultad de Medicina – Departamento de Fisiología
Paraguay 2155, 7º piso
1121 BUENOS AIRES
(Argentina)

Dr. Stanislas DEHAENE
INSTITUT NATIONAL DE LA SANTÉ (INSERM)
Service Hospitalier Frederic Joliot – CEA/DRM/DSV
Unité INSERM 562 'Neuroimagerie Cognitive'
4, place du General Leclerc
F-91401 ORSAY Cedex
(France)

Dr. Fiona DOETSCH
COLUMBIA UNIVERSITY
Departments of Pathology, Neurology
& Center for Neurobiology and Behavior
P&S 14-511, MC 23
630 W 168th Street
NEW YORK, NY 10032
(U.S.A.)

Prof. Alain FISCHER
HÔPITAL NECKER-ENFANTS MALADES
Unité d'Immunologie – Hématologie
149, rue de Sèvres
F-75743 PARIS Cedex 15
(France)

Prof. Kurt W. FISCHER
HARVARD UNIVERSITY
Graduate School of Education
Department of Human Development and Psychology
702 Roy E. Larsen Hall, Appian Way
CAMBRIDGE, MA 02138
(U.S.A.)

Prof. Paul L. VAN GEERT
UNIVERSITY OF GRONINGEN
Faculty of Behavioral and Social Sciences – Department of Psychology
The Heymans Institute
Developmental and Experimental Clinical Psychology
Grote Kruisstraat 2/1
NL-9712 TS GRONINGEN
(The Netherlands)

Prof. Usha C. GOSWAMI
UNIVERSITY OF CAMBRIDGE
Faculty of Education
Shaftesbury Road
CAMBRIDGE CB2 2BX
(United Kingdom)

Prof. Rudolf JAENISCH
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Whitehead Institute for Biomedical Research
Nine Cambridge Center
CAMBRIDGE, MA 02142-1479
(U.S.A.)

Prof. Hideaki KOIZUMI
HITACHI, Ltd
Advanced Research Laboratory
2520 Akanuma
Hatoyama-machi, Hiki-gun, Saitama 350-0395
(Japan)

Prof. Ronald D.G. MCKAY
NATIONAL INSTITUTE OF NEUROLOGICAL
DISORDERS AND STROKE
Laboratory of Molecular Biology
Building 36, Room 5A29
36 Convent Drive, MCS 4157
BETHESDA, MD 20892-4157
(U.S.A.)

Prof. Anne McLAREN
UNIVERSITY OF CAMBRIDGE
The Wellcome Trust / Cancer Research UK
Institute of Cancer and Developmental Biology
Tennis Court Road
CAMBRIDGE CB2 1QR
(United Kingdom)

Prof. Eraldo PAULESU
UNIVERSITÀ DEGLI STUDI DI MILANO-BICOCCA
Facoltà di Psicologia, ed. U6, loc. 428
Piazza dell'Ateneo Nuovo, 1
I-20126 MILANO
(Italy)

Dr. Juliana PARÉ-BLAGOEV
1340, 44th Street
LOS ALAMOS, NM 87554
(U.S.A.)

Prof. Laura-Ann PETITTO
DARTMOUTH COLLEGE
Department of Psychological & Brain Sciences
302 Silsby Hall
HANOVER, NH 03755
(U.S.A.)

Prof. Michael I. POSNER
UNIVERSITY OF OREGON
Department of Psychology
209 Straub Hall
EUGENE, OR 97403
(U.S.A.)

Prof. Andrea RICCARDI
UNIVERSITÀ DEGLI STUDI ROMA TRE
and COMUNITÀ DI SANT'EGIDIO
P.zza Sant'Egidio, 3/a
I-00153 ROMA
(Italy)

Prof. François SIGAUX
INSERM – Unité 462
IUH (porte 7, Entrée B, 2ème étage) – Hôpital Saint Louis
1, avenue Claude Vellefaux
F-75475 PARIS Cedex 10
(France)

Prof. Azim SURANI
UNIVERSITY OF CAMBRIDGE
Welcome Trust and Cancer Research UK
Institute of Cancer and Developmental Biology
Tennis Court Road
CAMBRIDGE CB2 1QR
(United Kingdom)

Dr. Fernando VIDAL
MAX-PLANCK INSTITUTE FOR THE HISTORY OF SCIENCE
Wilhelmstrasse 44
D-10117 BERLIN
(Federal Republic of Germany)

Prof. Carlo VINTI
UNIVERSITÀ DEGLI STUDI DI PERUGIA
Facoltà di Lettere e Filosofia
Dipartimento di Scienze Filosofiche
Via dell'Aquilone, 8
I-06123 PERUGIA
(Italy)

Prof. Irving L. WEISSMAN
STANFORD UNIVERSITY SCHOOL OF MEDICINE
Department of Pathology
279 Campus Drive, B257
STANFORD, CA 94305-5323
(U.S.A.)

Prof. Maryanne WOLF
TUFTS UNIVERSITY
Eliot-Pearson Department of Child Development
The Center for Reading and Language Research
MEDFORD/Somerville, MA 02155
(U.S.A.)

Observers:

Dr. Antonio ALLEGRA
UNIVERSITÀ DEGLI STUDI DI PERUGIA
Facoltà di Lettere e Filosofia
Dipartimento di Scienze Filosofiche
Via dell'Aquilone, 8
I-06123 PERUGIA
(Italy)

Prof. Paolo AMATI
UNIVERSITÀ DEGLI STUDI DI ROMA 'LA SAPIENZA'
Dipartimento di Biotecnologie Cellulari ed Ematologia
Sezione di Genetica Molecolare
Viale Regina Elena, 324
I-00161 ROMA
(Italy)

Dr. Gabriella BOTTINI
UNIVERSITÀ DEGLI STUDI DI PAVIA
Facoltà di Lettere e Filosofia
Dipartimento di Psicologia
Piazza Botta, 6
I-27100 PAVIA
(Italy)

Dr. Francesco BURANELLI, General Director
MONUMENTI MUSEI E GALLERIE PONTIFICIE
V-00120 VATICAN CITY

Prof. Kai-ming CHENG
Chair and Professor of Education and
Pro-Vice-Chancellor
THE UNIVERSITY OF HONG KONG
Pokfulam Road
HONG KONG

Prof. Léa DA CRUZ FAGUNDES
Director of the Laboratory of Cognitive Studies
FEDERAL UNIVERSITY OF RIO GRANDE DO SUL
Rua Ramiro Barcelos 2600-Santana
CEP: 90035-003 PORTO ALEGRE, RS
(Brazil)

Eng. Mario GARGANTINI
Via E. Toti, 8
I-20066 MELZO (MI)
(Italy)

Dr. Charles L. HARPER, Jr.
Executive Director & Senior Vice President
THE JOHN TEMPLETON FOUNDATION
Five Radnor Corporate Center
Suite 100 – 100 Matsonford Road
RADNOR, PA 19087
(U.S.A.)

Prof. Christian JUNGBLUT
Klosteralle 65
D-20144 HAMBURG
(Federal Republic of Germany)

Sr. Marguerite LÉNA
Communauté Saint-François-Xavier
24 boulevard Victor Hugo
F-92200 NEUILLY SUR SEINE
(France)

Dr. Anthony F. LIVERSIDGE
24 East 94th Street, Suite 3B
NEW YORK, N.Y. 10128-0664
(U.S.A.)

Prof. Paolo PONZIO
UNIVERSITÀ DEGLI STUDI DI BARI
Dipartimento di Scienze Filosofiche
Palazzo Ateneo – Piazza Umberto I
I-70121 BARI
(Italy)

Sr. M. Timothy PROKES, F.S.E.
LAVERNA CENTER
14 Kingshouse Court
SILVER SPRINGS, MD 20905
(U.S.A.)

Ms. Frances REYNOLDS, President
ARTE VIVA
RIO DE JANEIRO
(Brazil)

Ms. Courtney ROSS-HOLST
Founder of the Ross School
ROSS INSTITUTE & ROSS SCHOOL
18 Goodfriend Drive
EAST HAMPTON, N.Y. 11937
(U.S.A.)

Dr. Enrica SCHETTINI PIAZZA
Conservatrice manoscritti della Biblioteca
dell'Accademia Nazionale dei Lincei e Corsiniana
Via della Lungara, 10
I-00165 ROMA
(Italy)

Sr. Damien Marie SAVINO, F.S.E.
LAVERNA CENTER
14 Kingshouse Court
SILVER SPRINGS, MD 20905
(U.S.A.)

Dr. John M. TEMPLETON, Jr., President
THE JOHN TEMPLETON FOUNDATION
Five Radnor Corporate Center
Suite 100 – 100 Matsonford Road
RADNOR, PA 19087
(U.S.A.)

Prof. Dr. WEISS
BAYERISCHE JULIUS-MAXIMILIANS
UNIVERSITÄT WÜRZBURG
Sanderring 2
D-97070 WÜRZBURG
(Federal Republic of Germany)

ROUND TABLE ON THE HISTORY OF THE ACADEMY

SPEECH WELCOME
BY THE PRESIDENT OF THE ACADEMY

First of all, let me welcome all the representatives of our sister Academies, in particular Professor Conso of the Accademia dei Lincei, which is the other branch of direct descent from the Cesi Academy of 1603; the Ambassadors; the members of the Academies; Ladies and Gentlemen, and I would also like to apologise for not finding a place here for all those who wanted to be with us. We have organised, however, another room, which is probably more beautiful than this because it is part of the original building with wonderful frescoes, and the people who are here might want to go down and visit that room later on.

I do not want to spend any time on these preliminaries so I would like to call Professor Vinti to speak on 'Federico Cesi and the First Accademia dei Lincei and the Moral and Methodological Commitment of the Researcher'.

I think in this round table we should really keep to twenty minutes, then if our speakers have prepared more material we will be happy to publish it, to reproduce it, but we have to limit ourselves to twenty minutes, all of us.

Nicola Cabibbo

The Participants of the Commemorative Session, 9 November 2003

FEDERICO CESI, THE FIRST ACADEMY, AND UMBRIA

CARLO VINTI

1. *Cesi and the Adventure of the Lyncean Academy*

On 17 August 1603, at the home of Federico Cesi in via della Maschera d'Oro in Rome, a small group of scholars, all very young but animated by a fervid cultural and moral enthusiasm, met 'in an atmosphere almost of conspiracy, of secret and polemical play, today one would say anti-conformism',[1] to found the *Accademia dei Lincei*[2] (the Lyncean Academy).

The initiative for the meeting had been Cesi's, then eighteen years old, firstborn child of a rich and powerful Roman family of Umbrian origins. The other three companions of adventure were: his cousin Anastasio de Filiis from Terni, twenty-six, later named Secretary; his very close friend, Francesco Stelluti from Fabriano, who was to live longer than all the oth-

[1] E. Raimondi, *Scienziati e viaggiatori*, in E. Cecchi – N. Sapegno (ed.), *Storia della letteratura italiana*, Milano 1967, vol. V, p. 276. The first three parts of the following pages are a reformulation of the essence of C. Vinti, *La 'filosofica milizia' di Federico Cesi*, in *Interiorità e comunità. Esperienze di ricerca filosofica*, Roma 1993, pp. 191-228.

[2] For an overview of the experience of the first *Accademia dei Lincei* see: D. Carutti, *Breve storia dell'Accademia dei Lincei*, Roma 1883, pp. 3-97; M. Maylender, *Storia delle Accademie d'Italia*, Bologna 1929, vol. III, pp. 430-503; G. Gabrieli (ed.), *Il Carteggio linceo della Vecchia Accademia di Federico Cesi (1603-1630)*, Roma 1938-1942, voll. 2, hereinafter *Carteggio*; E. Raimondi, *Scienziati e viaggiatori*, op. cit., pp. 223-318; U. Baldini-L. Besana, *Organizzazione e funzione delle Accademie*, in *Storia d'Italia. Annali 3*, Torino 1980, pp. 1307-1333; L. Boehm-E. Raimondi (ed.), *Università, Accademie e Società scientifiche in Italia e in Germania dal Cinquecento al Settecento*, Bologna 1981, *passim*, but especially the essay by G. Olmi, *'In essercitio universale di contemplatione et prattica': Federico Cesi e i Lincei*, pp. 169-235; J.-M. Gardair, *I Lincei: i soggetti, i luoghi, le attività*, in 'Quaderni storici', 1981, pp. 763-787; A. Alessandrini, *Originalità dell'Accademia dei Lincei*, in *Convegno celebrativo del IV centenario della nascita di Federico Cesi*, Roma 1986, pp. 77-177; G. Gabrieli, *Contributi alla storia dell'Accademia dei Lincei*, Roma 1989, vol. 2, hereinafter *Contributi* (a collection of a long series of articles dedicated by the author to the history of the first Lynceans). A useful bibliographical essay on the subject is E. Schettini-Piazza, *Bibliografia storica dell'Accademia dei Lincei*, Firenze 1980.

ers and would later represent the Academy as general procurator, also twenty-six; and a foreigner, the twenty-four year old Jan Heckus of Deventer who, because of his Catholic faith, had fled the Netherlands at a very young age, lived for a time in Spoleto, and taken his degree in Medicine in 1601 at the University of Perugia.

The minutes of the first meetings contain the justification of the choice of the name:

> *Lyncaeam Academiam appellarunt ex Lince animalium omnium oculatissima. Cum enim in scientiis speculatione maxime opus sit ac se in mente vi praeditos debere esse cognoscentes quae Linx in corpore dotatus, eius Academiam nomine, et se ipsos indigitarunt Lyncaeos.*[3]

The Lynceans gave themselves an organizational structure and set forth their program in a lengthy charter, the *Lynceographum*, never completed despite successive drafts, and only recently published.[4]

The experience of the first Academy[5] is generally considered to have ended in 1657, the year that the Lyncean Cassiano del Pozzo died, and its brief history is usually divided into three periods: the first goes from 1603 to 1611, the year of induction of Galileo Galilei, and is marked by the group's initial enthusiasm as well as organizational and familial difficulties; the second lasted until 1630, the year of Cesi's death, and can be said to represent the most fecund and most interesting period of the institution's activity, by virtue above all of the presence of the great Tuscan scientist; and finally, the last period in which the Academy ceased to exist as an organized institution but continued as a scientific body, whose life, under the impulse of Stelluti, was much more protracted and which succeeded in 1651 in completing and publishing the *Tesoro messicano*, the Lynceans' great collegial opus.

From the very beginning the activity of the members of the institution was conceived in terms of a fraternal collaboration with precisely defined scientific objectives, in 'which each was to be master and disciple of the others', in such a way that 'an authentic brotherhood, having dispelled all pride and envy, should be nourished by the increment in equivalent virtues'.[6]

[3] *Gesta lynceorum*, in *Ms. Arch. Linc.*, 3, chap. 3.

[4] A. Nicolò (ed.), *Lynceographum, quo norma studiosae vitae lynceorum philosophorum exponitur*, Roma 2001, hereinafter *Lynceographum*.

[5] We speak of *First Academy* because over the course of the centuries, thanks to the prestige acquired in its all too brief life by the Academy of Cesi and his companions, subsequent Lyncean Academies were founded in various historical and cultural contexts.

[6] G. Gabrieli, *Verbali delle adunanze e cronaca della prima Accademia Lincea*, in *Contributi*, vol. I, p. 508.

Giuseppe Gabrieli captures very effectively the moral and religious but also cultural tension, which guided the first steps of this collective experience and which derived, above all, from the enthusiasm of the founder:

> Federico Cesi [...] had a most singular idea of and affection for his Academy. He had dreamed about it and conceived of it when he was just a young boy, as an organism of totally new scientific collaboration verging on cooperation, a sort of 'religion' in the multiple and specific sense that was given this word back then; a quasi religious order part cenobitic and part chivalric, aiming and living for the acquisition of scientific knowledge, with a singleness of purpose and a nearly monastic rule somewhere between the Oratorian, the Philippine and the familial. To him the Academics were and were to consider and call themselves 'brothers'; and he was the first to give the example, holding them dear, extending to them every kindness and affection, doing his best to satisfy all their desires and needs, every necessity, even private, economic aid, health care, social arrangements, and collegiality.[7]

Even when, in the early months of 1604, pressure from Federico's father and intervention by the Holy Office provoke the dispersion of the young Lynceans the ideals of the Academy are kept alive. These young men, especially in response to the continuous and passionate spurring of Cesi, – who devotes himself to the drafting of 'laws, constitutions, and by-laws' for the Academy – will never fail in their tenacious attachment to that primitive project, to that ideal of 'lynceality' which indicated a common way of feeling and understanding, an analogous conception of scientific research. Splendid testimony of this is contained in a letter from Cesi in Rome to Stelluti in Fabriano in July of 1604, in which he encourages all of their companions, assuring them that the storm would soon pass, and exalts the principles and obligations of 'lynceality', which is to say the obligations of moral probity, of communal research, equally distributed among speculation, made vigorous with the instrument of mathematics, and observation of nature.[8]

There is no doubt that, from 1611 on, Cesi's ideals, eminently expressed in the letter to Stelluti, are given a decisive imprint by Galileo's participation in the Lyncean community. Their relationship is certainly

[7] G. Gabrieli, *Ancora di Josse Ryke (Giusto Ricchio) panegirista e encomiatore ufficiale dei Lincei defunti nella prima Accademia*, in *Contributi*, vol. II, p. 1166.

[8] Cf. Federico Cesi to Francesco Stelluti, Rome 17 July 1604, in *Carteggio*, pp. 36-41.

one of reciprocal influence, leading to the establishment of an immediate commonality of philosophical and scientific interests. Galileo in fact appreciates and endorses the working methods and research approach of the Academy; he takes comfort in Cesi's organizational ability and political and cultural effectiveness, while his own participation provides new impetus to their concrete research.[9] With Galileo's contribution, through his prestige and authority, the Academy has the possibility to begin anew, or better to achieve remarkable growth, to acquire a precise identity, especially with regard to its scientific program;

> In place of the primitive projects and still confused aspirations of the Lynceans, Galileo provides clear and precise objectives, concrete programs, and a working method that is absolutely transparent.[10]

In effect Galileo's long battle for the affirmation of the Copernican system is conducted in a climate of collaboration with the Lynceans, who are firmly convinced, following the publication of *Sidereus nuncios* (The Starry Messenger), that seeing 'the new things of the heavens' is 'truly the office of the Lynceans'. And the Academy shares the drama that accompanies Galileo in his defense of the Copernican system. Still exemplary, from this point of view, is the meeting of 24 March 1616 during which the Lynceans solemnly express their solidarity with Galileo after his admonition by the ecclesiastical authorities and drastic measures are taken with respect to Luca Valerio, who does not share the position of his companions.[11]

This is certainly one of the most significant episodes for understanding the nature of the intellectual commitment of the 'studious company'. Clearly, the decisions taken with respect to Luca Valerio are also meant to serve as an admonition with regard to future actions that might run counter to the objectives for which the Academy had been constituted, but above all they confirm that among those objectives, the most fundamental is the freedom of confrontation and debate, in other words, freedom of research. Just a few months before that dramatic session Cesi

[9] On this, see A. Alessandrini, *Galileo Galilei Linceo. Origini cattoliche dell'Accademia*, in 'Studi Cattolici', 1965, 3, pp. 35-44; Id., *Documenti lincei e cimeli galileiani esposti nella mostra organizzata nella Biblioteca Accademica*, Roma 1965, pp. 145-229; R. Morghen, *Galileo e l'Accademia dei Lincei*, in *Galileo Galilei. Celebrazioni del IV centenario della nascita*, Roma 1965, pp. 131-143; R. Westfall, *Galileo and the Accademia dei Lincei*, in P. Galluzzi (ed.), *Novità celesti e crisi del sapere*, Firenze 1984, pp. 189-200.

[10] G. Olmi, *op. cit.*, p. 223.

[11] Cf. G. Gabrieli, *Verbali delle adunanze e cronaca della prima accademia lincea (1603-1639)*, in *Contributi*, vol. I, pp. 335-338.

reminds Galilei that the underlying question is not whether all of the Lyncean companions are 'Copernicans' but the effort to safeguard the fundamental principle for which the Academy had been born, 'the freedom to philosophise *in naturalibus*'.[12]

In the summer of 1630, having completed his *Dialogue on the Two Chief World Systems,* Galileo naturally decides to entrust it to the zealous care of Cesi to obtain the ecclesiastical *imprimatur* and publish it under the auspices of the Academy. But Cesi dies suddenly and prematurely on 1 August of the same year. This painful event abruptly interrupts that period of fervid activity of the Lynceans which had followed the election, in 1623, of Pope Barberini (Urban VIII). It seems very likely that Cesi's death deprives Galileo of a decisive source of support, because during the dramatic events of 1633 the solidarity of the Lynceans withdraws into the background and, in the absence of the Prince, the old friendship with Urban VIII cannot save Galileo from the accusation of violating the prohibition of 1616, of not having taken account of the 'precept' of Cardinal Bellarmino: 'It is very probable', writes Alessandrini,

> that if the 'Dialogues' had been published under the care and auspices of the Academy, if Federico Cesi had been able to handle the situation with his influence and prestige, perhaps things might have gone differently.[13]

Cesi's death, in fact, provokes the dissolution of the Academy and puts an end to the brief parabola of its history as an organized institution. Francesco Stelluti, Cesi's fraternal friend and 'procurator' of the Lynceans, does the impossible to save at least the cultural patrimony of the Academy, the fruits of its intensive activity left in an unfinished state. He does his best to give some kind of order to Cesi's notes prepared for works left unfinished or just barely outlined. Above all, after having published under Lyncean auspices a *Treatise on Fossilized Mineral Wood*, he devotes himself and all his energies to completing the glorious publication of the so-called *Tesoro messicano* (Mexican Treasure), justly consid-

[12] Federico Cesi to Galileo Galilei, 7 March 1615, in *Carteggio*, p. 489. Helpful considerations on the attitude of the Lynceans toward the Copernican system are contained in L. Conti, *Francesco Stelluti, il copernicanesimo dei Lincei e la teoria galileiana delle maree*, in C. Vinti (ed.), *Galileo e Copernico. Alle origini del pensiero scientifico moderno*. Assisi 1990, pp. 141-236.

[13] A. Alessandrini, *Originalità dell'Accademia dei Lincei*, op. cit., p. 157; also cf. the interesting observations of G. Olmi, *op. cit.*, pp. 209-210.

ered the most exemplary fruit of the Lynceans' collegial work and research. The definitive edition of this monumental work is issued in 1651 and concludes with the *Tabulae phytosophicae* by Federico Cesi, the first draft of the *Theatrum totius Naturae*, a project for an encyclopedia of nature which was the heart of the Lyncean program but which the premature death of the Prince had made it impossible to carry out.[14]

In 1653 Stelluti dies in Rome, the last of the four founders of the Academy, and in 1657 comes the death of Cassiano dal Pozzo, one of the Academy's most interesting figures, who, after the death of the Prince, had purchased, but in a purely private capacity, Cesi's books and instruments.

These fleeting observations dedicated to the brief history of the *Accademia dei Lincei* are nonetheless sufficient to indicate the moral, intellectual, and practical commitment of its founder as well as the originality of the institution to which he resolved to give life in a complex and crucial moment for Italian and European culture in general and for scientific research in particular.

It is certainly not easy to give a balanced judgment on the role played by the *Accademia dei Lincei* in the renewal of Italian and European culture at the beginning of the 17th century. To be sure, we do not share the very reductive evaluations of Caverni or Gardair.[15]

In a period such as the early part of the 17th century, in which founding an Academy was by no means an exceptional event, and when among the large number of Academies that were then springing up in Italy the great majority were purely decorative, exhibitionist, chit-chatty, practically ephemeral and superficial,

> the *Accademia dei Lincei* stood out as a new phenomenon, markedly different from all the others, for the originality of its formulation and the seriousness of its commitment.[16]

[14] *Rerum Medicarum Thesaurus Novae Hispaniae*, Roma 1651. On the work itself see: G.B. Marini-Bettòlo, *Osservazioni e considerazioni sul Tesoro Messicano*, in *Convegno celebrativo del IV centenario della nascita di Federico Cesi*, op. cit., pp. 323-342; Id., *Un'enciclopedia di storia naturale del XVII secolo*, in L. Conti (ed.), *Medicina e biologia nella rivoluzione scientifica*, Assisi 1990, pp. 180-191. Other interesting information is found in A. Alessandrini, *Francesco Stelluti e l'Accademia dei Lincei*, in *Francesco Stelluti linceo di Fabriano*, Fabriano 1986, pp. 114-128.

[15] Cf. R. Caverni, *Storia del metodo sperimentale in Italia*, Firenze 1891, vol. I, p. 1; J.-M. Gardair, *op. cit.*, *passim*.

[16] A. Alessandrini, *Originalità dell'Accademia dei Lincei*, op. cit., pp. 79-80.

The Lyncean commitment belongs to a moment of transition, to a season of cultural renewal that only later will succeed in liberating itself from a magical vision of reality and culminate in the triumph of mathematical reason. One might well subscribe to Vasoli's observation that the *Accademia dei Lincei* is the most celebrated 'example' characterized by a growing attention for philosophical and scientific 'novelties', by a modern conception of research and knowledge more and more in conflict with traditional models; it is, in sum, the example

> which can best help to understand, at the same time, the many motifs of continuity and discontinuity operating within a culture lacerated by profound crises and, nevertheless, conscious of having arrived at a decisive turning point.[17]

The Lyncean project presupposes a new concept of scholarship, a new definition of man in his role as researcher free from any kind of authority and restriction, from all undue cultural, political, and economic influence. This cultural, but at the same time methodological, opening up impels us to think that the underlying idea of the *Accademia dei Lincei* is

> the happy anticipation of future scientific organisms (such as the English Royal Society) – the idea, that is, of a scientific community industriously cohesive in its confrontation with the outside world and totally animated by an authentic passion for the discovery of truth.[18]

Today we are still lacking, despite the research of Gabrieli, Alessandrini, and others, an overall analysis of the experience of the first *Accademia dei Lincei* for a decisive historical evaluation of its role in the great cultural shift of the 17th century, and specifically, in the organization of a new idea of culture based on science.

For our part, we will limit ourselves in the following pages to an attempt to capture the programmatic originality of the project of Cesi and the Lynceans, the epistemological and ideological peculiarity of their method, referring exclusively to its constitutional speculation traceable specifically in two fundamental documents: the *Lynceographum*, begun in 1603 and the fruit of a collective elaboration, and *On The Natural Desire*

[17] C. Vasoli, *La cultura delle corti*, Bologna 1980, p. 115.

[18] A. Asor Rosa, *La figura di Federico Cesi nel quadro della letteratura scientifica tra '500 e '600*, in *Convegno celebrativo del IV centenario della nascita di Federico Cesi*, op. cit., p. 58. Still more explicit is R. Morghen, *Galileo e i lincei*, op. cit., p. 132; along the same lines see also G. Montalenti, *Introduzione*, in *Convegno celebrativo del IV centenario della nascita di Federico Cesi*, op. cit., p. 27. For a contrary view see J.-M. Gardair, *op. cit.*, pp. 1310-1311.

for Knowledge, a speech delivered by Cesi to a meeting of the Lynceans in January 1616 which encapsulates, on the other hand, the essence of the ideology underlying the enterprise of the founder of the Academy.

2. *The* Lynceographum *and the Laws of the Academy*

From the outset, the Academy was organized as an officially structured community which required, at the moment of induction, the signing of a declaration of loyalty to the ideals of the institution. The official record of these declarations was to be found in the *Albi Lincei* (Lyncean Registries) which contained the lists of the autograph signatures of the members, written in Latin and arranged in chronological order of induction. The registries were customarily preceded by the *Proponimento Linceo* (Lyncean Resolution), a condensed statement of the Lyncean commitment, which was to be clarified and spelled out more fully in the *Lynceographum*.[19]

First of all, the Resolution affirmed that the acquisition of Wisdom was to be preceded by a profound self-examination: 'that each should know himself by meditating deeply on the many errors and the misery of human things'. These consideration of a moral nature were followed immediately by precise methodological indications for its attainment: 'watchful discipline', 'precise methods', 'a labor of association'; these are the characteristics of a 'well-structured assembly', of a 'philosophical militia'. And if one of the conditions of scholarship is living a life of study segregated 'from the contagion of the common herd', there is nothing strictly private or individualistic about approaching the 'mysteries of Wisdom' and 'taking pleasure in those', which on the contrary presupposes a commitment

> to conserving among ourselves benevolence, reciprocal custom, and the bond of a sincere loyalty; to increase common goods; to profess the Lyncean name in all of our works of study and write it in our publications.[20]

These intentions, reduced here to the dry formula of an oath, are reiterated, developed, and refined, in the *Lynceographum*, a sort of programmatic charter elaborated in several drafts, in which are enunciated the

[19] For a detailed analysis of *Proponimento* see A. Alessandrini, *Originalità dell'Accademia dei Lincei*, op. cit., pp. 99-104.

[20] Cf. F. Cesi, *Il natural desiderio di sapere – The Natural Desire for Knowledge*, Extra Series 18, The Pontifical Academy of Sciences, Vatican City 2003, p. 89.

ideals of the Academy, a truly revolutionary method of research and study, and in which are delineated, 'with well-nigh utopian precision' (Gabrieli), the structures and the operational modalities of the institution.

The title itself is a synthetic expression of the content of the work: '*Lynceographum, quo norma studiosae vitae Lyceorum philosophorum exponitur*'.[21] The opening lines of the text state immediately that this 'norm' is to constitute the rigorous rule which regards an 'academy', a 'class', a 'college', of scholars who, by helping one another, must dedicate themselves ascetically to scientific research, emphasizing at the same time that

> the objective of the *Accademia dei Lincei* is not only to acquire knowledge and wisdom, by living together uprightly and piously, but to diffuse them among men, by voice and with writings, peacefully, without bringing harm to anyone.[22]

Already there clearly emerges an initial aspect that distinguishes the Lyncean commitment from that of the other academies: a serious scientific commitment that has at the same time a public pedagogical relevance which aspires not only to the cultivation of knowledge but also to its divulgation, '*voce et scriptus*'. The further emphasis that such divulgation must come about 'peacefully, without bringing harm to anyone', distinguishes the 'philosophical militia', the Lyncean 'order' from all those para-military chivalric orders, which then still had a considerable influence among Catholics. The Lynceans declared themselves 'cultivators of peace and the public good (*pacis et pubblici boni cultures*)'.[23]

With regard to the idea of wisdom itself, what emerges from the *Lynceographum* is a very democratic concept of wisdom compared to the aristocratic approach of the '*antiqui sapientes*', who believed the common people unworthy of receiving the fruits of knowledge, of enjoying the sweet fruit of philosophizing. The Lyncean view was not based on an aprioristically acritical attitude toward the past but on a more open conception of culture that explicitly recognized the contribution of the Christian experience.[24] It is indeed knowledge, and nothing else, that distinguishes the wise from the common herd; it is the study of science that can take any man whatever and make him resemble the angels.

[21] Our commentary is based in part on: G. Olmi, *op. cit.*, pp. 189 ff.; A. Alessandrini, *Originalità dell'Accademia dei Lincei*, op. cit., pp. 89-99.

[22] *Lynceographum*, c. 1, p. 3.

[23] On this see A. Alessandrini, *Originalità dell'Accademia dei Lincei*, op. cit., p. 93.

[24] *Lynceographum*, c. 61, p. 78.

Judgments as to the individual sciences must be read within this conceptual frame. In the first place the invitation to abstain from the study of theology and jurisprudence[25] but, above all, of history and politics.[26] This invitation, together with the recommendation of prudence and impartiality with respect to political and religious authorities, must not be interpreted as an attitude of bass servility, shameless courtliness, insipid conformism, but rather as a practice guided by a discerning prudence, by a line of conduct aimed first of all at ensuring the survival of the institution itself in the threatening climate of the Counter Reformation, at a moment in which the political and religious authorities seem bent on erecting obstacles to any attempt at cultural renewal. These prescriptions of the *Lynceographum* are direct expressions of the founder's precise sense of measure and fine political realism, of his lucid capacity to read the political and religious context of his time, of his attention for reasons of State. The caution and prudence of Cesi and the Lynceans takes on the connotation, truly precursory, of a defense of the freedom of research, which not many years later would be the chief concern of scientific institutions such as the Royal Society and great thinkers like Descartes.[27]

As concerns the other sciences, having underlined the utility of philosophy and language study, all attention is then focused on the natural sciences and mathematics.

> The Lynceans shall dedicate themselves instead, with alacrity and fervor, to the great field of Philosophy, to studying the most hidden recesses of Nature in order to penetrate her most intimate secrets. They shall also address themselves to all of the Mathematical disciplines and seek to apprehend exactly every aspect of them.[28]

Above all else the most exalted quality of these sciences is their *publicity*, both in the sense that scientific experiences as such must be public and in the sense of their public utility: 'They shall do public experiments in Medicine and Mechanics for public utility'.[29]

At this point the *Lynceographum* presents an explicit and decisive clarification with regard to the Lynceans' relationship to the esoteric sciences, and specifically with regard to alchemy:

> Furthermore, in regard to that part of Chemistry, which concerns itself with the lucrative transmutation, fission, or alteration of

[25] *Lynceographum*, c. 46, pp. 68-69.
[26] *Ibid.*
[27] On these themes see the splendid pages of G. Olmi, *op. cit.*, pp. 192-209.
[28] *Lynceographum*, c. 47, p. 69.
[29] *Lynceographum*, c. 47, p. 70.

> metals and at the same time aims to discover the arcana of Nature, we must conduct ourselves in such a way that there be for our part no commerce (*commercium*) with the many cheats and pseudo-chemists who carry on such activities; no confidence shall be granted them. If on the contrary experiments are to be carried out for a more profound knowledge of the arcana of Nature, such experiments shall be performed with caution, under the supervision of the Prince, so as not to bring us any disgrace.[30]

Although the Lynceans, at the beginning of their institutional experience under the influence of Heckius and della Porta, participated with interest in studies of astrology and alchemy, they already distinguish, on the level of methodology, between serious research, which aims at a 'profound knowledge of the arcane of Nature', and the pseudo-science of the charlatans, who dedicate themselves to the 'lucrative transmutation, fission, and alteration of metals'.[31]

The above-mentioned communal ideology of the Academy is clearly evident in the insistence with which the *Lynceographum* underlines that all scientific research, to be such, must be characterized by collegiality and community, must be based, that is, on the reciprocal and fraternal collaboration of the individual scholars. Science is in its essence communicable and he who is disposed to communicate to others and receive from others is wise. Every one who is 'maestro of his disciples shall be a disciple and co-disciple'.[32]

The method outlined in the *Lynceographum* demands, therefore, a total predisposition on the part of its adherents toward the community; demands brotherhood, collegiality, a communal association which leaves no room for other commitments, public or private. From this point of view, the rules prohibiting Lynceans from contemporaneous membership in a religious order or from the possibility of marrying[33] do not seem overly restrictive. Nor is one surprised by the extreme rigidity and selectivity of the rules of cooptation or by the emphasis placed on the virtues that should be part of the cultural baggage of every Lyncean, that is, of those

[30] *Lynceographum*, c. 46, p. 69.

[31] On this argument see M. Partini, *I primi lincei e l'ermetismo*, in 'Rendiconti dell'Accademia Nazionale dei Lincei', Classe di Scienze Morali, Storiche e Filologiche, sez. VIII, vol. XLI (1987), fasc. 3-4, pp. 59-89.

[32] *Lynceographum*, c. 51, p. 71.

[33] *Lynceographum*, cc. 65-66, pp. 80-81.

men 'worthy' of such 'business': they must remain far from worldly cares, obliged to maintain conduct that is prudent and in the most complete contempt for the pleasures of the flesh,

> upright and suited to discipline; healthy in body and mind; lovers of intellectual activity; inclined to silence and collectedness; disdainful of useless grandiloquence; courageous, intrepid, but alien to brawling and altercations; loyal and humble; obedient towards superiors; industrious and diligent; not greedy, nor lavish, nor avaricious. But above all chaste.[34]

They must live 'in peace, quiet, concord, with no ire, envy, or desire of emulation', they must 'concentrate all their efforts with utmost alacrity', composed of 'study', of 'discussion', of, that is, communal work.[35]

Equal attention is focused on the question of the places in which to organize research: 'The induction of subjects shall be followed by the establishment of places'. The necessity of building suitable residences for the institution is clearly expressed in the *Lynceographum*: 'Lyceums, that is the domiciles of the Lynceans, shall be built in suitable places'.[36] The plan is grandiose, so grandiose in fact that it would later prove to be unfeasible. Part of Cesi's 'utopia', in any event, is the idea of internationality, even the universality of the institution, which provides for the organization of Lyceums in various cities in the different parts of the world. These Lyceums, or local branches of the Academy, must be economically self-sufficient but above all they must be places suited to research, and thus outfitted with museums, libraries, scientific laboratories, observatories, botanical gardens. They must ensure the opportunity for meditation and a communal life for academy members in the local area, but they must also be places of hospitality for the confraternity, inasmuch as travel, along with meditation and contemplation, is considered essential to scholarship and to the continual expansion of experience.

The concluding section of the *Lynceographum* clarifies the reasons for which the institution has chosen the lynx as its emblem:

> The Lynx is an animal endowed with a very powerful sharpness of vision and an astounding capacity to penetrate to the interior of

[34] A. Alessandrini, *Originalità dell'Accademia dei Lincei*, op. cit., p. 96; cf. *Lynceographum*, cc. 5-6, 75-78, pp. 10-13, 89-93.

[35] *Lynceographum*, cc. 54 ff., pp. 74 ff.; on the criteria for induction cf. the letter from Federico Cesi to Galileo Galilei, Rome 11 May 1613, in *Carteggio*, p. 253.

[36] *Lynceographum*, c. 71, p. 85, cf. cc. 71 ff., pp. 85 ff.

> things. Their name itself indicates the desire of the Lynceans, of each and all, to enter into the admirable properties of things and into the arcana of Nature.[37]

The Lynceans' motto was '*sagacious ista*' in reference to the lynx, but it connotes not only and not primarily a refinement of bodily vision, of the 'brain-eye', which the Lynceans will nevertheless actuate with the aid of the spy-glass and the telescope, but also of the wholly intellectual capacity ('in the mind') to penetrate the secrets of nature. Stelluti underlines how there is implicit in the choice of the lynx a completely modern conception of knowledge, understood contemporaneously as description and intellectual compression, as observation but also as theoretical interpenetration.

> Having elected it, let it be a stimulus, and continual spur to remind us of that sharpness of vision, not of our bodily eyes, but of our minds, that is necessary for natural contemplations, which we profess.[38]

The 'utopian' character of the project contained in the pages of the *Lynceographum* has been noted many times: 'It is interesting to note that the Lynceans', writes Alessandrini,

> in their *Lynceographum*, trace the features of a most learned and most happy human community similar to the *New Atlantis*, Bacon's imaginary island, in which the new science, with the dominion of nature and the renewal of society, would be able to achieve the *regnum hominis*. In this respect, the Lyncean ideal can also be associated with the *Utopia* of Thomas More and the *Città del Sole* of Campanella, which present evident analogies with each other.[39]

But in Alessandrini's view, quite rightly, these comparisons, if drawn too closely, 'constitute a forcing of reality'. 'Federico Cesi', Alessandrini continues,

> was an innovator and an anti-conformist; he was, however, neither a revolutionary nor a visionary. He did not aim to overthrow the system, but neither did he intend to seek refuge in a dream of evasion. He attempted (and in large part succeeded) to create for himself and for his confreres, united in the Lyncean community, a space of liberty [...]. The 'Cesian Utopia', if you will, reveals itself as an ambition often vast perhaps, but not absurd or imaginary. The 'Lyceums' were not an imaginary island projected into the future, but real

[37] *Lynceographum*, c. 241, p. 192.
[38] F. Stelluti, *Persio tradotto in verso sciolto*, Roma 1630, p. 37.
[39] A. Alessandrini, *Francesco Stelluti e l'Accademia dei Lincei*, op. cit., pp. 32-33.

places, where real scholars could live in community to devote themselves together to the practice of science.[40]

And if the project of Cesi and his companions, while certainly ambitious, cannot be considered a pure sign of evasion, it is equally evident that the neither can the *Lynceographum* and the constitutional elaboration derived from it, be considered the umpteenth product of that normative mania that characterized the charters and by-laws of the academies up and down the peninsula. 'The *Lynceographum*, that is', writes Olmi, 'is not simply to be interpreted as the codification of a ceremonial void, as an attempt to cover, under the mantle of minutely detailed rules and regulations, the total absence of a preconceived plan of development and clearly expressed purposes'.[41] The aim of the *Lynceographum* is certainly to ensure a 'sound foundation', solid bases for the institution, with the objective of protecting it from all disruptive actions, whether internal or external; but all this, which we could call the level of organizational and normative policy, explicitly finds its strength in what Cesi repeatedly refers to as the ideal of 'lynceality', that is, an ideal of life and scholarship rigorously grounded in assumptions of a moral and epistemological order.

3. *Cesi and the Moral and Methodological Commitment of the Scholar*

It is indeed these assumptions that emerge from Cesi's speech of 1616, which make it the authentic ideological manifesto of the institution, and which explain its inclusion here in its entirety. In the speech the affirmations of the *Lynceograph*, expressed in the detached coldness of the latter's normative and constitutional elaboration, take on instead the substance of a speculative reformulation, of a solid reflection on the culture of the time, on the necessity of a new model of scholarship, on the role, the function and the responsibility of the scholar in the realization of this model.

The speech opens with an examination of the internal and external obstacles which impede the acquisition of knowledge, which is, or at least should be, for everyone, the fruit of a 'natural inclination', of an 'innate affection', and the result of the 'exercise' of reason and 'the sublime operation of the intellect'. The internal obstacles which hinder this 'so worthy inclination', are to be attributed 'to the pleasure of laziness', to the 'arts of luxury', to the 'companions of these vain amusements'. But it is above all

[40] A. Alessandrini, *L'originalità dell'Accademia dei Lincei*, op. cit., pp. 187, 190.
[41] G. Olmi, *op. cit.*, p. 191.

the anxiety for gain ('money' and 'material things'), for honors and power, that distracts man from the pursuit of knowledge and learning.[42] From here a critique, efficacious and current, of the attitude, almost common and certainly deeply rooted, that considers knowledge exclusively as a function of the success and economic utility which can come from it, and disdains those sciences, such as mathematics and philosophy, which rely on research that is truly disinterested, and which 'truly are the aim of the innate desire' for wisdom present in man.[43]

There is nothing moralistic about Cesi's analysis. It rests above all on the realistic observation that human attitudes are often influenced by the environment, by the desire for honors and gain for which the renunciation by the scholar, addicted to 'speculation', 'to business' comes to be seen as ineptitude, his activity of 'contemplation' interpreted as a spineless renunciation of the virile affairs of the world. Thus the defense of the Lyncean ideal of a life dedicated to disinterested scholarship takes on, in Cesi's speech, the tones of a melancholy reflection on the meaning of existence and on the necessity of not losing oneself in the externals that it can offer us, in the ordinary tasks and dealings, in the 'many kinds of business', in the 'comfortable and pleasurable course of life'.[44] Scholarship demands a total commitment, of 'labor', time, and assiduity which 'want the whole man'.[45] The time that scholarship requires is 'long and continuous', for which, in life, 'one must begin early and never stop', and above all one must leave behind all those influences, those 'tasks and affairs, and family occupations' which impede its regular conduct.[46]

Immediately after this, Cesi indicates, in brief passages, what should be the ideal methodological conditions for authentic scholarship.

First of all, one must have a solid knowledge of the subject through the perusal of books 'where all subjects are more fully discovered and which communicate to us the contemplation and labor of others'; but equally necessary is the concourse of maestros 'that teach us with their live voices'. In sum, in order to advance and to be 'of benefit to others', scholarship will have to be essentially interdisciplinary and communal.[47]

[42] F. Cesi, *Il natural desiderio di sapere – The Natural Desire for Knowledge*, cit., pp. 99-103.

[43] *Ibid*., p. 103.

[44] *Ibid*., p. 105.

[45] *Ibid*., p. 107.

[46] *Ibid*., p. 109.

[47] *Ibid*., pp. 107-109.

The preceding conditions are then joined by the one that cinches the modernity of Cesi's views: 'Nor is this sufficient, since, in order to do something on our own, it is necessary to read well this great, veracious and universal book of the world'; and in order to do this

> it is necessary therefore to visit its parts and exercise oneself in observation and experimentation so as to ground in these two good means an acute and profound contemplation, the first representing to us things as they are and how they change by themselves, the other how we ourselves can alter and vary them.[48]

We do not believe it is an exaggeration of the value of this statement to affirm that it points to the most profound meaning of modern science, of Galilean science, which is realized in the close connection between theoretical-conceptual elaboration and verification through experimentation.

The greater the awareness of the necessity for scholarship of an 'exquisite regularity' and 'good order in learning' the more the impatience with teaching that changes continually 'from chance and abuses and the different thoughts or caprices of teachers and customs of places'.[49] Thus Cesi strongly stigmatizes scholarship devoid of method, left completely to the whims of subjective invention, where everyone can choose one path or another, where one courses or plummets, rather than moving 'regularly forward'; where, rather than follow 'the ordinary path of the preceptor's authentic writings', preference is given to disorderly work and research, 'the hindrances of shouting, chattering, clowning, the rocky shoals of bad and immoral companions'; he is pained by the rarity of work and research done in common, conducted with the aid of 'good advice and exhortations, of conferences and the friendly exchange of thoughts and ideas', as he denounces the raging of disputes in 'which all is reduced to musicians, impresarios and printers', to 'altercations' in which 'the truth is lost rather than found', and which

> serve to demonstrate nothing except cheek and dicacity and, with all this making a big exhibition and spending thousands of conclusions, one then comes round to the end without having concluded anything.[50]

Cesi clearly and forcefully contests a culture which exhausts itself in the passive repetition of schemes from the past, compliant with the 'authority' of 'this or that ancient scholar', of 'this or that sect', inclined to enjoyment

[48] *Ibid.*, p. 109.
[49] *Ibid.*, p. 113.
[50] *Ibid.*, p. 113.

of 'things philosophized by others', of 'the fruits of other intellect', a culture which ends up reducing us to being lazy and sterile, 'philodoxers' rather than authentic philosophers, ultimately, 'privatetics', that is, 'truly deprived of science'.[51] An indictment, not without irony, of a peripateticism which, unmindful of the invitations of the maestro, closes itself up in the passive repetition of things said by 'the favorite sect and its dear maestros', deaf to the other voices and to 'the necessary reading of the book of the universe'.[52] This amounts to a serious diagnosis of the times, of a cultural climate that reveals its profound incapacity to be autonomous with respect to the past, to formulate a project that goes beyond sterile and passive repetition.

Particularly prominent in this context is the detailed diagnosis of the decline of university studies and of the figure of the university professor, which Cesi subjects to a merciless indictment. If the professors

> pretend or possess public lecture, they seek always with new arguments to acquire great name and authority in order to attain or maintain it, and their aim is more in appearing than in being, and at having fame of doctrine rather than knowledge.[53]

Their concern is not so much the search for truth but success or applause from their students, the approbation of the dominant culture, 'of the reigning sect'.[54] The harshness of Cesi's attack even reaches the point of caricatured description of the behavior of the university professor of the time:

> Giving satisfaction to the students usually means such a desire to have a reputation for benevolence that, throwing off all magisterial authority, one competes with them in games, pranks, vain entertainments, or better, they are received with cheery banquets and farcical conversations and from superior one becomes even inferior to them to the point of going to receive them at home and taking them to the lesson and then taking them back and similar compliments and ways belonging more to courtship than to study and as alien to the acquisition of knowledge as anyone can consider.[55]

[51] *Ibid.*, p. 115. The antiperipatetic slant is certainly one of the characteristic points of the Lyncean program. An in-depth analysis of the anti-Aristotelianism of the Lynceans has been done by L. Conti, *Giuseppe Neri, un matematico aristotelico all'Accademia dei Lincei*, Roma 1990, especially pp. 29-54.

[52] *Ibid.*, p. 115.

[53] *Ibid.*, p. 121.

[54] *Ibid.*, p. 121.

[55] *Ibid.*, p. 121.

The university chair, more than a position of independent research, is the place of 'courtliness', where 'one seeks the grace of the master and of the entire court'; the professor, instead of the 'honored rank of philosopher' falls into 'the most vile role of the parasite, clown, or at least adulator'.[56] Thus he spends his time in the antechamber of the prince, spitting out sentences and witticisms in time, seeking the admiration 'of those who ordinarily know little' and 'the more the person knows how to banter, mock and deride the more learned he is reputed to be'.[57] Cesi concludes this ironic description of the chaired professor of his time like this:

> Of concepts therefore, and similar propositions he tends more to provide himself than with science, and passes his time in accompaniments and compliments, not in lucubrations; passes all the more as he has to do battle with the envy which from the grace and favors of the prince ensues immeditely and copiously, nor is there little to do with knowing how to shield and defend oneself so that for the satisfaction of the good inclination he can work very little.[58]

If this is the level of university faculty, the status of the culture of teaching suffers in turn. Students encounter no difficulties in attaining a university degree,

> as one sees it indifferently crowning all those who finish the course without any regard whatsoever either for how they arrived there, or whether limping or walking straight.

The degree itself comes to be considered as the ultimate terminus of scholarship,

> comes to be placed as a goal and a terminus, ordinarily, to the studious labors of each, either because he doesn't believe there is anything else to know, or because he doesn't see any other grade of approval in literature;

attainment of the 'doctorate', more than marking the beginning of further studies 'truncates for many the way of knowledge'.[59] Yet Cesi is convinced that the means for investigating the 'great field of knowledge' are not lacking. But the great work of 'contemplations' and 'lessons' is not sufficient unless account is taken of 'the end for which one studies', that is, disinterested knowledge and not 'gain, honors, favors and comforts'.[60]

[56] *Ibid.*, p. 121.
[57] *Ibid.*, p. 123.
[58] *Ibid.*, p. 123.
[59] *Ibid.*, p. 115.
[60] *Ibid.*, p. 119.

Most scholars pursue those activities that are cultivated exclusively because they are the source of professional gain or power; medicine 'for the public and private practice and the collection of the daily stipend house by house', law for 'governments and offices and ministries at the service of princes and retainers and procurations'.[61] While the sciences, which 'are not breadwinning activities', such as 'the great philosophy, mathematics and the philological and poetical eruditions', those which 'are best able to satisfy the native desire' which 'give us the most cognition and bring us more perfection and ornament', are 'the most abandoned and derelict'; those 'very few' who remain to cultivate these sciences 'propose either to attain a public chair with stipend or a place of maintenance under some prince'.[62]

This portrait of university studies is truly desolating. The project of the Lyncean Academy will be to represent an alternative to an antiquated model of university teaching. The *Accademia dei Lincei* thus proposed as its objective to move beyond the by now old, codified, and crystallized cultural model of the University.

Cesi is of the opinion that it is time for a change. Above all,

> knowing the small and defective power of the solitary and divided and the strength of well-ordered unions and conspirations, with well-regulated congregations and assemblies well furnished with both aid and counsel,

he indicates the need to change the method and organization of research in a clearly communal direction, the necessity of an institutionalized organization, taking as examples 'the happy successes of the particular militias, though small'. Cesi has in mind the idea of a private organization, not very large, but 'vigorously united' which binds the members to a severe program of organization and research. He does not deny that the Universities, the Colleges and Seminaries, and above all 'the private Academies' were born for this purpose, but he bitterly observes that so many 'orders and assemblies' are often 'addressed to other ends and ideas', or have not

> 'provided for it sufficiently or pursued those advances that their institutors pretended, giving in for the most part to current abuses and more common ends'.[63]

[61] *Ibid.*, p. 119.
[62] *Ibid.*, pp. 119-121.
[63] *Ibid.*, pp. 123-125.

In the Academies, even the private ones, there is no communal scholarship, the 'assemblies' do not have that 'strength of union' that should characterize scholarship but are exclusively aimed at the conquest of the title of doctorate, bureaucratically dominated by formal teaching and thus characterized by 'the din of the uncivil applause and of the bells and hooting' from adulating and bored students.[64]

Even in the more serious Academies, those in which time is employed 'in rich and useful lessons' rather than in 'vain and pompous gossip', 'in the good and useful of philology and poetry rather than sonnets, madrigals, funny tales and comedies', a lesser role is assigned to the 'scholarly exercises' of mathematics and natural philosophy.

> Just barely in the public schools there remains a little corner, the most remote, the most solitary, the most easeful, with no danger of crowding.[65]

Thus, in Cesi's mind, the Lyncean Academy does not wish to be another one of those many Academies where time is passed in 'useless gossip', nor to repeat that humanistic model which in the final analysis had produced results that were very disappointing; he was thinking instead of an institution with totally new objectives which would restore to favor abandoned subjects, such as natural philosophy and mathematics and, above all, which would have as its principle aim the rigorous study of nature:

> There lacking an ordered institution, a philosophical militia for such an enterprise so worthy, so great, and so proper to man as the acquisition of wisdom, and particularly with the means of the principle disciplines, to this end and with this intention the Lyncean Academy or assembly has been erected, and with a proportionate union of subjects suited and prepared for such work, it seeks, well regulated, to compensate for all the above-mentioned defects and lackings, to remove all of the obstacles and impediments and to fulfill this good desire, having proposed for itself the keen-eyed lynx as a continuous spur and reminder to procure for ourselves that acuteness and penetration of the mind's eye that is necessary to the knowledge of things, and to regard minutely and diligently, both inside and outside, in so far as licit, all of the objects that present themselves in this great theatre of nature.

[64] *Ibid.*, p. 125.
[65] *Ibid.*, pp. 125-127.

With this sure method, 'by cultivating particularly these two great fields of philosophical and mathematical doctrine' it will be satiated the 'natural appetite', and the 'cognition of nature'.[66]

We have now arrived at the part of the speech containing Cesi's proposals and it is here, as Rigobello has written,

> that Cesi can give free expression to his ideal proposal. The speech abandons its polemical tone to take on more constructive and even celebratory one.[67]

He traces with a sure hand the fundamental lines of the structure of the 'ordered institution', of the 'philosophical militia', of the 'studious company', the lines of conduct 'of the subjects suited and prepared' for truly new and modern scholarship, immune to the poisons of political ambition and mercenary interests.

Cesi intends first of all to emphasize that the 'exemption and freedom' which the Academy must ensure to its members 'from all the occupations and duties depending on the body' and from business both domestic and familial and from any kind of noise and molestation' is not required by an aristocratic attitude of the scholar with respect to worldly commitments, but rather by the knowledge that 'to elevate the mind and maintain it always valorous in its work' there is need for an absolute freedom from material influences, it is necessary that the 'studious labors' are not bent immediately and 'sinisterly' to gain, 'as occurs with physicians and lawyers'; freedom from material influences will ensure that scholarship will not 'be limited to years and terminated with the course, degree or some prefixed time, but with the very life of the subjects', and will pretend from them a commitment that is free and total.

> It will be therefore assiduous, unremitting, on the contrary always greater without any interruption or weariness; nor will it be restricted to the writings or teachings of this or that maestro, but all kinds of cognition, which by our own invention or by communication from others may come to us, will always be received and sought in an universal exercise of contemplation and practice.[68]

And here we have a restatement of the ultramodern Cesian ideal of scholarship: to start from tradition without being slaves to the writings 'of this

[66] *Ibid*., p. 127. On this point see the incisive considerations of G. Olmi, *op. cit*., pp. 187-188.

[67] A. Rigobello, *L'ideale del ricercatore in Federico Cesi*, in Id., *Struttura e significato*, Padova 1971, p. 426. Previously published in *Filosofia e cultura in Umbria tra Medioevo e Rinascimento*, Perugia 1967, pp. 605-623.

[68] F. Cesi, *Il natural desiderio di sapere – The Natural Desire for Knowledge*, cit., p. 129.

or that maestro', without 'preferring one author', 'one sect more than another', always proceeding 'ahead with our own intellects, by philosophizing with all sincerity, without any passion that could alter it in the search for truth', but above all by devoting oneself to a contemporaneous work of theoretical reflection and experimental research.

Cesi's speech then turns, with new and modern accents, to the outline of a model of scientific research based on the availability of means and collegial collaboration among scholars. A suitable place for research, in fact, will be a place equipped with 'complete libraries', with 'sure and prompt publications', with amenities for 'orderly experimentation and peregrination'. All of this, however, is not enough because the scholar also relies on 'the continuous guidance and help of elders and colleges', on 'the help of companions', who will, on the one hand, communicate the results of their own research, but above all

> with continuous, friendly, and loyal conference they will correct, refine, and enrich our ideas and awaken new ones, always helping with both counsel and advice, not least by always signifying to us what may occur in any place in literary matters or new observations or instruments or compositions or other things as though they were universally present.[69]

For Cesi, true scholarship is distinguished, besides the availability of means, by the moral and spiritual qualities of the scholars themselves: the 'hard and laborious exercise' of scholarship, the constant labor which it requires, will have its sweetest 'fruits' not in the acquisition of 'honors and offices' of 'appointments and positions', but in the memory of this communal work in which a healthy envy puts the researchers in a situation of emulation, which gives rise to 'sparks of hope for glory in everyone'.[70]

At this point Cesi's speech abandons the details of his methodological indications and turns more intimate and emotional in the exaltation of friendship, of the fraternal union in which the 'emulation' in these 'congregations', 'comparisons', assemblies' is not in fact harmful but stimulates a 'competition' that is not jealous of the success of others. Any project of community scholarship will have to ban 'all controversy outside of the natural and mathematical', will always remain subject to the 'bond of friendship and correspondence of good will'.[71] We are now at the culmi-

[69] *Ibid.*, p. 131.
[70] *Ibid.*, p. 133.
[71] *Ibid.*, pp. 139, 145.

nation of Lyncean spirituality where the ideal of disinterested scholarship, stimulated by the 'desire' for truth, and by the 'enjoyment' of peace is lived and completed in a context of fraternity, of a

> virtuous and sweet friendship, that knows how to counsel, to examine with the fullness of charity and with detachment from all calculation.[72]

Even as the speech levitates to a more spiritual tone, Cesi's programmatic concerns are nevertheless always present in his constant references to the value of communal work and to the necessity, also clearly present in the rules of the *Lynceographum*, that the participants in this work be 'selected, well-united and fervent subjects', who after 'having given up all business', with 'firm and constant will' and with 'continuous warmth and foment of companions' dedicate 'all their time and all assiduity' to the common research.[73]

The undeniable scarcity of actual realizations of these indications on the part of the Lynceans takes nothing away from the prophetic modernity of Cesi's scheme. Equally modern in our view is the Cesian affirmation of the necessity, once arrived at the acquisition of knowledge, of pursuing 'a propagation of the sciences', 'a communication and a perpetuation to the public benefit of their virtuous labors and acquisitions'.[74] Cesi reiterates that 'knowledge itself is the objective, and suffices to move'; but then adds that the 'accomplishment of knowledge' is leaving it 'not to the few [...], but to everyone and in every place and every time' and he is convinced above all that

> also to be had from these, in addition to inventions, are the fruits of heroic and virtuous actions, in the service and profit of their superiors and elders, I say, in peace, in war, and in every condition.[75]

Science is always 'at the service of the public', addressed 'to the public benefit'; it will create 'copious and certain fruits'. Cesi and the Lynceans feel strongly the need to indicate an ideal of knowledge which is not resolved exclusively on the level of mere speculative reflection. For them, as for Bacon, scholarship has no meaning unless its results are published and diffused, if they don't find concrete application, are not a function of the satisfaction of practical needs.[76]

[72] A. Rigobello, *Motivi di spiritualità nel progetto di Cesi e dei primi Lincei*, in *Convegno celebrativo del IV centenario della nascita di Federico Cesi*, op. cit., p. 68.

[73] F. Cesi, *Il natural desiderio di sapere – The Natural Desire for Knowledge*, cit., p. 131.

[74] *Ibid.*, p. 133.

[75] *Ibid.*, pp. 143, 153.

[76] *Ibid.*, p. 149 ff. On the modernity of Cesi's concept of science as a legacy for future generations see G. Olmi, *op. cit.*, pp. 215-216.

And if the 'labors' and the 'contemplations' and the 'experimentations' are therefore to have an effective 'propagation' and 'communication', this involves a binding commitment to diffuse the results of one's own research and a special interest, on the part of the Academy itself, in the activity of publishing. The publication 'with one's own writings' of research results is an obligation provided for in the regulations of the Academy and 'the Lynceans must obtain and maintain their name, their honor and their fame only with books and works'.[77] This explains why Cesi dedicates special attention to the question of the publication of the writings of the Lynceans, to the fact that the Academy must take responsibility for all of the printing expenses for the purpose of freeing the authors from all preoccupations of a material nature. Entrusted to the Academy, publication becomes an act of collective responsibility, an obligation which guarantees the authors themselves, even after their death.[78] This is a far-sighted and modern aspect of Cesi's mentality, due less to a snobbish self-satisfaction for his own productions and those of his companions than to a truly democratic conception of culture.

It must nonetheless be pointed out that, despite Cesi's insistence and zeal on this point and apart from the Galilean publications of the *Macchie Solari* (Letters on the Sun Spots) and the *Saggiatore* (The Assayer), despite the undertaking of the *Tesoro messicano* (1651), the concrete results of this project were rather disappointing.[79] It should be added, however, that one of Cesi's most innovative and original ideas was the publication of an 'epistolary volume of the celestial novelties',[80] which was to have collected the most scientifically important letters among the Lyncean correspondence. The idea of giving priority to correspondence, along with the printing of scientific works, responds to the necessity of collaboration on which is grounded the very idea of the academy itself; the idea of instituting a type of continual and periodic information, so as not to leave our companions 'disunited, scattered, hidden and with no correspondence, guidance, or counsel'.[81] The well 'regulated correspondence' would have to guarantee, above all, besides the opportunity of open contact with scholars domestic and foreign, the 'beautiful union' of the Academy, based on 'mutual aid and

[77] Federico Cesi to Francesco Stelluti, mid-April 1513, in *Carteggio*, p. 350.
[78] F. Cesi, *Il natural desiderio di sapere – The Natural Desire for Knowledge*, cit., pp. 135-137.
[79] J.-M. Gardair, *op. cit.*, pp. 175-176.
[80] Federico Cesi to Giovanni Faber, 7 July 1612, in *Carteggio*, p. 249.
[81] F. Cesi, *Il natural desiderio di sapere – The Natural Desire for Knowledge*, cit., p. 137.

advice', through which the fruits of individual 'contemplations' can be communicated to others. Concerning this point Olmi has written,

> the letter, this means of communication which, to use the words of Garin, 'faithfully reflects the tone of a culture which is breaking with the ideal of knowledge as solitary contemplation', constitutes for Cesi and his companions the unifying material, the cement of the Academy. The institution is kept alive by epistolary exchange, through it debate can develop and scholarship become effectively communal.[82]

Here we have identified for us, therefore, the characteristic traits of the academic institution, of the objective it set for itself in the identification of a new method of research based on the communal work of subjects free from any kind of external influence but at the same time bound by the assiduity and seriousness of their commitment, in addition to profound friendship, to the rigorous observation of nature and, finally, to the idea of knowledge not reserved for the few but communicable to all and directed to the profit of society. The concluding words of Cesi's speech recall, in a happily condensed form, these concepts.[83] They, as indeed his entire speech, express quite clearly Cesi's intention to safeguard the specificity and the autonomy of scientific research guaranteed by a profound moral and religious conviction as well as by a shrewd political prudence. The prudence of his positions, grounded in a conscious awareness of his situation, does not absolve him from a severe denunciation of the depressing conditions of the intellectual climate of his time, and from the indication of a new and revolutionary way of conceiving scientific research; but, at the same time, his profound moral and religious attitude can lead us to hypothesize that

> the speech under examination and therefore Cesi's institution, present the outlines of a new modern spirituality, in which Christian *pietas* is harmonized with scientific research and animates it in full respect of the methodological autonomy of science.[84]

It can certainly be affirmed that the institution of the Academy, as it emerges from its programmatic documents and Cesi's speech, finds its most profound causes and motivations not only in the events of its brief

[82] G. Olmi, *op. cit.*, pp. 218-219.

[83] F. Cesi, *Il natural desiderio di sapere – The Natural Desire for Knowledge*, cit., p. 157.

[84] A. Rigobello, *Motivi di spiritualità nel progetto di Cesi e dei primi Lincei*, in *Convegno celebrativo del IV centenario della nascita di Federico Cesi*, op. cit., p. 72, cf. pp. 72-76.

history outlined above, but above all in the necessity for an effective renewal of the pursuit of knowledge, a renewal that presupposes new methods and new subjects, indeed a renewed vision of the very idea of the function of the researcher and the scholar. In Cesi the figure of the scholar finds a balance, though difficult and delicate, between profound moral and religious motivations and new methodological and epistemological convictions. This balance is not simply the product of external behavior in conformity with the rules imposed by a wise prudence but rather that of a mature and modern consciousness of the plurality of perspectives and the levels of human behavior, of the distinction of the spheres and methods which are the very foundation of the autonomy and freedom of scientific research, of philosophizing '*in naturalibus*'.

To be sure this difficult and delicate balance, in a moment in which conflicts seem to have reached the point of a dramatic explosion, upsetting and calling into question the whole range of human experience and enterprise, will not survive the death of Cesi, with devastating consequences not only for the life of the institution, which will look on helplessly during the drama of Galileo.

This does not compromise, on the contrary it exalts, the utopian and revolutionary modernity of Cesi's ideal and program, the still contemporary essence of his community of scholarship that makes science the entire aim of its existence.

4. *Cesi and 17th Century Umbria*

One final point remains to be addressed, namely the relationships between Cesi and his academy and the Umbrian roots of the enterprise. Is it not perhaps true, as more than one critic has affirmed, that Cesi's biographical and intellectual experience, along with that of the birth and the brief parabola of the *Accademia dei Lincei*, is *a completely Roman episode*, or at any rate independent of the cultural context of Umbria in that period?

Our response is rooted in the opposite conviction, perhaps already explicit in what has been said up to now, especially in the first section: Acquasparta, and with it some of the most significant places in Umbria, the entire horizon – historical, geographical and also cultural – of Umbria at that time constitute points of reference which are indispensable, even essential to an understanding of the nature and the peculiarity of the events in question. There exists, to use Gabrieli's expression, 'a Cesian and Lyncean Umbria', to be understood in a double and dynamic conception:

as horizon and context in which to place the biographical and intellectual experience of Cesi and the first Lynceans and as a historico-cultural legacy which they have left us. 'Gathering the Cesian and Lyncean vestiges or memories' (Gabrieli) in the various forms in which they have come down to us, constitutes an act directly functional to the identification of the dynamics that have contributed in important ways to the formation of that identity.[85]

As far as concerns, *in primis*, the historico-geographical horizon in which the experience of Cesi and the first Lynceans was played out, Gabrieli's affirmations could not be any more explicit and detailed:

> Cesian and Lyncean Umbria is to be found precisely in the region's central part, which from Perugia and Terni declines toward Rome, closed within the two river valleys of the Tiber and its tributaries from the left (the Topino, the Maroggia and the Naia), between the two present day rail lines Terni-Foligno-Perugia and Terni-Todi-Perugia-Umbertide; crossed for a large part of its length, from Narni to Bevagna, by the famous old Via Flaminia and its branches (Ulpia, etc.) the road which touches the places and lands proper to Cesi, and of which two Lynceans, Francesco Stelluti from Fabriano and the Hamburghese Luca Olstenio, researched, studied, and drew the multiple, ancient traces.[86]

And further on Gabrieli reiterates that

> the largest number of Cesian and Lyncean memories are encountered in central and southern Umbria, in the valley of the Tiber and its tributaries, the Nera and the Naia, along the present day electric train line of the 'Central Umbria', that runs through Todi, Acquasparta, San Gemini, and Cesi.[87]

[85] Already in 1940, for example, Gabrieli lamented the fact that 'the official program of the upcoming Umbrian regional celebration, among various other illustrious figures, contains no mention of Federico [...] who, Roman by birth, but from a family originally from Umbria, spent considerable time in the region, in Acquasparta, Cesi, Narni, and Todi, as a youth and as a mature man, especially in the closing years of his not very long life', G. Gabrieli, *Federico Cesi Linceo nella sua 'Abadia angelica' presso Narni*, in 'Latina gens', XIX, 1941, pp. 5-10, cit. from *Contributi*, vol. I, p. 143. Gabrieli's view is shared by another attentive historian of Umbrian culture: 'The institution of one of the most celebrated academies, that of the Lynceans, is an Umbrian glory', P. Pizzoni, *Gli umbri nel campo delle scienze*, Perugia 1951, p. 227.

[86] G. Gabrieli, *Umbria cesiana e lincea. Appunti per un itinerario linceografico*, in 'Latina gens', XVIII, 1940, pp. 255-271, in *Contributi*, vol. I, pp. 177-178.

[87] *Ibid.*, p. 181.

And in the first draft of the *Tabulae phytosophicae*, as mentioned earlier the unfinished encyclopedia of nature, Cesi notes, referring to what he affectionately calls 'our Umbrian meads',

> But that land which, for much honor of plants and grace of culture, for its general configuration of rivers, of mountains and all of its soil, sprinkled with cities, castles, villas, farmhouses, resplendent with distinguished, admirable spectacles of Nature and Art, is the famous valley of Umbria which, stretching from Perugia to Assisi and Foligno, comes to a close at Spoleto, over whose middle part, facing the aged Propertian Bevagna, dominate the holiday lands of my family, in such a way that, on days of great light, we can measure and capture it all in our gaze.[88]

And this place, here so admirably described, had an influence on the cultural and sentimental education of Federico Cesi, on his idea of rich and open research, grounded in dialogue and communication, in the careful observation of nature.[89]

What we are proposing here already receives initial and immediate support from a simple reflection on the roots of the House of Cesi, in a word on the Umbrian origins of this glorious family.[90] Although in fact the Cesi achieved their period of greatest splendor from the middle of the 1400s for approximately the next two centuries, in Rome and in the orbit of the Papal court, through the accumulation of offices – some five members of the family were raised to the office of cardinal – of benefices, properties, the creation of residences in Rome and Lazio, participation in the construction of churches and the decoration of family chapels in some of the most important churches in Rome, the institution of ties, by way of a shrewd marriage policy, with the major families of the time (Orsini, Colonna, Caetani, Borromeo etc.) the Cesi actually take their name from their place of origin, that is, from the small Umbrian center situated between Terni and Acquasparta. The Chitani or Equitani of Cesi, were one of the few Umbrian families who, transplanted to Rome in the 1400s,

[88] F. Cesi, *Tabulae phytosophicae* (ed. R. Pirotta), Roma 1904, tav. 9, p. 37.

[89] *Ibid.*; also D. Freedberg, *The Eye of the Lynx*, Chicago 2002, p. 66, 69.

[90] The following presentation is based on the synthetic but precise: G. Sapori, *I Cesi e il Palazzo di Acquasparta*, in G. Sapori, C. Vinti, L. Conti, *Il Palazzo Cesi di Acquasparta e la rivoluzione scientifica lincea*, Perugia 1992, pp. 17-38. On this question see, in addition to previously cited sources, also: E. Martinori, *Genealogia e cronistoria di una grande famiglia umbro-romana: i Cesi. Con introduzione e appendice di Giuseppe Gabrieli*, Roma 1931.

succeeded in achieving and maintaining, for more than a century, a position of high prestige, and Umbria, in the 1500s and 1600s was a place of remarkable possibilities and accomplishments for the family.

In fact, contemporaneously with their rise in Roman circles, the main branches of the family established holdings in several important centers of Lazio (Cantalupo, Tivoli, Frascati, Nettuno, Monticelli etc.) and *also in Umbria* (Cesi, Acquasparta, Todi, Narni, etc.). And in these centers the Cesi 'created as continuing testimony of their presence or dominion, as places of leisure or of representation and administrative offices, villas, palaces and hunting lodges'.[91] Thereafter, the bishops of the Cesi family succeeded themselves in the manner of regular dynasties in Todi and Narni. In Todi, Angelo Cesi, head of one of the main branches of the family, ordered a complete rehabilitation of the inside of the ancient cathedral, built the grandiose diocesan palace, and sponsored various projects of urban renewal.

Among the family residences in Lazio and Umbria, certainly the most eminent was the one in Acquasparta, rising up in the center of an estate which in 1540, Giangiacomo Cesi, grandfather of Federico the Lyncean, and his wife Isabella of Alviano, had obtained from Pier Luigi Farnese in exchange for their residence in Alviano. Giovanna Sapori writes,

> After the Cesi had tried without success to acquire dominion over their place of origin, their installation in nearby Acquasparta and the growing importance attributed to the construction of a residence there reflect the very special attention of the family for those lands.[92]

We cannot allow ourselves, however, to overlook, in favor of Acquasparta and its magnificent palace, other Umbrian places admirably recalled by Gabrieli in reference to the Cesi family and, above all, to the life and cultural and civic commitment of Federico the Lyncean. Narni, for example. In the abbey of Sant'Angelo near Narni, the residence of an uncle bishop, upon whose death he would inherit it, 'Federico Cesi the Lyncean used to retire from time to time to study', and 'many of his letters were dated from this place'.[93] In one of these, dated 5 December 1617, Federico writes to his dear friend Johannes Faber:

> Neither am I wasting my time, amid books of physics, philosophy, metaphysics, utilizing in this hermitage the little time that I man-

[91] G. Sapori, *op. cit*., p. 21.

[92] *Ibid.*, p. 22, cf. pp. 22-38 for an account of the construction of the palace along with its architectural details and artistic merits.

[93] G. Gabrieli, *Federico Cesi Linceo nella sua 'Abadia angelica' presso Narni*, op. cit., p. 143.

> age to rescue from the harassments of affairs and annoyances that make it all the way up here from Rome to seek me out and bother me, in this central refuge and hiding place of Umbria (*Umbriae meditelliu m*), where I would long for nothing else than to collect myself peacefully and give myself entirely to study. As I seek in the breezes and cool recesses of Acquasparta defense against the summer heat, here I temper the rigor of the winter cold in two ways: on the inside, by melting it with the liquor pressed from the vines that grow among the rocks, the junipers and the mastic trees of these mountains; on the outside by moving myself closer to the lively fireplace ...[94]

And after Narni, the equally important Terni which, already in the 1500s had welcomed a branch of the Cesi family, one of whose descendents, Anastasio de Filiis, was one of the four founders of the Academy, and another, Angelo de Filiis, served for many years as the Academy librarian. Another founder, Jan Heckius, was often a guest of the de Filiis in Terni.

Next, as mentioned earlier, Todi; without a doubt one of the most significant places for Umbria's relationship with the Cesi family, Federico himself, and the Academy. Federico nourishes an authentic affection for Todi and a lively interest for the life of the city, as evidenced, among other things, by his acceptance of the office of Prior of the city, offered him on several occasions.[95] 'My debt to Your Lordships and to your entire city' writes Federico Cesi to the Priors of Todi on 13 April 1624,

> grows in the utmost as I enjoy continuous demonstrations of affection toward my person, which, being on all sides assailed by your great kindness, knows all the more the obligations and the continuous favors, and since all of this is indelibly impressed in my memory, so it always suggests to me with what readiness and fervor I must apply myself in the service of your entire City.[96]

[94] Federico Cesi to Giovanni Faber, 5 December 1617, in *Carteggio*, pp. 620-621, cit. and translated into Italian in G. Gabrieli, *Federico Cesi Linceo nella sua 'Abadia angelica' presso Narni*, op. cit., p. 146.

[95] G. Gabrieli, *I Cesi in Todi. Documenti cesiani negli archivi todini*, in 'Latina gens', XIX, 1941, in *Contributi*, vol. I, pp. 150-169, where particular attention is given to the Cesi's association with Todi with special emphasis on the town's long lasting and effective relationship with the various generations of the House of Cesi but above all with Angelo Cesi and later Federico. Analogous considerations are found in Id., *Umbria cesiana e lincea, Appunti per un itinerario linceografico*, op. cit., pp. 181-186.

[96] Federico Cesi ai Priori di Todi, 13 April 1624, in *Carteggio*, p. 865.

Along with those already cited we cannot fail to mention other Umbrian localities which offer firsthand testimony of the experience of the first Academy and its members. Among them is Spoleto, adoptive home of the young Heckius, who, just escaped from Deventer, his native city, was taken in by the noble family of the Gelosi. It was in Spoleto that this free spirit wrote most of his juvenile works in Italian and he would return to Spoleto after his restless peregrinations around Europe. 'Spoleto thus conserves for us', writes Gabrieli, 'multiple memories, both representative and suggestive, of the Lyncean Heckius in his early youth'.[97] After Spoleto also Foligno, to whose annual fair Fedrico Cesi came from Acquasparta or else sent his German physician, Johann Baptist Winther, to purchase supplies of local and foreign 'simples'; and then Assisi, Perugia, Gualdo, nearby Fabriano, home of Stelluti. And above all, Perugia, where, in 1601 Heckius took his university degree, where Giusto Ricchio, later a Lyncean, also studied, and where another Lyncean, the jurist and mathematician Giuseppe Neri (1586-1623) was born.[98]

More than any other Umbrian locality, Acquasparta, its Palace, and its delightful surrounding hamlets were witness to the splendid and courageous adventure of Federico and the first Lynceans. It is in his residence in Acquasparta, in the early months of 1604, that the young Federico takes refuge, disappointed by familial misunderstandings, after the brief but exulting experience of communal meditation and study following the foundation of the Academy. In 1609, when the four founders could finally meet again, their first sessions were held in the cozy rooms of the Palace. And while as early as 1614 Federico begins to think with more insistence to make the Palace the reference point for the activities of the Academy, working on creating the conditions to bring this about, it is from 1618 to 1630, in the period of the institution's most intense activity, that he decides to adopt the Palace as his habitual place of residence, confident of finding there, far away from the 'harassing business' of Rome, the necessary peace to attend to the collegial organization of the work of the Academy, to the conduct of his scientific research. The palace is transformed from princely residence to scientific institution, to a place of scholarship in which are accumulated books, manuscripts, engravings, investigative instruments. In these twelve years of industrious retreat, up to his sudden and prema-

[97] G. Gabrieli, *Umbria cesiana e lincea. Appunti per un itinerario linceografico*, op. cit., pp. 179-180.

[98] *Ibid.*, pp. 180-181.

ture death in 1630, he lovingly hosted his Lyncean companions, and 'visiting and observing' the surrounding environment, but also engaging in animated discussions in front of the fireplace – as happened during the memorable visit of Galileo in 1624 – he meditates on the ideals of the Academy and scientifically organizes his research. With the aid of an 'eyeglass' (microscope) made by Galileo himself, he conducts his zoological and botanical investigations, without, however, being able to complete the studies that were meant to lead to the realization of the grand project for the encyclopedia *Theatrum totius naturae*.

Giuseppe Gabrieli, the great historian of the first Academy, has this to say about the love of Federico Cesi for the land of Umbria and for his home in Acquasparta:

> He loved it greatly; it was there that he spent the most serene and least tormented years of his life, attentive to family cares, agriculture, domestic economy, much more so to the study of botany, to scientific meditation, to the joyful contemplation of nature, to the activities and the honor of his Academy.[99]

And in a letter to the Lyncean Johannes Faber, dated 17 April 1624, Johann Baptist Winther, physician to the Cesi family, expressed his feelings about the marvelous place surrounding the Palace of Acquasparta that was home to the meditations of the Prince and his friends:

> The eminent site of the Palace, together with the indescribable loveliness of the fertile green fields lying beneath it, terminating in beautiful mountains, seemed to me on first glance to resemble the wondrous Elysian Fields celebrated by poets, or heavenly gardens to whose beauty no painter with mortal hand, even with the most curious mixture of different colors, accompanied by the most exacting diligence not only can add nothing but cannot even approach in any way; [they] left me stunned with excess admiration, in such a way that, already tired from admiring, though still not satiated by admiring Acquasparta, I admired that earthly paradise.[100]

Traces of this industrious activity and of the methodological, moral, and spiritual ideals that guided them, are visible in the mural paintings as

[99] *Ibid.*, p. 187.

[100] J.B. Winther to Giovanni Faber, 17 April 1624, in *Carteggio*, p. 856. For the relationship between Acquasparta, the Palace, and the Academy cf. G. Gabrieli, *Umbria cesiana e lincea. Appunti per un itinerario linceografico*, op. cit., pp. 187-190, but especially Id., *Galileo in Acquasparta*, in 'Atti Accademia d'Italia', Mem. Mor., s. 7, III, 1942, pp. 1-28, now in Id., *Contributi*, pp. 195-221.

in the inscriptions, that is in the judgments and admonitions that Cesi had engraved in Latin, Greek, and Hebrew on the walls and on the frames of the doors and windows in the various rooms of the Palace; ideals effectively and synthetically summed up in the epigraph above one of the doors in the room dedicated to the 'Genealogy of the Cesi Family', home of the meetings of 1609, right after the end of the diaspora of the founders; ideals and precepts that were later taken up again and continually reconfirmed in the institutional speculations and the writings of the Prince and his companions.[101]

To be sure, these considerations of a biographical, and, more generally, of a historico-geographical nature are not the only ones which we intend to recall here to justify the placement of Cesi's writings at the heart of the Umbrian tradition of scientific-literary culture. There are more cogent reasons for this choice which demonstrate, together with the preceding ones, a further connection between Umbria, Cesi, and the *Accademia dei Lincei*, a peculiarly cultural connection related to the fact that among the initial group of the Academy's founders the most numerous component was composed of Umbrians and Marchigiani and, above all, to the fact that Jan Heckius, 'the true cultural spirit of the four founders' of the first Academy, 'emblematic figure of the Renaissance naturalist', took his degree in medicine from the University of Perugia in 1601 at the age of 22. Heckius was 'the only one among the four founders in possession of a university education', and 'he determined the intellectual curvature of the first phase of the *Accademia dei Lincei*'. Heckius constitutes the 'principal channel through which the astronomic investigations, the botanical research, and the philosophical orientations cultivated at the University of Perugia reached the Lynceans and penetrated their initial attempt to delineate a new investigative approach to natural reality'. It is through Heckius that

> the models of naturalistic investigation and the medico-astrological conceptions circulating in the Perugian institution flowed directly into the foundation of the first scientific academy in the world.[102]

[101] This question is discussed more fully in C. Vinti, *L'epigrafe di Acquasparta e gli ideali della 'studiosa compagnia'*, in G. Sapori, C. Vinti, L. Conti, *Il Palazzo Cesi di Acquasparta e la rivoluzione scientifica lincea*, op. cit. pp. 41-56.

[102] L. Conti, *Sotto il segno degli astri: lo studio perugino e i Lincei*, in G. Sapori, C. Vinti, L. Conti, *Il Palazzo Cesi di Acquasparta e la rivoluzione scientifica lincea*, op. cit., pp. 57, 63.

It can be asserted then with sufficient certainty, Conti insists, that the

> principal lines of research which characterized the cultural horizon of Umbria, and the University of Perugia in particular, constitute an indispensable reference point for understanding the genetic context and the initial phases of the tortuous itinerary of the Lynceans toward a modern model of scientific research. These directives are reflected, in fact, in the initial thematic, philosophical, and methodological orientations of the original nucleus of Lynceans, composed in large majority of Umbrians,

and

> although filtered and sometimes concealed within an irreducible rebellion against the worn and often specious tradition of formal education, there are constant references among the first Lynceans to the complex cultural map of Umbria, as well as subterranean affinities and harmonies with it.[103]

Thus it is fair to state that the Lyncean project, clearly delineated in Cesi's writings, presents itself as 'the revolutionary development' of the three lines of research conducted with the most interest at the University of Perugia: naturalistic investigation, mathematical-astrological investigation, and philosophical-methodological investigation. These three fields of research 'had found valid cultivators in Umbria and had taken root in solid traditions of scholarship' and

> it is not difficult to recognize that the physiognomy of the studies and the scientific interests of the four founding members, at the beginning of the complex and tormented history of the Academy, move precisely along these three lines of research.[104]

Certainly it cannot be forgotten that the university environment in Perugia did not grant a warm reception to the *Sidereus nuncios* (The Starry Messenger), the Galilean cosmological doctrine substantially defended, perhaps even anticipated, by the Lynceans, which refuted the Ptolemaic and Aristotelian system and proclaimed that the moon was mountainous, that the Milky Way was a formation of thousands of stars, and that Jupiter was orbited by four wandering stars. The Galilean message upset age-old beliefs, in the field of astronomy and in other sciences as well, including medicine. And in Perugia too, as in all the other cultural

[103] *Ibid.*, p. 57.
[104] *Ibid.*, pp. 59, 63.

centers of the time, on the part of many 'virtuous' scholars, a 'great outcry was raised against Signor Galilei'.[105]

It should also be recalled that Galileo immediately took it upon himself to try to recover 'the assent, not just of one in particular, but of an entire university so special and famous', without failing, however, to voice his criticism of those 'principal gentlemen of Letters in Perugia' who believe that the 'eye-glass is a trick'.[106]

Nevertheless, despite these disputes, a complete break between Galileo, the Lynceans, and the University of Perugia was avoided. On the contrary, the relationships were reinforced thanks above all to the figure of Giuseppe Neri (1586-1623), esteemed and valued scholar, himself later to become a Lyncean, 'typical exponent of the Perugian cultural environment directly known by and geographically very close to Prince Cesi'. Neri, in fact,

> is the heir to those currents of thought gravitating around the Perugian university, in which the founding fathers of the Academy had been educated and against which they measured themselves.[107]

In his chronicles of the time, Ottavio Lancellotti relates that Neri, graduated from Perugia in 1614, besides being an expert jurist, was also very well versed in theological studies and above all in mathematics, something which stupefied the 'famous Tuscan mathematician Galileo Galilei', who 'was delighted to submit his labors to Neri's censure' and 'the doctor censor noticed errors of some consideration and modestly corrected them'. The fact remains that

> Galilei accepted the correction and admired it, so much so that in order to satisfy his debt he decided to travel to Perugia to pay his respects personally to Neri, with whom he spent several hours one evening, leaving early the next morning full of satisfaction and amazement.[108]

[105] Letter from Cosimo Sassetti to Piero Dini, 14 May 1611, in G. Galilei, *Opere*, Edizione Nazionale (eds. A. Favaro et al.), Firenze 1890-1909, XI, p. 103; cit. also in L. Conti, *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., p. 11.

[106] Letter from Galileo Galilei to Piero Dini, 21 May 1611, G. Galilei, *Opere*, ed. cit., XI, pp. 105-106, cit. also in L. Conti, *Sotto il segno degli astri: lo studio perugino e i Lincei*, in G. Sapori, C. Vinti, L. Conti, *Il Palazzo Cesi di Acquasparta e la rivoluzione scientifica lincea*, op. cit., p. 70. For a detailed reconstruction of this episode see also L. Conti, *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., pp. 11 ff.

[107] L. Conti, *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., p. 3.

[108] The passages by Lancellotti, originally in the manuscript *Scorta sagra*, have been taken from L. Conti, *Sotto il segno degli astri: lo studio perugino e i Lincei*, in G. Sapori, C.

It is difficult to establish the reliability of the episode recounted by Lancellotti, but if things really went as he says, Giuseppe Neri, professor at the University of Perugia, was believed by Galileo not only to be a worthy reader of his works, but also to be their corrector and deserving of his gratitude for performing this task. Beyond the possible exaggeration with which this episode is recounted, it is nevertheless historically documented that in May of 1618, during his journey on the occasion of a pilgrimage to Loreto, Galileo passed through Perugia on the road from Florence and paid a visit to Neri. One of the purposes of this visit was to find out about Federico Cesi's plan to come to Acquasparta. The Tuscan scientist was hoping, in fact, to realize an old desire of his to visit the 'precipices of the mist' – the Marmore falls – a desire that he would fulfill, with Cesi now present in Acquasparta, six years later, in 1624.

Thus, we can identify in Neri the figure that rekindled the relationships between Galileo, the University of Perugia, and the *Accademia dei Lincei*. For this service Cesi himself will propose, in May 1621, Neri's candidacy for induction into the Registry of the Lynceans,

> *Doctorem Nerium, perusinum, legis peritum, professione quidem, ceterum insignem etiam mathematicum, et philosophum, historicum et politioribus literis addictum*.[109]

Neri was effectively inducted into the Academy on 24 April 1622.

Certainly, Galileo's condemnation in 1616 had imbued Neri with a certain caution in his defense of the Copernican system: 'In the heavens we can read much that is new, as far as I can see; but I', Neri wrote to Galileo in December 1618, referring to the appearance earlier that same year of three new comets, 'for the most part keep my eyes on the Earth ...'.[110] Nevertheless, in 1622, when Virginio Cesarini invites all of the Lynceans to read the manuscript of *Il Saggiatore*, Neri himself is invited to carry out

Vinti, L. Conti, *Il Palazzo Cesi di Acquasparta e la rivoluzione scientifica lincea*, op. cit., p. 71. A detailed reconstruction of Galileo's visit to Giuseppe Neri can be found in L. Conti, *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., pp. 5-6, 21-27.

[109] G. Gabrieli, *Verbale delle adunanze e cronaca della prima Accademia Lincea (1603-1630)*, in *Contributi*, vol. I, p. 541. On the relationship between Cesi and Neri and on the reasons for the esteem and friendship that led the founder of the Academy to propose Neri's induction into the Academy cf. L. Conti, *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., pp. 29 ff.

[110] Letter from Giuseppe Neri to Galileo Galilei, 12 December 1618, in G. Galilei, *Opere*, ed. cit., XII, pp. 24-25, op. cit. also in L. Conti, *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., p. 27.

the office, even though he did not manage to see the publication of the work, in October of 1625, having died on 8 August of the same year.

With the passing of Giuseppe Neri the Accademia dei Lincei lost a precious point of contact with the University of Perugia, although the individual members of the Academy, and among them especially Galileo, continued to see in the Umbrian cultural environment, in the very land of Umbria a point of reference, at least a place worthy of attention, as will be demonstrated by Galileo's memorable visit to Acquasparta, the Marmore falls, and Lake Piediluco in 1624. This is surely an episode which must be recalled in the present context, an episode defined by some, perhaps with a bit of exaggeration due to the recent discovery of a letter written by Stelluti which analyzes it in all its particulars, 'an extremely significant event for the birth of modern science and for the history of the Lynceans'.[111]

Indeed, with the advent, in 1623, to the papal threshold of Urban VIII, Cardinal Barberini, to whom Galileo had dedicated *Il Saggiatore*, things certainly seemed to have taken a favorable turn both for Galileo and the Lynceans. It was absolutely necessary, however, that Galileo undertake a journey to Rome to pay homage to the person of the Pontiff, and in the spring of 1624 he decides to take this necessary step, this non-deferrable duty, but he decides to pass through Acquasparta on the way in order, finally, to visit the Marmore falls. Galileo leaves Florence on 1 April 1624; from 3 April, the Wednesday of Holy Week, through Easter Monday he stays, for a necessary rest stop, in Perugia, leaving, in all probability, a copy of *Il Saggiatore* at the Augusta Library where to this day it is still conserved. After a stop in Todi, and a discussion with Giovanni Battista Guazzerini about the optics of spherical mirrors, he finally arrives on the evening of 8 April at the Ducal Palace of Acquasparta and remains there as the guest of the Prince until Sunday 21 April.

Even though we have no detailed account of Galileo's two-week stay in Acquasparta, it is known, on the basis of now available documents, the

[111] On the episode of Galileo's visit to Cesi in Acquasparta see the detailed and fascinating reconstruction in G. Gabrieli, *Galileo in Acquasparta*, op. cit. The value of Galileo's experiment at Lake Piediluco is discussed by Conti in *Sotto il segno degli astri: lo studio perugino e i Lincei*, in G. Sapori, C. Vinti, L. Conti, *Il Palazzo Cesi di Acquasparta e la rivoluzione scientifica lincea*, op. cit., p. 76; and in *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., pp. 55-60. Cf. also: L. Conti, *Francesco Stelluti, il copernicanesimo dei Lincei e la teoria galileiana delle maree*, in C. Vinti (ed.), *Galileo e Copernico. Alle origini del pensiero scientifico moderno*, op. cit., pp. 161 ff.

notes of the Cesi family physician Johann Baptist Winther, and Gabrieli's splendid reconstruction, that Galileo, Cesi, and Stelluti considered, especially during the evenings, in long and gripping discussions in front of the fireplace, the central themes of the scientific revolution, first among them that of inertial physics and the relativistic conception of motion.

During his stay in Acquasparta, Galileo did not fail to undertake his oft planned excursion to the Marmore waterfall,

> and it was indeed during this excursion that the Tuscan scientist carried out at Lake Piediluco the first relativistic experiment with heavy objects falling within a moving system of reference for which there is direct and documented historical testimony.[112]

An account of this experiment is contained in a letter written by Stelluti on 8 January 1633, in which he intended to offer a summary of the *Dialogo sopra i due massimi sistemi*.[113] In brief: to the objection of the Aristotelians who defended the immobility of the Earth partially by virtue of the experiment in which a rock thrown from a high tower falls at the foot of the tower and not far away from it, as should happen if the Earth were in motion, and to the Galilean indication in the second day of the *Dialogue*, in which it is held that in reality the rock must fall naturally at the foot of the tower because it

> has two movements, one direct in falling downward and the other transverse caused by the circular motion of the earth, whence the rock thrown by us from on high in falling downward makes almost a semi-circle because of the two movements that it has,

Stelluti adds,

> And I saw the experiment, and it is that going with Signor Galileo to Piediluco on the lake with a six-oar boat that was going very fast, and with him sitting on one side and I on the other he asked me if I had something heavy, and I said I had the key to my room, he took it; and as the boat moved along rapidly he threw the key up into the air so that I thought it was lost in the water; but, even though the

[112] L. Conti, *Sotto il segno degli astri: lo studio perugino e i Lincei*, in G. Sapori, C. Vinti, L. Conti, *Il Palazzo Cesi di Acquasparta e la rivoluzione scientifica lincea*, op. cit., p. 77; cf. Id., *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., p. 55.

[113] The letter can be read in the Appendix to L. Conti, *Giuseppe Neri: un matematico aristotelico all'Accademia dei Lincei*, op. cit., pp. 61-65: Francesco Stelluti to unknown (perhaps to Fabio Colonna), Rome 8 January 1633. For an account of the discovery of the letter, *ibid.* p. 56, n. 64.

> boat had gone some eight or ten arm's lengths ahead, with all that the key fell down between him and me, because besides going up it had also acquired from the motion of the boat the other, to go along with its movement and follow it, as it did.[114]

Beyond its extemporaneous character, Galileo's experiment as recounted by Stelluti takes on important historical, methodological, and scientific significance. It reveals first of all that some privileged places of the land of Umbria, like the Ducal palace itself, were the places in which for the first time the principle of the relativity of motion was advanced and discussed, reveals that these were the very places that witnessed the experimental baptism of the principle of relativity, 'the true keystone of modern physics'.[115]

Without exaggeration, Galileo's two-week stay in the region of Umbria, in Acquasparta, in 1624, can be considered the crucial moment of conjunction between the experience of the Lynceans and the methodological horizon of modern experimental science.

And that's not all. On his journey Galileo had in fact brought with him his 'eye-glass', that is his microscope, 'to see up close the most minimal things'. And while on that occasion, having to carry it down to Rome, Galileo did not leave the 'eye-glass' with Cesi, he did, however, send him another one, duly improved, in September of the same year. It was thanks to this same Galilean instrument, in fact, that the Lynceans became the founding fathers, as was mentioned earlier, of present day scientific microscopy. And although, as again Conti observes, 'in nearly all the universities of the time natural philosophy had not followed the investigative and methodological advances of "Lynceality"', thanks to the contiguity of their interests and experiences, 'the University, which had contributed directly to the cultural preparation of two prestigious Lynceans, would surely have welcomed and developed the legacy left by Cesi', if it were not that the controversy over the stars and intolerance had made it so that things turned out differently.[116]

[114] Francesco Stelluti to unknown, Rome 8 January 1633, in *loc. cit.*, p. 62.

[115] L. Conti, *Sotto il segno degli astri: lo studio perugino e i Lincei*, in G. Sapori, C. Vinti, L. Conti, *Il Palazzo Cesi di Acquasparta e la rivoluzione scientifica lincea*, op. cit., p. 79.

[116] *Ibid.*, p. 83.

Professor Antonino Zichichi presenting his paper ‘Galilei, Divine Man’ during the Commemorative Session, 9 November 2003

GALILEI, DIVINE MAN

ANTONINO ZICHICHI

1. Introduction

It is not an easy task to speak about a man who is defined to be *Divine* but condemned by the Church. I will start with two quotations in order to see what Galilei was thinking about God and his work.

I will then show that Galilei was considered *Divine* already during his time; he was under the inquisition of the Aristotelic Culture of that time, being considered *Divine* by authoritative members of the Catholic Church. This in the past.

Then I will show why he is *Divine* still at present and, finally, why he will be *Divine* also in the future.

Let me start with the two quotations.

1.1. *The work of God according to Galilei*

If I ask who made the Sun, the Moon, the Earth, the stars, their movements and their positions, the answer is God. The world is *His work*. So too is the Bible. The scriptures are *His word*. Here is the exact wording of Galilei (from now on, all quotations in italics are the translation in English of the Galilei writings. The reference is reported at the bottom of each page).

> *... If I ask*
> *who created the Sun,*
> *the Moon,*
> *the Earth,*
> *the stars,*

their positions and movements,
I think the response will
be that they are the work of God;
and asking
who dictated the Holy Scriptures,
I know the answer will be
the Holy Spirit,
that is likewise of God.
The world, therefore, is the work
and the Scriptures are the word
of the same God.

(Galileo Galilei, *Opere*, XV, 24)

1.2. *Galilei believed it was God who made the world*

We do not seek
that which God could have made,
but *that which*
He made.
But I ask you
if God could have made
the world infinite or not:
if He could and did not,
making it finite,
as it is de facto,
He did not exercise His power more
in making it so,
than if he had made it as large
as a pea; ...

(Galileo Galilei, *Opere*, VII, 565)

2. Past

2.1. The Inquisition Against Galilei

2.1.1. *Signor Galilei, 'Divin Uomo'*

On 18 January 1642, shortly after Galilei's death, Lukas Holste (1596-1661), a close assistant of Cardinal Francesco Barberini (1597-1679), wrote to a friend in Florence, Giovan Battista Doni:

> Today there arrived the news of the death of Signor Galilei. This is not a loss only for Florence, but for the whole world and the whole century, which from this divine man has received more splendour than from almost all the other ordinary philosophers combined. Now that the envy has placated, the sublimity of that genius will begin to be understood, and will serve as a guide for the whole of posterity in the search for the truth, so abstruse and buried in the darkness of opinions (*Opere*, XVIII, 378).

Cardinal Francesco Barberini, the nephew of Pope Urban VIII (Maffeo Barberini), was one of the three cardinals who had refused to sign the Inquisition's condemnation of Galileo Galilei in 1633. And of the three, Barberini was undoubtedly the most authoritative.

There could be no more fitting judgement of Galilei, who in seeking to understand how the world is made, had placed God at the centre of his thinking and experimental research. The prevailing culture has made out that Galilei just pretended to be a believer and was in fact an enemy of the Church. But not only was Galilei the father of science, he was also highly devoted to his Church. He tried in every possible way to make the Church understand the main aim of his research and the real significance of his discoveries. No one in the world had ever managed to discover a fundamental law of Nature, and Galilei realised that it was not easy to distinguish between the first and the second level of credibility. He had understood that the laws capable of explaining how the world is made were not written exclusively in the sky, but here in the surrounding matter. A stone was worth more than all the stars.

One of the innumerable measurements he made of such matter concerned the weight of air, an element considered essential – together with water, earth and fire – by the philosophers of the past. Starting with these four elements, they postulated the existence of a fifth element, the quintessence, as the basis of heavenly reality.

Studying air, water and other materials (for instance, lead), Galilei tried to discover some property they all shared. Density, for example. Air is less dense than water. Lead is twelve times denser than water. Galilei managed to measure the density of various substances. God made these things, thought Galilei. He began to find the first fingerprints of the Creator and no one understood him. Galilei wanted the Church to have the opportunity to announce this good news to the world.

Let me show a quotation by Galilei concerning his work on the discovery of a common property of different materials and on the so much discussed problem of the motion of the Earth.

2.1.2. *It was God who made lead heavier than water*

Galilei measured the weight of air and established that lead is twelve times denser than water.

> *... God*
> *could have made birds fly*
> *with bones of heavy gold,*
> *with veins full of living silver,*
> *with flesh heavier than lead*
> *and with small, heavy wings,*
> *and in so doing He would have demonstrated*
> *His power even further;*
> *He could have made fish heavier than lead,*
> *that is 12 or more times heavier than water:*
> *but He*
> *made the first of bones,*
> *flesh and the lightest of feathers,*
> *and the second as light as water,*
> *to teach us*
> *that He*
> *enjoys simplicity and easiness...*
>
> (Galileo Galilei, *Opere*, VII, 566)

2.1.3. *Let's not allow the movement of the Sun and the Earth to become a matter of faith*

> *Take note, theologians, that*
> *in your desire to make*
> *propositions concerning*
> *the movement or fixity*
> *of the* ⊙ [the Sun] *and the Earth*
> *a matter of faith,*
> *you expose yourselves to the risk*
> *of having eventually to condemn for heresy*
> *those who assert*
> *that the Earth is fixed*
> *and that it is the* ⊙ [the Sun] *that moves;*
> *eventually, I say, at such a time*
> *as it might be sensibly or necessarily*
> *demonstrated*
> *that the Earth moves*
> *and the Sun stands still.*
>
> (Galileo Galilei, *Opere*, VII, 541)

2.2. What Galilei Wanted the Church to do

Galilei did everything he could to stop the Church from making an error that would discredit centuries of accumulated wisdom. '*The fathers of the Church*', said Galilei, '*had wisely separated faith from science*'.

Galilei's concern was not to prove who was right in the scientific dispute, but to keep scientific issues clearly separate from questions of faith. The prevailing cultural view is that Galilei wanted to convince the Church to adopt the Copernican system he believed in, even though he knew the main proof, that of 'parallax', was missing.

There was strong evidence to support the hypothesis that the Earth was not fixed at the centre of the world, with the Moon and all the stars of the Universe circling round it. Evidence that Galilei had discovered, such as the satellites of Jupiter, the 'phases' of Venus and irregularity in the velocity of the 'planets' (from the Greek *planetes* = 'wanderer'), which displayed different properties depending on their distance from the Sun. Finally, there were the tides, which Galilei attributed to the movement of the Earth.

The key point here is what Galilei sustained, namely that nothing in science was immune to modification by subsequent discoveries, in that his science proceeded on the basis of experimental results and as such was subject to subsequent improvement.

St. Augustine (354-430) had emphasised many centuries previously that it was incorrect to link Christianity to astronomical doctrines. Galilei never questioned the Church's right to intervene, but he wanted to convince it not to resort to the authority of the Scriptures to defend astronomical theories, which had absolutely nothing to do with religion. Galilei did not want the Church to defend Copernican theory. He simply wanted the Church to steer clear of this dispute, and to follow the teaching of St. Augustine and St. Thomas (*c.* 1225-1274). Below is *a note he scribbled* in the margin of his copy of the *Dialogue Concerning the Two Chief World Systems – Ptolemaic and Copernican*.

We can say today that the Bible is not a treatise on *quantum electrodynamics*, nor can it be considered an authority on the most advanced *theoretical* propositions of our times, for example theories describing the evolution of the cosmos or the supersymmetrical theory postulating the existence of a *superworld*.

2.2.1. *Galilei cited St. Augustine, one of the fathers of the Church*

> *Note, then,*
> *what St. Augustine said,*
> *namely that one should not betray*
> *literal meaning*
> *but not be contrary to reason either;*
> *from which it follows that*
> *first it is necessary*
> *to prove with reason that which*
> *concerns the motion*
> *or the fixity of the* ⊙ [the Sun]
> *and the Earth,*
> *and then consider if it is possible*
> *or necessary to alter*
> *the meaning of the words of the Scriptures.*
>
> (Galileo Galilei, *Opere*, VII, 562)

2.2.2. *The faintest shadow*

How, asked Galilei, can one condemn a man who has done nothing other than try to decipher the logic of Creation?

> *In the reading of all my works*
> *no one will*
> *be able to find*
> *the faintest shadow ...*
>
> (Galileo Galilei, *Opere*, XVI, 215)

2.3. What Galilei Wrote on 22 February 1635

Nicholas-Claude Fabri de Peiresc in Aix, a Frenchman with a passionate interest in Galilean science, had attended Galilei's lessons in 1603 when the latter was teaching in Padua. Upon learning of the punishment inflicted on Galilei, he wrote to inform him of his intention to turn to the ecclesiastical authorities to convince them that it would be only just to pardon him. The father of science responded on 22 February 1635 (*Opere*, XVI, 215):

> ... Sir... my pleasure has been infinite... in seeing how a gentleman... of such excellent qualities sympathises with such tender affection with my state... And if my misfortunes bring such sweet things, let my enemies continue to find new stratagems, and I will always thank them. I have said... that I do not hope for any relief, because I have not committed any crime. If I had erred, I might hope to obtain mercy and pardon, because errors are things over which the prince may exercise mercy and pardon, while with someone innocently condemned it is better, in order to appear to have acted juridically, to maintain the utmost strictness; which afflicts me less than others might think, because I am constantly comforted by two things: first, that in my writings there cannot be found the faintest shadow of irreverence towards the Holy Church; and second, the testimony of my own conscience, which only I and God in Heaven thoroughly know. And He knows that in this cause for which I suffer, though many might have spoken with more learning, no one, not even the ancient Fathers, has spoken with more piety or with greater zeal for the Church than I.

If it were not for Galilei, how could we respond to someone who said to us that we are the children of chaos? Working to discover a rigorous logic that applies to both stones and stars is of extraordinary value in giving our existence the cultural dignity of being made in the image and likeness of the Creator. In fact, Galilei asked how he could have acted with 'more piety' or 'with greater zeal'. Four hundred years on, and after everything that has been said and done by the prevailing atheist culture, it is possible to recognise how true his words are.

Let me close this point by emphasizing the quotation by Galilei already mentioned.

2.3.1. *No one could have acted with more piety or with greater zeal*

How could a person who did nothing other than try to read the book written by the Creator have acted more correctly?

> *He knows that*
> *in this cause for which I suffer,*
> *though many might have spoken with*
> *more learning,*
> *no one,*
> *not even the ancient Fathers,*
> *has spoken with more piety*
> *or with greater zeal*
> *for the Church than I ...*
>
> (Galileo Galilei, *Opere*, XVI, 215)

2.4. The Truly Unique Greatness of Galilei

In history books in the millenniums to come, Galileo Galilei will be celebrated for his true role as the father of science, the one who paved the way for humanity to understand how the world we live in is made. His work was founded on *intellectual humility*, *rigour* and *reproducibility*. Most of what our form of living matter was under the illusion it had understood about the nature of the world, before Galilei managed to open the Book of Nature, proved to be completely wrong.

My book (*Galilei, divin uomo*, ed. Il Saggiatore, 2001) recounts what has never been said about Galileo Galilei, both as a man of faith and as the father of science. His greatness lies not only in his astronomical discoveries, extraordinary though these are. Just one would have been enough, and he made lots. Galilei's truly unique greatness lies in the fact that he was the first man to discover the first, fundamental signs of the Creator carved into 'vulgar' matter – stone, string, wood.

If curiosity was all it took to discover science, our Stone Age ancestors would have done so. They were extremely curious. If logical rigour was all it took, the Greeks would have discovered it. Galilei was motivated by an act of Faith in the Creator of the world. The Creator of whom he wanted to discover the imprints, these being the Fundamental Laws which govern the world.

I have no time to discuss all Galilei's achievements. The following page is a synthesis from which you can see that the three Laws of motion are not due to Newton, but to Galilei.

Furthermore, the principle of relativity is not due to Einstein, but, once again, to Galilei. Of all his achievements, I would like to call your attention to number 8. This great discovery took 300 years to be understood. The Chinese government is the only one who celebrated the 400th anniversary by printing millions of postcards, as shown on page 11.

The experiment was implemented by my friend, the Commander of Apollo 15, David Scott, on the moon. David Scott exclaimed: 'Galilei was right!'.

The fellow who convinced the Chinese government to pay tribute to Galileo Galilei is my friend T.D. Lee, President of the Chinese Centre for Advanced Science and Technology (CCAST) in Beijing.

SIXTEEN DISCOVERIES, ELEVEN INVENTIONS AND THAT'S NOT ALL...

It seems unbelievable that the same person could have been the author of so many discoveries, inventions and original ideas. One would have been enough to become famous.

Sixteen discoveries

Studying the logic of Creation on Earth, Galilei discovered: **1**) the principle of relativity; **2**) the principle of inertia; **3**) the conservation of momentum; **4**) the conservation of energy; **5**) the principle of action and reaction: for every action there is a corresponding equal and opposite reaction; **6**) that force is proportional, through inertial mass, to acceleration and not to velocity; **7**) that gravitational force is proportional to gravitational mass multiplied by the acceleration of gravity; **8**) the proportionality (and hence the close connection) between inertial mass and gravitational mass.

Studying the celestial bodies, he discovered: **9**) the mountains of the Moon; **10**) sunspots; **11**) the spinning rotation of the Sun; **12**) that the Milky Way is composed of a myriad of stars; **13**) the satellites of Jupiter; **14**) the rings of Saturn; **15**) the phases of Venus; **16**) an apparently fixed star with very low luminosity, which was in fact the eighth satellite of the Sun (Neptune).

Eleven inventions

And these are his inventions: **1**) the inclined plane to measure the acceleration of gravity; **2**) the pendulum to study the motion of bodies 'without' attrition; **3**) the escapement, in the mechanism of pendular motion, that paved the way for the era of pendulum clocks; **4**) the high resolution telescope, capable of observing structures and detailed features of the celestial bodies; **5**) the hydrostatic balance, for measuring the density of bodies, **6**) the microscope; **7**) the instrument for measuring the weight of air; **8**) the thermoscope, for measuring temperature and atmospheric pressure; **9**) a machine driven by animal power for transporting water to high levels; **10**) the 'proportional compass' for making calculations about the squaring of the circle and for resolving mathematical and geometric problems; **11**) the 'celestial clock', using the satellites of Jupiter.

And that's not all...

As if that were not enough, in studying the logic of Creation, Galilei decided that light could not have infinite velocity, and so he tried to measure it. While considering motions along inclined planes, he discovered the problem of minimum time in the fall of material bodies. Having intuitively grasped the consequences of infinitesimal calculation in the description of motion, he prompted one of his students, Bonaventura Cavalieri (1598-1647), to study indivisibles. In mathematical logic he discovered the first property of the infinite, namely that one part is equal to all. In the field of art, he demonstrated how painting, which is two-dimensional, cannot be inferior to sculpture, which is three-dimensional. What is important in art, as in poetry and music, according to Galilei, is the emotional power it is capable of transmitting, irrespective of the raw description of reality.

China celebrated a great Galilean discovery

The Chinese government paid tribute to Galilei by printing postcards to commemorate his discovery regarding the falling feather and hammer, namely the equality between inertial mass (m_i) and gravitational mass (m_g).

2.4.1. *God gave us 'news' about the logic of Creation through Nature*

... But the same God
who endowed us with senses,
reason
and intellect,
wished, subordinating the use of these,
to give us in another way
the news
with which we can grasp them ...

(Galileo Galilei, *Opere*, V, 284)

2.4.2. *The laws that underpin Nature are sources of certainty*

... as Nature is inexorable
and immutable
and indifferent
to whether its hidden reasons
and ways of operating
are or are not displayed
to the capacity of man,
because it never transgresses
the terms of the laws imposed on it; ...

(Galileo Galilei, *Opere*, V, 283)

It is thanks to Galilei that we could, from the very beginning of Science, distinguish clearly the three levels of scientific credibility. It is the first one which makes Galilei the father of Modern Science. Each level needs Inventions of new instruments, Discoveries and Basic measurements.

SCIENCE AND ITS THREE LEVELS

1st level

Invention:	•	*Inclined Plane.*
	•	*Pendulum.*
Discovery:	•	*The Law of Inertia.*
	•	*F = mg .*
	•	Action = Reaction.
	•	*The Principle of Relativity.*
Measurement:	•	*'g'.*

2nd level

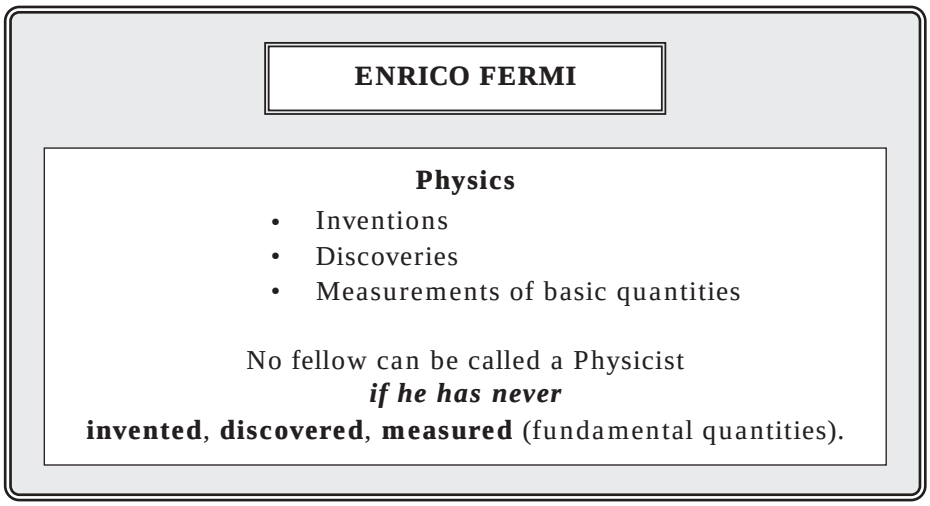
Invention:	•	*The Telescope.*
Discovery:	•	*The irregularity in celestial bodies: the Moon (craters ...); the Sun (spots).*
	•	*Jupiter's Satellites.*
	•	*Saturn's 'ears' (rings).*
	•	*The phases of Venus.*
	•	*The structure of the Milky Way.*
Measurement:	•	*The Time of the cosmic clock (Jupiter's satellites).*

3rd level

Invention:	•	*Microwave Detectors (Penzias & Wilson).*
Discovery:	•	*The Cosmic Microwave Background Radiation.*
Measurement:	•	*The Black Body Spectrum at 2.7° K.*

Following Galilei, Enrico Fermi emphasized in the 20th century that even the most advanced frontier of Physics needs – as ever – inventions, discoveries and measurements (of the fundamental quantities).

Fermi – the greatest Galilean of the 20th century – pointed out that no one should be considered a 'physicist' if he has never invented anything, nor discovered anything nor measured any basic quantity. This is illustrated in the Figure below.



With Fermi we go to the present status of Galilean Science.

3. Present

Galilei is Divine, even at present, since he gave us the correct way to be able to read the Book of Nature, telling us that the Book is written in mathematical language, and that, in order for us to understand this rigorous language, we need exact and reproducible experimental results.

3.1. *The Book of Nature is written in mathematical language*

... this grand book (the universe)
which is always open
in front of our eyes,

but which cannot be understood if first
one has not learnt to understand
the language,
and read the alphabet
in which it is written.
It is written in the language of mathematics,
and its characters are triangles, circles,
and other geometric figures,
without which it would be humanly impossible
to understand a word of it;
without which one wanders vainly
in a dark labyrinth.

(Galileo Galilei, *Opere*, VI, 232)

3.2. *Mathematical Rigour and Experimental Reproducibility*

These are the basic rules in today's Science.

It is this Galilean Science which allows us to be sure that we are not the result of chaos, but the product of a Rigorous Logic, which governs all regions of Space-Time, from the innermost structure of the proton (10^{-17} cm), to the extreme frontiers of the Universe (10^{29} cm).

Where are we
now,
just 400 years
after
Galilei?

3.3. *We are at the Planck Scale*

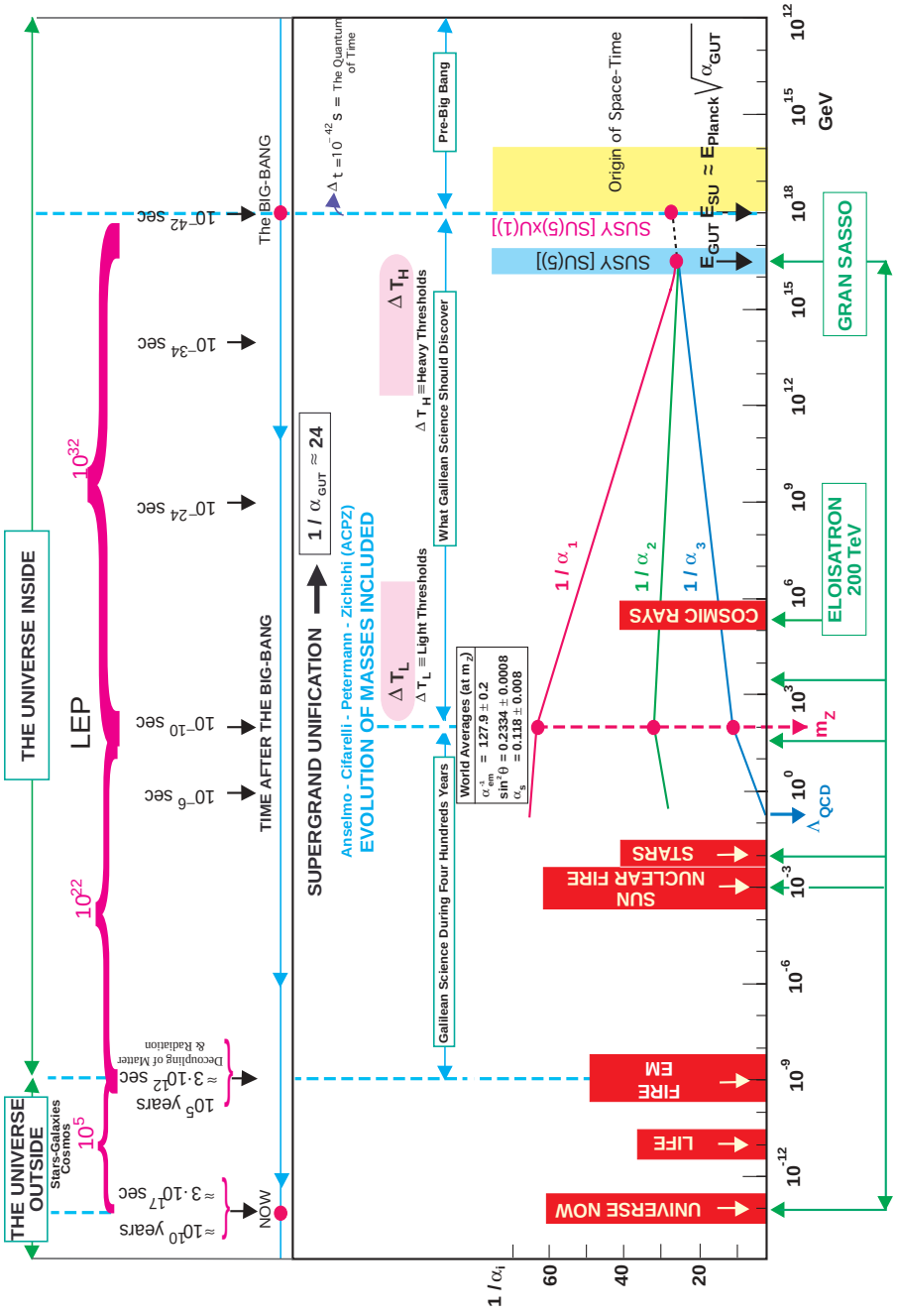
In the Figure on page 98, a synthesis of all we know about the world is shown. From the Universe now, to the Big Bang.

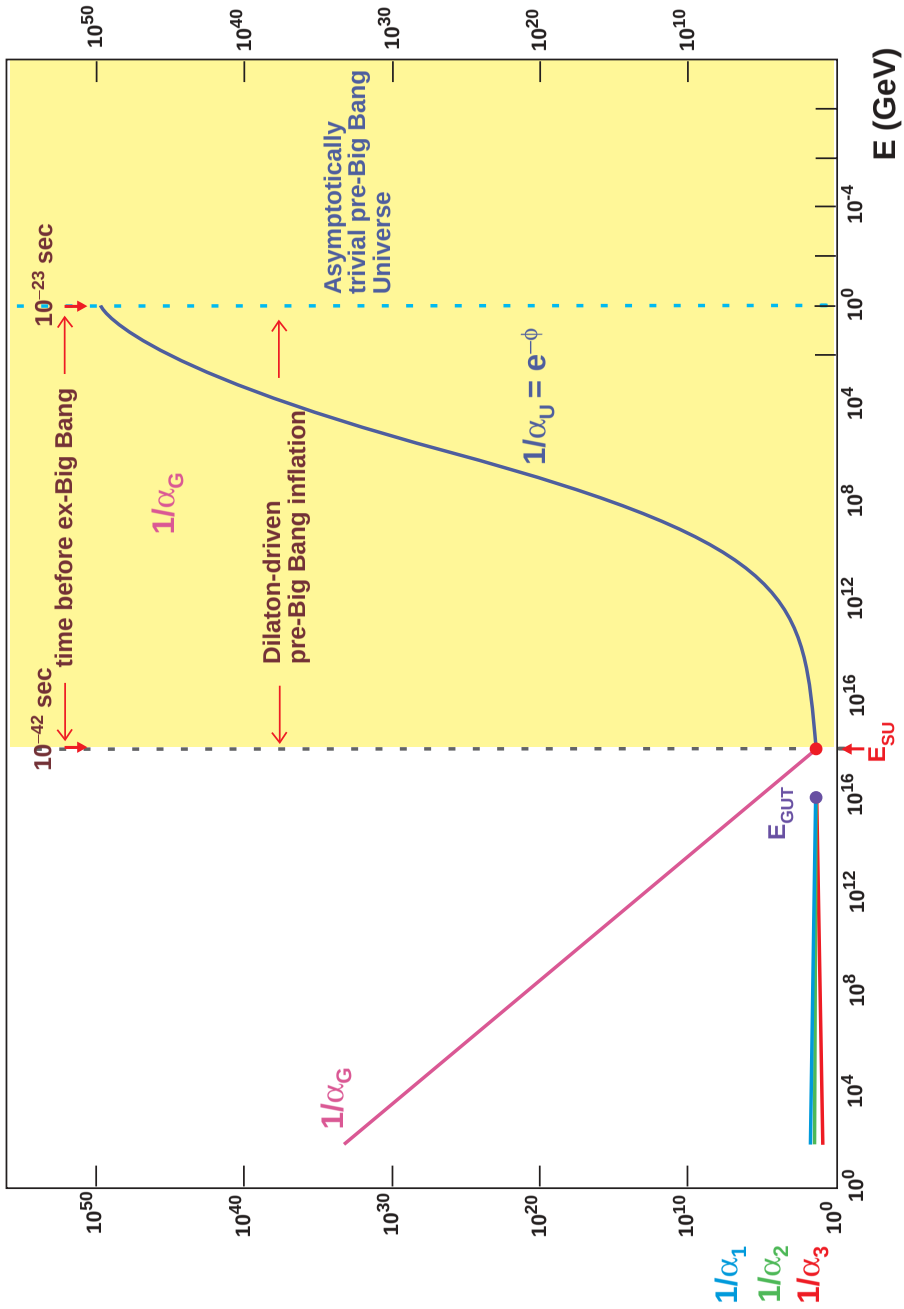
In the Figure it is indicated what Galilean Science has been able to achieve, during these 400 years. And also what we expect it will be doing

in the future. The point where the Big Bang is, is no longer considered the origin of Space-Time. This is why the physics of the pre-Big Bang is now at the centre of everybody's attention. A synthesis of this new domain of advanced research is shown on page 99, where the upper line illustrates the effect of the gravitational constant and the three lines at the bottom are the same as those on page 98, which now appear very much compressed, due to a change in the vertical scale which represents the inverse of the couplings of the fundamental forces. The three dots on page 98 are three experimental results obtained in our laboratories, here on Earth, studying the modern galilean stones, i.e. protons, electrons and neutrons. The upper part of the Figure on the same page 98 illustrates the consequences in the cosmos of our findings. Let me just give an example.

When astrophysicists speak about the origin of the Big Bang, their observations stop at the second arrow, indicating 10^5 years after the Big Bang. All phenomena which occur from 10^5 years to the smallest time distance from the Big Bang can be investigated in our laboratories, here on Earth. The experiments performed in our labs on Earth are Galilean Science of first level. It is the guide to understand the second level. Let me just give another example. Without the discovery of the neutron in 1932 by Chadwick, no one could have imagined the existence of neutron-stars. The same is true for many other astrophysical discoveries whose roots are in our laboratories. I said that, in 400 years, we went from the study of falling stones to the physics at the Planck scale. Here new phenomena are expected to be discovered.

The new physics deals with 'gravitational densities', those predicted by the Schwarzschild radii and those derived by the Planck scale. The results are shown on pages 98 and 99.


THE UNIVERSE INSIDE
THE UNIVERSE OUTSIDE
Stars-Galaxies Cosmos
10^5
LEP
10^{22}
10^{32}
$\approx 10^{10}$ years
$\approx 3 \cdot 10^{17}$ sec
10^5 years
$\approx 3 \cdot 10^{12}$ sec
Decoupling of Matter & Radiation
NOW
10^{-6} sec
10^{-10} sec
10^{-24} sec
10^{-34} sec
10^{-42} sec
TIME AFTER THE BIG-BANG
The BIG-BANG
$\Delta t = 10^{-42}$ s = The Quantum of Time
Pre-Big Bang
SUPERGRAND UNIFICATION
$1 / \alpha_{GUT} \approx 24$
Anselmo - Cifarelli - Petermann - Zichichi (ACPZ)
EVOLUTION OF MASSES INCLUDED
$\Delta T_H \equiv$ Heavy Thresholds
ΔT_H
$\Delta T_L \equiv$ Light Thresholds
ΔT_L
What Galilean Science Should Discover
Galilean Science During Four Hundreds Years
World Averages (at m_Z)
$\alpha_{em}^{-1} = 127.9 \pm 0.2$
$\sin^2\theta = 0.2334 \pm 0.0008$
$\alpha_s = 0.118 \pm 0.008$
$1 / \alpha_1$
$1 / \alpha_2$
$1 / \alpha_3$
Origin of Space-Time
$E_{GUT} \; E_{SU} \approx E_{Planck} \sqrt{\alpha_{GUT}}$
SUSY [SU(5)]
SUSY [SU(5)xU(1)]
COSMIC RAYS
ELOISATRON 200 TeV
GRAN SASSO
m_Z
Λ_{QCD}
STARS
SUN NUCLEAR FIRE
FIRE EM
LIFE
UNIVERSE NOW
$1 / \alpha_i$
60
40
20
10^{-12}
10^{-9}
10^{-6}
10^{-3}
10^0
10^3
10^6
10^9
10^{12}
10^{15}
10^{15}
10^{18}
10^{12}
GeV


E (GeV)
10^{50}
10^{40}
10^{30}
10^{20}
10^{10}
10^{0}
10^{-4}
10^{4}
10^{8}
10^{12}
10^{16}
10^{-23} sec
10^{-42} sec
time before ex-Big Bang
Asymptotically trivial pre-Big Bang Universe
Dilaton-driven pre-Big Bang inflation
$1/\alpha_G$
$1/\alpha_U = e^{-\phi}$
E_{SU}
E_{GUT}
$1/\alpha_1$
$1/\alpha_2$
$1/\alpha_3$

THE GRAVITATIONAL DENSITIES OF SCHWARZSCHILD

$$R^S_M = 2 \cdot \frac{G_N}{c^2} \cdot M$$

RADIUS	DENSITY
$\left(R^S_{M=10^8 m_\odot}\right)_{Laplace} = UA = 1.5\times10^{13}\,cm$ $= 1.5\times10^{8}\,Km$	$\rho = 1 gr/cm^3$
$R^S_{m_\odot} = 3\,Km$ $R^S_T = 0.9\,cm$ $R^S_L = 0.1\,mm$	$\rho \gg 10^{15} gr/cm^3$

$R^S_{m_\odot} \equiv$ the Schwarzschild radius of the Sun.

$R^S_T \equiv$ the Schwarzschild radius of the Earth.

$R^S_L \equiv$ the Schwarzschild radius of the Moon.

Density of our body	**Planck density**
$1 gr/cm^3$	10^{37} Universes/cm^3
The units familiar to us	***The units of the Planck Universe***
cm	1.6×10^{-33} cm
gr	2.2×10^{-5} gr
sec	5.4×10^{-44} sec
Everyday life	The real world where we are coming from

4. Future

The reason why Galilei will be *Divine* in the future is based on another Galilean vision: scientific discoveries go beyond the limits of human imagination.

Here is what Galilei wrote.

4.1. *Beyond the limits of human imagination*

What we imagine
must be
either something already seen,
or a combination of things
or parts
of things other times seen,

such as sphinxes,
sirens,
chimeras
centaurs ...

(Galileo Galilei, *Opere*, VII, 86)

Beyond the Limits of Human Imagination
are the Ten Challenges of our Science

THE TEN CHALLENGES

1) ***The Physics of the Imaginary Masses: SSB***

2) ***P ≠, C ≠, CP ≠, T ≠ : SSB; CPT ≠ and Matter-Antimatter Symmetry***

3) ***Supersymmetry SUSY***

4) ***Non perturbative QCD and the Physics of deconfined colour charges***

5) ***Anomalies and Instantons***

6) ***Flavour mixing in the quark sector***

7) ***Flavour mixing in the leptonic sector***

8) ***The problem of the missing mass in the Universe***

9) ***The problem of the Hierarchy***

10) ***The Physics at the Planck Scale, the Gap and the number of expanded Dimensions***

No one could have imagined the existence of imaginary masses (point 1). One kilo of spaghetti is real mass. A hundred grammes of gold is also real mass. These real masses could not exist if the Creator had forgotten to put the imaginary masses in the mathematical structure of the Universe.

We are made of matter. But we have discovered that antimatter exists. We can be here to discuss this item because, in our world, matter-antimatter symmetry is violated. It is not true that the cosmic evolution explains this asymmetry. Point 2 in our ten challenges deals exactly with this open problem.

The 3rd concerns the existence of the superworld. This is needed if we want to explain the regularities observed in our world. The points 4, 5, 6 and 7 are too far away from an easy illustration. Point 8 is very interesting. The matter we are made of is no more than 4% of all matter in the Universe. In fact, if we consider only the stars and all celestial bodies emitting light or any other form of electromagnetic radiation, their mass amounts to no more than 1% of the total matter in the Universe. Could anyone imagine this feature of our material existence?

Let me skip point 9 and close with the challenge number 10. In this splendid Lecture Hall there are three geometrical dimensions plus time: total four. But this is the number of expanded dimensions. Another feature of our existence in this world which goes beyond the limits of human imagination is the fact that we have reasons to believe that the total number of dimensions is 43: eleven of bosonic type and 32 of fermionic type. I have no time to illustrate the meaning of these two properties. Just an example. If we were made of matter of 'bosonic' type, in this Lecture Hall we could be millions. Light has bosonic properties. If we were made of light, all the 6.5 billions of fellows on Earth could stay here. The reason why we need a seat for each one of us is because we are made of matter having 'fermionic' properties.

All the Universe is made of two types of particles: bosonic and fermionic. It took nearly a century of human imagination to extend this property – discovered in the study of light and of particles – to Space-Time. This extension, from which originated the concept of Superspace, could have taken place much earlier than the 1970s. But Superspace was, as predicted by Galilei, beyond the limits of our imagination.

Now, a final note.

5. Never to Close the Book of Nature

As you know, I am not a historian.

It happens that I know a couple of details about the history of Galileo Galilei. Details which are not part of Modern Culture.

When I was a boy, I read all Galilei's works.

Here in this Lecture Hall is the son of my uncle who saved my Galilei books: during the war, bombs were falling on my city and my uncle Riccardo had my Galilei books under his bed. His son is here and he is the Mayor of Erice, Dr Ignazio Sanges.

Galilei's writings are simple, fun and you can learn all sorts of things, above all about the birth of science.

Later, when I started work as a scientist, I had the privilege of meeting some of the leading exponents of twentieth-century Galilean science, highly eminent figures responsible for important inventions and discoveries.

These scientists (listed below) are clear proof of how important it is never to close the Book of Nature.

John Adams, John Bell,
Patrick Blackett, Paul Dirac,
Richard Feynman,
Murray Gell-Mann,
Vladimir Gribov,
Werner Heisenberg,
Willibald Jentschke,
Pëtr Kapitza, Tsung Dao Lee,
Giuseppe Occhialini,
Wolfgang Paul, Wolfgang Pauli,
Isidor I. Rabi, Bruno Rossi,
Abdus Salam, Victor Weisskopf,
Eugene Wigner, Robert Wilson.

I came to know Enrico Fermi through his splendid wife, Laura.

Here we have the most cherished pupil of Fermi, Tsung Dao Lee, a distinguished member of our Academy.

To some of these people I owe a debt of gratitude that is more than just strictly scientific.

John Bell, Patrick Blackett, Tsung Dao Lee, Isidor Rabi and Victor Weisskopf enabled me to found, way back in 1962, the institution that

was to offer the world a vision of scientific collaboration without secrets or barriers (EMFCSC).

From this institution, the WFS (World Federation of Scientists) was generated.

6. The Pope and the President of Italy

The Celebration of the 400th anniversary of the foundation of the first Academy dedicated to the work started by Galileo Galilei in the study of the world around us, where we live and of which we are an extremely small part, has given to me the opportunity of illustrating a series of facts which prove that Galilei has been considered a *Divine* man by authoritative members of the Catholic Church in the past and so he is in the present and will be in the future of Science.

I would like to express my gratitude to two eminent leaders of our Culture, H.H. John Paul II and H.E. the President of the Italian Republic, Carlo Azeglio Ciampi; with both of them I had on several occasions the privilege of discussing the value of Galilei's achievements in proving that we are not the result of chaos, but the product of a Rigorous Logic which governs all regions of Space-Time, from the innermost structure to the extreme borders of the Universe.

7. Conclusion

Let me close with a quotation by Galilei, dated 1613. This is important for those who claim that Galilei changed his devotion to God after his discoveries.

> *Both Holy Scripture and Nature issue from the word of God: the first because it was dictated by the Holy Spirit, the Spirit of God, and the second because it is the most faithful agent of divine order.*

Thus wrote Galilei in his letter dated 1613 to Benedetto Castelli (National Edition of the Works of Galileo, vol. V, p. 282).

How could anyone but a holy man proffer such words?

Professor Andrea Riccardi presents his paper 'The Restorations of Pius XI and John Paul II' during the Commemorative Session, 9 November 2003

The Participants of the Commemorative Session, 9 November 2003;
below, a close-up of H.E. Georges M.M. Card. Cottier

THE RESTORATIONS OF PIUS XI AND JOHN PAUL II

ANDREA RICCARDI

The Pontifical Academy of Sciences is profoundly inserted in a rich cultural tradition that comes from afar: four hundred years of history. How much of that rich heritage is left? If we look at the Academy in the 18th and 19th centuries, we see an aged noble institution, peripheral to the great scientific and cultural debates, as peripheral was the climate of Rome during the last century of the temporal power of the popes. Furthermore if we look at the vicissitudes of the institution after 1870, with the change of premises and with the divorce from the Italian 'Lincei', we see it surviving with dignity, but we do not surely see it as a central player within the great debates of the 20th century, only the vestiges of the interest of the Holy See for science. Why then the investments of the popes in such a peculiar institution within the administration of the Church after 1929? It is not a functional institution in the framework of this administration. The plan for the new Academy has to be found in Pius XI. We are in 1936, three years before the beginning of the Second World War, in a world shaken by conflicts and at the threshold of crucial changes. Italy founds, in a wave of glory, its empire in Ethiopia but, after few years, the end of colonial empires begins, starting from India, the pearl of the British crown. We are in the most tragic years of the Pontificate of Pius XI, marked by a prophetic vein. The pope feels that its Church is foreign both to the Soviet world and to that of the western authoritarian regimes: uncomfortable in a complex and confused world.

The plan of Pius XI is to renew and restore the world. It is not political action but a longterm commitment having, obviously, religious action as its fulcrum. This pope, librarian and man of culture, was the first to propose a strategy of interest towards non Christian religions. In a talk with Mons. Pietro Rossano, Paul VI revealed that he had heard for the first time, about

the value of religions, from Pius XI: religions and – as he used to say – 'religious cultures'.[1] On the other hand, just in 1937, with the *Mit brennender Sorge* against Nazism and the *Divini Redemptoris* against Communism, Pius XI was outlining a meaningful vision of the rights of human beings that had been granted by the Creator himself. In the complexity of the world, this pope, convinced as he was of the possibility of reaching God by means of human reason, had paid special attention to the Academy. The pope, in 1938, introduces himself to the academicians as the

> old friend of books, of the writers and creators of books, and of those who are and who want to be workers for the development of the human sciences![2]

He defines himself as an 'old Librarian'[3] who believes in the value of another book, besides that of the Scriptures: the book of nature.

Confronting the complexity of the world of his time the pope, who had proposed an alliance of religions against atheism, proposed, with more success, an alliance in freedom to the world of science. The Academy is Pontifical – as Regis Ladous writes in the most complete work on this institution, *Des Nobel au Vatican* – not Catholic: the pope wants to gather, as an academician declares in front of him, 'the most eminent wise people of all countries, of all religions and of all races'.[4] A non Catholic institution in the Vatican? Pius XI has a dream, that Rome, through the Academy, may be a *communis patria* for people of high scientific level and intellectual honesty.

The choice of the premise is sophisticated: at the periphery of the Vatican, if we can say this about the small and monumental ecclesiastical village in the heart of Rome. It is the 'Casina del boschetto', a Renaissance Villa, deep in the 'Garden of the Simple', made up of ancient medicinal plants and rare plants that, in the 1500, the Herbalist of His Holiness – as he was then called – had gathered in conjunction with the Department of Botany at the Sapienza University in Rome. Agostino Gemelli, a Franciscan and Rector of the Catholic University of Milan (because of his character he was called

[1] As stated by Mons. Pietro Rossano to the author.

[2] *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, *Scripta Varia*, 100 (Vatican City, 2003), p. 58.

[3] *Ibid.*, p. 57.

[4] Régis Ladous, *Des Nobel au Vatican – La fondation de l'Académie pontificale des sciences* (Cerf, Paris, 1994), p. 7.

Terror Magnificus instead of *Rector Magnificus*), is the soul of the scientific endeavour that welcomes non Catholic scientists such as the Jewish mathematician Vito Volterra. A Nazist paper in 1937 accuses the Academy of being a refuge for the Jews (there were two of them). Gemelli answers:

> The Academy does not consider the religion of its members but their services to science ... Only the political furor of Nazism can fail to understand the value of this freedom of spirit of which the Catholic Church gives a great example.[5]

The peacefulness of the venue and the independence of its profile are signs of a strategy.

For Pius XI, next to the cardinals seen as a 'Hierarchical Senate'[6] there must also be a 'Senate of Science'.[7] But difficult times are coming: 'dies mali sunt' says the eighty years old pope to the academicians while war approaches. And the war is a challenge for all those who do not want to bend to a nationalistic dimension. And we know how science has been used at the service of the destruction of humanity. But the Holy See in wartime – Pius XII is elected in 1939 – does not want the international of science, the Academy, to fall under the blows of hatred. There are two solemn sessions and various plenary sessions during the war. The two Jewish academicians continue to work for the institution and when they die, they are remembered, notwithstanding the fact that they had been purged in Italy after the racial laws. The international scientific work continues despite the division of war. In 1941 Pius XII launches a message of brotherhood in a time of hatred:

> In the Divine school we are all brothers; brothers in our contemplation, in our study and employment of nature ...[8]

It is to say that science unites in friendship and the Academy looks beyond the inflamed boundaries of war.

In 1945 the hot war becomes cold war: and the great problem of the use of science after the tragic experience of the Second World War emerges. Max Planck, a pontifical academician, had told Pius XII about the atomic risk. Already in 1943 the pope speaks about it; in 1948 he defines the atomic bomb as: 'the most terrible weapon which the human mind has conceived up to date'.[9] The question is if a war that uses this

[5] M. Bocci, *Agostino Gemelli rettore e francescano*, Brescia 2003, p. 480.
[6] *Papal Addresses*, *op. cit.*, p. 46 ff.
[7] *Loc. cit.*
[8] *Ibid.*, p. 99.
[9] *Ibid.*, p. 112.

weapon may be morally conceivable. During the cold war the work of the academicians continues. I do not have an expertise that enables me to appreciate the quality of so much work, and I apologize; but I feel the sense of a continuity in the work. The book of nature must be read: the intention of God must be discovered – says Pius XII. In 1955 he says:

> It pertains you to interpret the book of nature, to describe its contents, and to draw the consequences therefrom for the good of all.[10]

In this statement we can find the value of the secularity of the scientist but also the value of his moral aim. Among the severe academicians, within the ancient walls of the Vatican, we find something of the Franciscan intuition, offered, never imposed: nature, that humankind assaults and violates, must be opened to dialogue with gentleness. This is the reason why Saint Francis speaks and listens to nature, so much so that St. Bonaventure of Bagnoregio, in his *Legenda Maior* writes:

> It appears as if the machine of the world is at the service of the, by now so sanctified, senses of this holy man (St. Francis of Assisi).[11]

But one must search for the common good. In 1955 the Academy discusses the role of trace-elements in the growth of plants and animals. The Academy also speaks about the suffering of humanity and about cancer. In 1963 they discuss econometric analysis in the preparation of development plans and the study of economical fluctuations. With Paul VI there is a commitment towards common good, development and peace: I shall return later to this.

In the meantime the Academy becomes international with the growing participation of eminent non Italian members. In 1974 the first woman, Rita Levi-Montalcini. John XXIII widens the participation of non Europeans and non Catholics and names as president, Mons. Lemaître, who does not believe to the subordination of science to faith. In 1939 Pius XII had spoken about 'the unknown God'[12] in the 'enigma of creation'.[13] In the same speech he had recalled how the Church itself is progress, that is,

> divine progress in the world and the mother of the highest intellectual and moral progress of humanity and of the civilised life of the nations.[14]

[10] *Ibid.*, p. 143.
[11] *Legenda Maior Sancti Francisci* (1260-1263), 5, 12.
[12] *Papal Addresses*, *op. cit.*, p. 81.
[13] *Loc. cit*.
[14] *Ibid.*, p. 85.

It is, he had said with words that will have greater echo and concreteness from the voice of John XXIII,

> master of truth and virtue, fighting against errors, and not against those who err, not tearing down but building up ...[15]

It is a programme that comes from afar – as we can see – but that with John XXIII, Paul VI and John Paul II, acquires greater concreteness in the policy of the Academy. But all is not as straightforward as it may appear in a world that has been troubled in its optimism by war.

It is an anxiety we find in Paul VI, who gives a substantial impulse to the Academy and names a lay Brazilian, Carlos Chagas, at the head of the institution. In 1964 he strongly reaffirms: 'The religion which we have the happiness to profess is, in fact, the supreme science of life'.[16] In 1970 he says to the academicians:

> We often speak of the 'death of God'. But should we not rather speak of the death of man and of his thinking in its superior form?[17]

In 1970 Montini raises the problem of the need for another Academy dealing with social and human sciences. Paul VI reveals to the Nobel Prize winner Max Born:

> Even if I love science, I feel it opposes so much both history and tradition ... Could it be that the political and military horrors and the complete break down of ethics I have witnessed in my life are not the symptoms of a transitory social weakness but a necessary consequence of the development of science.[18]

Paul VI seems to be searching for a greater balance between science and humanism. But his years are a period of great scientific freedom of the institution, of great renewal of its members, with a special attention to non Europeans and to non Western scientists.

In the years of the pontificate of Paul VI the Academy insisted on the relationship between science and the good of humanity. I am thinking of the session on the use of fertilizers in the framework of the struggle against hunger:

> a deeply human task awaits you. You are and will to an increasing extent be the educators of this rural cultivator; he expects a great deal from your teachings.[19]

[15] *Loc. cit.*
[16] *Ibid.*, p. 181.
[17] *Ibid.*, p. 199.
[18] M. Gorran, *Science and Anti-Science*, Ann Arbor Science, 1974, p. 54.
[19] *Papal Addresses*, *op. cit.* (Address of 15 Apr. 1972), p. 206.

And he ends: 'But as you know, our concern goes first and foremost to the poorest ...'.[20] The great dream of Montini is that of a Church that may set the social question not any more as a problem of industrial societies but as a reality of the relationship between the North and South of the world. It is the theme of the Encyclical *Populorum Progressio.* In 1968 he asks the help of the scientists of the Academy:

> To make the earth fruitful, producing bread for all its dwellers ... to make possible a victory over hunger which today still affects entire nations, to give hope and the means of subsistence to the ever increasing generations of men – such is your conquest, such your art, your mission, your crown![21]

John Paul II, within a more relaxed relationship with science, repeats the invitation of the Second Vatican Council, that of *Gaudium et Spes:* 'For the future of the world stands in peril unless wiser men are forthcoming'.[22] I cannot here touch upon the many themes John Paul II deals with, that are by the way collected in the important book *Papal Addresses.* Its introductions by Marcelo Sánchez Sorondo merits our attention as one of the key texts on the identity of the Academy. In his inaugural Encyclical, *Redemptor Hominis,* Wojtyla speaks about a man who is threatened by what he builds. But he is also convinced of the need for free scientific research: free not only from theological subordination, but also – and most of all in our time! – from political and economic powers. The proximity of the Academy to the vision of the Holy See on the contemporary world can be a chance of freedom. After all, what is the Holy See before and after the end of the cold war? From a sociological point of view it is an international of believers, spread in various ways in different countries of the world, under the most diverse regimes. It knows the lacerations of contemporary history but, with the strength of a religious inspiration lived by millions of people and rooted in faith, it also feels a common destiny between men and peoples. On this aspect one can connect the fraternal dialogue between the Church and the Academy without confusion of roles and aims.

In the vision of John Paul II the academicians, from the 'Casina' of Pius IV, between the beautiful garden and the Vatican walls, must look, through science, at the greater world. In the boundless panorama of the globalized universe, the Church believes in a free, friendly and close sci-

[20] *Loc. cit.*
[21] *Ibid.*, p. 195.
[22] Paul VI, Pastoral Constitution *Gaudium et Spes* (1965), n. 15.

ence to decipher together the paths of history. In 1979 the pope took up the ancient Franciscan motif:

> So the scientist will not treat nature as a slave but, taking inspiration, perhaps, from the *Canticle of the Creatures* by St. Francis of Assisi, he will consider it rather as a sister called to cooperate with him to open new ways for the progress of humanity.[23]

But there is another theme that emerges from the celebration of the 50th anniversary of the Academy in 1986. The coincidence of the inauguration with the initiative of prayer in Assisi that the pope had wanted with the participation of the leaders of Christian Churches and of great world religions (the academicians were going to join in as the communiqué said), says something regarding the unity between the concern for peace, the inspiration of religion and the work of the scientists. A few years earlier, during an audience on *The knowledge that builds peace*, the pope had given a very demanding speech:

> Unarmed prophets have been the object of derision in every age, especially on the part of shrewd politicians, the supporters of power. But today must not our civilisation recognise that humanity has need of them? Should not they alone be heard by the whole of the world's scientific community, so that the laboratories and factories of death may give place to laboratories of life? ... the scientists of the whole world ought to be united in a common readiness to disarm science and to form a providential force for peace. ... Faced with this great patient in danger of death which is humanity as a whole, scientists, in collaboration with all the other members of the world of culture and with the social institutions, must carry out a work of salvation analogous to that of the doctor...[24]

The Academy, according to the words of the pope, is the expression of a 'cultural ecumenism'.[25] I would not want some of my quotation to have given the impression of a tense vision of the world, of the function of scientists and of their relationship with the Church. The walls of the Vatican village obviously refract many problems of the world, situations of pain and war, social and political tensions, internal questions of the Church. It has been happening for centuries but with greater intensity in the last decades. It is a unique observatory of the world of today: this is

[23] *Papal Addresses*, *op. cit.*, p. 236.
[24] *Ibid.* (Address of 12 Nov. 1983), pp. 260-261.
[25] *Ibid.* (Address of 28 Oct. 1986), p. 287.

the true 'Specola Vaticana' (Vatican Observatory)! But here does not grow an anguished vision: if peace is urgent, the times are those of history, long, complex, often unknown. The time of science is set in these times without having to bend to the hurry of the political, economic or even ecclesiastical decision makers. What is important, for the Church of Rome, is that this time may flow as a friend, in dialogue, not remote. John XXIII in 1962 had well expressed the climate that we still can find in the 'Casina Pius IV':

> the vision of a gathering, at once fraternal, pacific and spiritual, which should be devoted entirely to the praise of God and to the service of man, in his noblest aspirations to know the truth, to seek to attain it and to embrace it lovingly.[26]

[26] *Ibid.* (Address of 5 Oct. 1962), p. 169.

PAS President Nicola Cabibbo presents his paper
'The Meaning of the Pontifical Academy of Sciences', 9 November 2003

THE MEANING OF THE PONTIFICAL ACADEMY OF SCIENCES

NICOLA CABIBBO

The four hundredth anniversary of the creation of the Accademia dei Lincei offers the occasion to reflect on the meaning and aims of our Academy. The Lincei Academy of Federico Cesi was conceived as a community of scholars who could together engage in the study of nature. Among their more notable productions, the *Tesoro Messicano*, an encyclopedic study of the variety of new species which the new world revealed, the first systematic use of a microscope to uncover the marvelous structure of insects, and the first attempt toward a systematic classification of living beings. Many of these efforts remained unfinished with the death of Cesi. Had it not been for Galilei the Accademia dei Lincei would be remembered as an episode in the history of science, an early example of a research team more than the precursor of present-day Academies. Galilei made the difference, and projected the Academy in directions which prefigured the role of modern Academies as centers for the promotion of scientific culture and the discussion and evaluation of its progress. Galilei helped his younger colleagues in many ways, both with his personal prestige and in providing them with some of the most advanced tools of the times, such as the microscope. In turn the Academy took upon itself the task of publishing his work and promoting its diffusion in the scientific world and beyond.

In moving to the court of Florence, Galilei requested the title of the Grand Duke's Philosopher, not that, at the time more usual, of Mathematician, which was Kepler's title at the imperial court in Prague. Galilei thus insisted that Science belongs to the highest reaches of human culture, those which engage in the search for Truth and in studying the means by which Truth can be approached, briefly: to philosophy. In

searching for truth, experimental tools as the telescope or the microscope and the theoretical tools offered by mathematics are as essential as the syllogism, experiment and the patient observation of nature, as essential as the more abstract modes of the philosophical discourse. These ideas fully resonated with those of the young prince Cesi and became the distinguishing trait of the Lincei.

In 1847 Pius IX adopted the Lincei Academy as an official institution of the Pontifical State, the Pontifical Academy of the New Lincei. The Academy was assigned eminently practical tasks: that of furthering the progress of science and of becoming a center of expertise to cater for the needs of the Pontifical States in the improvement of their technical infrastructure. The comparison is often made with the research councils that were established in that period in many European nations. The membership reflected, with interesting exceptions, the relatively backward scientific level of the States: a comparison with the great centers of science of the time would be ungenerous. The Academy however fulfilled its task with honor.

When the Pontifical States were incorporated in the Italian kingdom, the Pontifical Academy of the New Lincei continued its activities of study and publication. With the taking of Rome in 1870, a branch of the Lincei was reestablished as an Italian Academy, the present Accademia dei Lincei, which soon reached an excellent level, thanks to the guidance of Quintino Sella and to a wider membership taken from many regions of Italy, many of which enjoyed a high level of technical and scientific development. I am very glad that Prof. Conso, the president of the Accademia dei Lincei, has accepted to be with us on this festive occasion, and I take this as a portent of a fruitful collaboration in the coming years between the two academies which share a common ancestry. In 1923 Pius XI assigned to the Nuovi Lincei its present seat, the Casina Pio IV, a magnificent renaissance building that the recent restoration has brought back to its pristine splendor. This was the first tangible sign of a revival of the Academy, but the turning point came with the Motu Proprio *In Multis Solaciis* by Pius XI, issued on 28th October 1936, which provided for the transformation of the Academy of the New Lincei into the present Pontifical Academy of Sciences. This was not a simple change of names: the Academy was given a new membership, chosen among the most prominent scientists of the time, and was assigned a lofty task, that of becoming the Scientific Senate of the Catholic Church. No longer a center of expertise for the Pontifical States, the Academy would become a center at the service of the Roman Pontiff, and in general of the Catholic

Church, in the performance of His pastoral mission. The Academy would study the progress of science, and its philosophical implications, with particular attention to the consequences of the new scientific discoveries for the progress of the human condition. The restored Academy would establish, at the highest possible level, an open channel of communication between the Catholic Church and the scientific community.

The Academy is under the direct protection of the ruling Pope but it enjoys remarkable freedom in establishing its agenda and organizing its activities. In aiming for the best possible representation of the scientific world, the membership is chosen without regard to religious beliefs, and includes many Nobel Prize winners – about thirty at the present time – and a few winners of the prestigious Field Medal in mathematics. We are particularly proud of the fact that some of our members have received a Nobel Prize after being nominated to the Academy, the most recent being Professor Ahmed Zewail, a native of Egypt, Nobel Prize for chemistry in 1999.

I would like to quote some memorable passages from the addresses of John Paul II to the Academy which exemplify the fruitful interchange which the Academy activates between the world of religion and that of science, starting with the address of 1978, the year of His accession, when He said:

> The Church of Rome, together with all the Churches spread throughout the world attributes a great importance to the function of the Pontifical Academy of Sciences. … How could the Church have lacked interest in the most noble of the occupations which are most strictly human, the search for truth? … Both believing scientists and non believing scientists are involved in deciphering the palimpsest of nature … where the traces of the different stages of the long evolution of the world have been covered over and mixed up.

The Pope returned to the problem of the evolution of the natural world in His address to the Academy on the occasion of the 1996 Plenary Session, where the origin of life had been extensively discussed. Elaborating on the observations on this theme contained in the Encyclical *Humani Generis* by Pius XII, He said:

> Today, almost half a century after the publication of the Encyclical, new knowledge has led to the recognition of more than a hypothesis in the theory of evolution. It is indeed remarkable that this theory has been progressively accepted by researchers, following a series of discoveries in various fields of knowledge.

In His first address to the Academy, in 1979, John Paul II called for the establishment of a committee of historians, theologians and scientists

which would renew the study of the Galilei case, so as to 'remove the distrust that this case still generates, in the minds of many people, placing obstacles in the way of fruitful concord between science and faith'. The results of this work were presented by Cardinal Poupard in a solemn session of the Academy in 1992, at the presence of the Pope. As this passage already suggests, the aim of establishing a dialogue between the world of science and that of religion goes beyond mere reconciliation, it delineates a process toward a new unity in the common search for truth and for the improvement of the human condition. In the letter to Father George Coyne, the Director of the Vatican Observatory and a member of the Academy and of its governing Council, John Paul II wrote in 1988:

> As dialogue and common searching continue, there will be growth toward mutual understanding and a gradual uncovering of common concerns which will provide the basis for further research and discussion. ... each discipline should continue to enrich, nourish and challenge the other to be more fully what it can be and to contribute to our vision of who we are and of who we are becoming. … We carry forward, before God, enormous responsibilities toward the human condition because historically we have had and we continue to have a determining influence in the development of ideas and values and the course of human actions.

The Academy operates through Plenary Sessions, working groups and study weeks. The Plenary Sessions, normally held every second year, are attended by the full academic body, and are the occasion of interdisciplinary discussions on the progress of science and of its philosophical and cultural meaning. It is in the Plenary Sessions that the interdisciplinary and truly international nature of the Academy fully shines, this was indeed a feature of the original Cesi Academy. They also provide the academicians with a chance to discuss the past and future activities of the Academy.

Working groups and study weeks are specialized meetings devoted to particular scientific problems, with the participation of academicians who have an interest in the theme and of other scientists which contribute their specialized expertise. Some of these specialized meetings are devoted to themes at the forefront of scientific research, as is the case of the two meetings held during this week. Among the recurring themes of these meetings are progress in astronomy and cosmology, the relationship between brain and mind, and new developments in the field of genetics. We endeavor to foster the interaction between scientists and the theologians or philosophers who often take an active part in the discussion. To

give just an example, let me recall the two meetings held in 1985 and in 1989 on the determination of the moment of death and the relationship between brain death and human death, which gave an important contribution to the debate on the ethical aspects of organ transplants.

A large portion of our activity is devoted to discussions on the impact that, in different ways, science can have on the human condition. On this subject it is important to recall that the rapid advance of scientific knowledge and technical capabilities poses a problem of justice and equity. Most scientific knowledge is produced in the rich countries, and it is these countries which mainly enjoy the fruits of the new technologies. The gulf between the rich and the poor widens, and the poor become more and more dependent on the rich for their basic necessities. These problems are the object of the yearly United Nation report on human development. The 2001 report, *Making New Technologies Work for Human Development*, contains an extensive analysis of the research needs of the developing countries and shows how far we are from satisfying those needs. Just to quote a few issues where poor countries require a particular effort, we can mention diseases which are under control or nearly so in industrialized countries – AIDS, malaria – tropical diseases which draw little interest from the pharmaceutical industries, and the special problems of agriculture, energy, and communications. As the UN report emphasizes, these problems must be solved through partnership and cooperation, and the poor countries must become able to contribute to the advancement of scientific knowledge and to partake equitably of the fruits of progress.

Issues of this kind have been regularly addressed by the Academy with the help of experts from the UN organizations and from the interested countries. In 1963 a study week addressed *The Econometric Approach to Development Planning* (our sister institution, the Pontifical Academy of Social Sciences, is now very active on the economic and social aspects of human development), followed in 1968 by a meeting on *Organic Matter and Soil Fertility*, the first of a series of meetings devoted to agricultural concerns, the last being the one on the *Food Needs of the Developing World* held in 1999. Other meetings have studied energy and resources, the protection of the environment, desalination, and chemical hazards in the third world. You can refer to the Academy's Year Book for a complete list of our publications on these and other themes. I would like to take this occasion to remember my two predecessors, Carlos Chagas and Giovanni Marini-Bettòlo, who gave a great impulse to development and ecological

studies. Our discussions have been given particular resonance thanks to the attention that the Pope has always given to the 'Poor of the Earth'.

I would like to conclude by thanking all the Academicians who have greatly contributed to the success of the Academy in its special task, giving freely their wisdom and their precious time to organize excellent meetings and to further its many activities. The advent of the digital age has greatly facilitated the knitting together of an academic community scattered in so many countries in different continents, improving the way we operate. I hope Federico Cesi would appreciate the work of this distant descendant of his great institution. We probably have not yet produced anything comparable to his *Tesoro Messicano* or to Galilei's *Saggiatore*, but we have tried to do our best and will keep on trying!

DISCUSSIONS AND SUGGESTIONS OF THE PRESIDENTS OF THE ACADEMIES

The Participants of the Commemorative Session, 9 November 2003

NICOLA CABIBBO

We can maybe set aside some time for discussion and this could also be an occasion for our friends, the Presidents and the representatives of the other Academies who have so kindly visited us. I think this is our anniversary but also their anniversary because I think the Lincei Academy really was the prototype, the ancestor of all Academies of Science, there were certain traits, certain ideas which are constant and this is why we consider it to be a sister organisation, because we have the same father, the same great-grandfather. Professor Conso.

GIOVANNI CONSO

A heartfelt thank you for your warm invitation to take part in this intense morning, first in the church and now in this conference hall which I think is magnificent. I would also like to add my most impassioned congratulations for the organisation of such an important congress in the last few days and in the following; it is really great, this room in particular which has been equipped with such modern instruments, combining scientific requirements and mechanisms with this sense of togetherness, with everyone sitting in a circle. I must say I envy this setting and we will try to reproduce something similar – maybe also with the President's help – for we are very fortunate in having as President of this Academy such an authoritative member of the Accademia dei Lincei. I believe this is accidental, but nevertheless this has come about in the very year in which this fourth centenary is celebrated, which lasts a year, not a day, otherwise we would have had to hold this meeting on 17 August both there and here. It lasts a year, and this four hundredth year has just begun and I very much hope that we can build an even closer relationship between the two Academies, which are undoubtedly twins: they were practically born together, they are inspired by the same ideals, and today I have heard the recollection, through dates, events but especially through ideals, ideals of this freedom of thought, of this openness to dialogue which the broader it is the better it enables us to express the various personalities, and to further examine the various contributions for the common good.

In my opinion this is the basic concept that must be taken into account as much as possible on all fronts, because results must be sought but must then be circulated, discussed and improved. I think that, from the point of view that I suggest, of creating relations between the two Academies which are as close as possible – and Professor Cabibbo will be a direct witness and so will Monsignor Sánchez Sorondo, who has already honoured me with such an intense, proactive and promising personal meeting – when the celebrations of this fourth centenary are over, the publications and proceedings, a grandiose series on your and on the Lincei's behalf, must then be thought over in order to draw some conclusions. Celebrations are good, important, they must be held, especially when such historical and important things happen; but the consequences must also be drawn, to verify which fruits we can gather to provide a new boost, because history is important, we must remember the moment as a crucial reference point, but we must also modernise more and more. Nature changes because maybe mankind does certain things that change it and others that do not: consequently changes take place because of human events such as wars and discoveries that slightly transform the face of the world. I believe that we could study together in order to verify the consequences and how to make the most of the intense commitment shown in the last few months and which will also be shown in the following ones by the Accademia dei Lincei, but especially by this great Academy of yours, which I salute and will recall in the opening speech that I will give in a few days' time for the beginning of our academic year, for its commitment but also for the quality of the various considerations that I was able to listen to, read and reread, and also for the ones that will be presented tomorrow. Thank you President, thank you all.

ALEXANDER O. CHUBAR'IAN

Mr. Chairman, I am here from the Russian Academy of Science, I am a member of the Russian Academy and the Director of the Institute of History: I say this because my President is not here. I arrived in Rome a few days ago with the President of our Academy and we wanted to take part in your distinguished meeting but, suddenly, the day before yesterday, he had to leave for Moscow.

For us, for me, it is a great honour to be here and to give you our greetings and congratulations. We know the history of your Academy: for example our Institute, my Institute, is interested in the history of science in the

world and in this context the history of your distinguished Academy is of very great interest to us. This morning when I heard the report about Galilei it was extremely interesting for me: I am not a physician, not a mathematician, but for me it is one of the interesting examples of the discussion taking place now in Italy and other countries about Galilei, his role and his work.

I must also inform you that in the last decade we have had a good cooperation with many Pontifical institutions, for example with the Historical Committee of the Vatican and our Orthodox Church in Moscow. We organised in Moscow a great conference on the history of Christianity and many people from Christianity, Catholic people, took part, and we received a message from the Pontiff that was a great honour for us. Now I again repeat our honour to give you our best wishes and I have an address from our Academy for you and a small souvenir. I am very sorry it is so heavy but it is an album of religious art in Moscow and in St. Petersburg. Thank you.

Ismael Clark-Arxer

Thank you, Mr. President, I am really sorry for my limitations in English. In any case, I would like, first of all, to thank you, and our dearest friend Chancellor Sánchez Sorondo, for your kind invitation to be here and I take this opportunity to congratulate very heartily the Pontifical Academy on this relevant anniversary.

Now I would like to bring to your attention some suggestions for possible future activities. I am aware of the important previous events organised by the PAS covering essential contemporary problems – you have mentioned many of them in your speech, such as sustainability and the cultural values of science – and I do express my appreciation for these important contributions.

Now, however, I would like to raise what I think is another essential, or some other essential items of today's world. I refer to poverty, Mr. President, to inequity, and to their terrible effects on the lives and living conditions of hundreds of millions of human beings all over the world, and especially in developing countries. With all respect, Mr. President, I wonder, and I present to your consideration, what could be done from the perspective and standpoint of the PAS to enhance the use of scientific knowledge and technological progress to provide all those people with better health, proper education and a life of work and dignity I am sure we all think we all deserve. I dare to make this proposal considering the modest experience of my little

country and its recognised achievements in some of these fields. Our experiences show, I think, that many things can be done with very little resources by using proper knowledge and when you have the moral commitment and the goodwill that are necessary for that. So I sincerely think that the Pontifical Academy, on the basis of its respected scientific proficiency and elevated ethical standards, could certainly give an important contribution to eliminate these shameful scourges affecting humanity nowadays. In my opinion, that would make an important contribution to overall security and peace for every nation. Excuse me, Sir, if I have been perhaps too long, or I am going too far but I thought this was the right place and the right moment to share these ideas. Thank you.

JACOB ZIV

Thank you Mr. Chairman. It is a real pleasure to convey the greetings of the Israeli Academy of Science and Humanities in Jerusalem on this festive jubilee. I also want to thank you again for inviting us to participate in the unique working group on Mind, Brain and Education. In a way, one might think of all our Academies throughout the world as a collective mind, brain or, if you wish, neural net. It is meetings like this that may cause all of these individual neurons, namely each one of these Academies, to operate in unison for the benefit of mankind. Furthermore, it is a workshop like this that may serve as stem cells in initiating a renewal process in our joint neural net of Academies, exposing all of us to new ideas as well as new problems, complex as they may seem to be. Thank you.

ANDRZEJ B. LEGOCKI

Mr. President and distinguished participants of this celebrative session, I would like to pass to the Pontifical Academy the best congratulations and wishes from the Polish Academy of Sciences. We live now in a very dynamic world and especially now we need, I think, univocal and strong indications about what is the humanistic value and what is the ethic value, because those sides will help us to build up the system of moral values in our scientific and educational as well as cultural activity. We admire the Pontifical Academy for bringing its attention to such important and difficult subjects as, for example, innovative technologies. Our Academy in

Poland took a route of intense and deep modernisation and I do believe that all those values that were important signs in this Academy will also be important indications for our activity in Poland. Mr. President, later on I will give you a special diploma and address that has been awarded to your Academy by the authorities of our Academy. Thank you very much.

ETIENNE-EMILE BAULIEU

Mr. President, I speak here for the French Académie des sciences, and my first words are to thank the Pontifical Academy for organising such a remarkable meeting taking care of two of the most important matters which are currently presented to humanity: education and brain studies, as well as what we will study in the next few days that are new aspects of cell biology.

The French Academy of Sciences is 'almost' young, sixty-three years younger than the Pontifical Academy, and it is a great pleasure for me to salute both this initiative to celebrate your four hundred years of studies, and your concern about Science, one of the most specific activities of human beings.

Science progresses without any doubt but suddenly a question has arisen: have these contemporary changes become counterproductive? To believe in progress there must be confidence and today, in developed countries, paradoxically, doubt replaces confidence. However, it is clear that integration and connection between technological inventions and science have generated two energising breakthroughs in the human condition: on the one hand, the extraordinary development of communications which has abolished distances between both men and cultures and, on the other, the unrelenting and unprecedented prolongation of human life. Therefore the duties of scientists now include making these extraordinary changes beneficial to humanity, for better physical conditions, food, comfort, health, particularly during aging, and more satisfactory mental activities, intellectually, artistically, and emotionally at large.

The issue of the relationship between science and nature is at the core of today's doubts regarding the progress of science and raises new terms as regards the living world, both animal and plant life. There are three words which to me summarize the present situation, the present difficulties: fear, ignorance and ideology. *Fear* is understandable since there is such a turning point and a great scientific change. Fundamentally, in an imposing manner, what is natural is knowingly altered, and the discovery of the mas-

tery of genes is disturbing. By suggesting an alternative to selection, science has given mankind the chance of attaining a level which so far was the preserve of the obscure designs of evolution and even of a divine power. After fear comes *ignorance*. It is certainly easy to believe, in such a gathering of scientists, that other people have difficulty to understand what is going on concretely in terms of scientific progress, so I just want to confine myself to another few words on ideology.

Antiscientific *ideology*, in the context of transfer of scientific research and knowledge into society's practice, uses fear and ignorance to help the ambition of hidden politicians. Frequently and paradoxically, this masks conservative positions (in science) behind humanistic declarations and followers are recruited by amalgamating fabrications: economics (the multinationals), politics (big capital), and the media. Must we, the researchers, be seen as scientifically in error because some others are viewed by the media – temporarily I hope – as being right? In this way, the necessary debate between science and society is distorted and clouded, although there is an urgent need to exhibit and explain discoveries and discuss their use. It is important not to turn the precautionary principle into a principle of suspicion and inertia. On the contrary, there is a need to research, and verify, and check, whilst never ignoring criticism, and to be always alert to different solutions. This is a duty of humanity and the public responsibility of scientists in Society. Are scientific advances contributing to human progress? Yes, if viewed in the light of greater fraternity, of better understanding of our world and the men that people it. Let us hope that scientific progress does not simply lead to new opportunities for moneymaking. How will such change and progress influence our family lives, our loves, our personal happiness? I believe that with fire, electricity and antibiotics, we are happier than the authors of the Lascaux paintings: we have more time to live, to love, and to be free. But their art is meaningful and moving for us: the *continuum* between us probably owes much to emotion, to imagination, to aspirations, and these are not just the way we live and what we have acquired.

The progress we make shapes us, but does not define us. It could be tempting at this point to be content with the acquisitions of humanity so far, which already offer so many means for leading a better life, and choose to share them out more. I can understand that sentiment, that intuition that a pause is called for. But there should be no expectation of a plateau of scientific stability, or of a moratorium on change: that is a totally unrealistic hypothesis – and many a quiet conservationist will regret it. Change and transgression are inseparable from science: to seek further is ever a univer-

sal human activity, 'a bolder version of the business of life' as stated by Primo Levi, the chemist – and humanist – whose life was scarred by deportation. Man invents, constantly seeks to know more, more about the earth's climate and its evolution, the neighbouring planets, or the possibility of prolonging life in good health and complete lucidity. This cannot be repressed.

Now, scientific progress is an activity which is currently too concentrated in a single part of the world. There is danger intellectually, ethically, commercially with consequences at both the political level and the day to day conditions of life of the majority of human beings. Science should be performed or at least understood or maybe taken into consideration by the whole of mankind. It is up to men and to women, to their representatives, to their academies, to their civilisations to fashion scientific progress into happiness, to abide by these advances and to forge the rules of life that turn them into steps forward for the human species. Thank you Mr. President.

GUILLAUME WUNSCH

On behalf of the Belgian Royal Academy I would also like to congratulate the Pontifical Academy for this four hundredth anniversary and thank the organising committee, the Chairman and Monsignor Chancellor for the invitation and also for organising this very very interesting meeting on Mind, Brain and Education.

Now, as Professor Vinti pointed out in his paper, for Federico Cesi and his colleagues 'research is meaningless if its results do not meet the practical needs of human beings' and, as once again this seminar has stressed, science, in this case, is not only natural science, meaning that the humanities, the social sciences and the natural sciences must collaborate if we want to solve or try to solve some of the problems that have been pointed out around this table. So may I modestly suggest, as next to this Pontifical Academy has been set up the Academy for Social Sciences, that the two Academies work in close collaboration to try to understand and solve the problems that we have today in the world. Thank you.

NICOLA CABIBBO

Thank you. Of course we already do to a certain extent, and Monsignor Sánchez Sorondo is actually the Chancellor of both Academies so this is a guarantee of collaboration at the highest possible level.

NAUM YAKIMOFF

Mr. President, distinguished Academicians, dear Presidents of the Academies, dear colleagues, I am privileged and honored to represent the Bulgarian Academy of Sciences and its President on the day of the celebration of the four hundredth anniversary of the Pontifical Academy of Sciences.

The Bulgarian Academy of Sciences is much younger, only one hundred and thirty five years old, and it has been created following the principles and the experience of the already existing Learned Societies in Europe.

It is with utmost respect that we look at the incredible example of the Pontifical Academy of Sciences: example of intellectual freedom, transparency, openness, tolerance and morality on the way to wisdom and truth.

It will be a great pleasure for me, after the Session, to give what I have brought for you and this is a gift from the Bulgarian Academy of Sciences to the Pontifical Academy of Sciences, a copy of the cover of a Gospel from 1701, which is one of the best examples of Bulgarian Christian art and which we consider as a contribution to mankind's cultural heritage.

Thank you very much for your invitation.

EIICHI HOSHINO

Mr. Chairman, dear colleagues, all the participants of this Congress. I am from Japan, a small country in the Far East. The Japan Academy was founded in 1879, that is to say, about ten years after the restoration of Meiji, after the beginning of the modernisation of Japan. And I have brought a small message from the President of the Academy. As the President could not come here he nominated me as his representative or as the representative of the Japan Academy. A little different from this Pontifical Academy, our Academy consists in two sections: one, Human and Social Sciences and the other, Natural Sciences. We have a very short message from the President which I also have prepared, so I would like to read this written message.

> It is a great honour and a privilege for the Japan Academy to offer a congratulatory address to Pontificia Academia Scientiarum on the occasion of the celebration of the four hundredth anniversary of its foundation. It is our pleasure to have Professor Eiichi Hoshino, member of the Japan Academy, participate in the ceremony representing our Academy. We, the members of the Japan Academy, are deeply impressed by your invaluable role in promoting the progress

of the mathematical and natural sciences and studying epistemological problems related thereto. We are also strongly impressed by your principle of choosing members from all over the world, without any discrimination as regards race or religion. It is our honour and pleasure that several members of our Academy were chosen as members of your Academy, for instance, the late S. Mizushima, H. Umezawa, K. Fukui and M. Oda. At present, Ryoji Noyori is among your members. As we are in the world where we enjoy the benefits of science and technology on one hand, but where we face the danger of unlimited use of them on the other, the role of your Academy will become more and more important. So once again, we take this opportunity to express our hearty respect and warmest congratulations for Pontificia Academia Scientiarum.

Thank you.

ARTURO J. BIGNOLI

Mr. President, if you will allow me to, I will speak in Italian since others have done so before me. I am the President of the Argentinian National Academy of Exact, Physical and Natural Sciences and also of the Academy of Engineering. I am very moved by the events of the last few days in the Pontifical Academy of Sciences and I would like to do something similar with our Academies in Argentina and will take as an example, maybe as a goal, the fact of achieving events such as those that I have experienced in the last few days, which, in my opinion, are wonderful.

There is no need for me to say that those of us who are under the Equator are not the same as those who are above it, despite globalisation etc., of which we are maybe somewhat the victims. However, Argentina, and I would say what we call the southern cone of Latin America, is very European. Argentina was made by Italians and Spaniards and, without wanting to upset Monsignor Sánchez Sorondo, I would say more by the Italians than by the Spaniards. I ask, if possible, to have an even closer relationship than the one we already have with this Pontifical Academy, which I think is an example in the world and which bears in mind so well those words of our Lord Jesus Christ that no exceptions must be made among people. Looking at those of us who are here, I see that we come from all religions, races, nationalities, even from below the Equator, those who live so far below they can almost see the South Pole.

So I would like to leave as a request – as well as saying a heartfelt thank you, a very heartfelt thank you and congratulations for the organisation of this event – I would like to leave the request to try to tighten the relations between the Argentinian Academies and this Pontifical Academy. In Argentina, in particular, there are three Academies of Science that cannot all be present here. There is also an Academy of Engineering. It is true that I am an engineer, but I believe that engineering is science's great trouble-maker. Sometimes we even do things before science gives us its approval, and there are magnificent examples of this in the history of technology. I would just like to mention one, Risorgimento Bridge, which is nearby: it was built against all scientific rules, they said it would fall, and yet there it is, it was even crossed by all the armies of all the countries that entered Rome, and yet Ponte Risorgimento is still standing. Therefore, Mr. President, I will stop here and say thank you very much on behalf of my country, of the Academicians of my country, and leave a strong request to have a very close contact with this Academy, and I will then ask His Excellency the Chancellor how to proceed to make this possible.

HELENA ILLNEROVÁ

Mr. President, dear colleagues, on behalf of the Academy of Sciences of the Czech Republic I would like to express our best wishes to the Pontifical Academy of Sciences. I am really very glad and feel very honoured that I am here with you on such a wonderful occasion.

I have been very much impressed by the history of your Academy and mostly by the original ideas of the first Academicians, namely by the search for truth and by the search for political and ideological independence, and by the search for ethical values and also, of course, by reading in the book of nature. I think that we should all be very faithful to the original ideas of your Academy. I know what I am talking about because I have lived almost all my life under an ideological regime, under the communist regime and so I know how important it is to keep to the truth and to keep to independence, and I think that we all should have not just credit as scientists but also as human beings, this is something I consider the most important. I thank you very much for your invitation and I really am very glad to be here with you today. Thank you.

VOLKER TER MEULEN

Mr. President, dear colleagues, I am here to represent the German Academy of Natural Sciences called *Leopoldina*, an Academy which is old but not as old as your Academy. Our Academy was founded in 1652 and our main interest is in the area of medicine and natural sciences and, like you, we have interdisciplinary or transdisciplinary symposia and meetings and we also have working groups that we call ad hoc committees.

In your programme you mentioned and asked for suggestions. I have a question and a suggestion: my question is, how do we transfer our knowledge and the discussions we have in our Academies to the public. I think nowadays it is of course important to discuss great problems like the ones presented yesterday or tomorrow and on Tuesday, on stem cell research, and come to conclusions but these are topics which our society certainly has to be informed about and has to get a scientific-based opinion about, which is not influenced by non-governmental organisations or by politics.

I think it is important that science comes to a definition of a problem and then suggests something from the point of view of the scientist, and then it is up to society to take this advice or not to take this advice and my problem is, how can we communicate our information to society. I would like here in this room, maybe we have the time to discuss and exchange views on how other Academies solve this problem or have solved this problem and maybe we have time until the end of our meeting to come up with this topic and express our views, and we can learn from each other how we can inform our own society when we go back home. Thank you very much, I enjoyed very much the meeting here and I am very impressed by your Academy.

MICHAEL T. CLEGG

Thank you Mr. President, distinguished Academicians and colleagues, I am Foreign Secretary of the US National Academy of Sciences and, in that capacity, I am here as the representative of our Academy to give you our best wishes and greetings on the occasion of the four hundredth anniversary of the Pontifical Academy of Sciences.

Listening this morning to the discussion on Galileo reminds us once again that we share a common culture, a culture based on the application of

rational principles to understanding the material world. Looking ahead towards the future, we believe that the 21st century will pose even greater challenges to mankind. These are driven in part by global population and by extreme demands on the resources that we depend on for human sustenance. There are two broad categories of issues that face the world and that should be of great concern to the global science community. One is global sustainability and the second is achieving a greater measure of global equity so that all humans can experience a sense of human dignity in their lives, a standard not presently achieved for roughly 800 million people on this globe.

So we look forward to joining the Pontifical Academy of Sciences and the global community of Science Academies in working towards a resolution of the challenges that the future presents us, and we also believe that not only the rational principles of science but also the ethical framework provided by the world's great religions will be required to achieve the solutions to these problems. Thank you.

MICHAEL E.F. RYAN

President, it is my great honour and pleasure to bring you the congratulations and good wishes of the Royal Irish Academy. We have long looked with envy on the Pontifical Academy as a great example for us and we have much to learn from your traditions and your experience and from the kind of meetings that you have organised in the last two days and the meeting to come. We have found, in the 218 years of our existence, that fidelity to the ideals of the Academy as they were first enunciated four hundred years ago and keeping faith with the wishes of our founders, has been a great strength particularly since the island of Ireland became divided. Academies, by providing safe places for rational, free debate, can transcend the stresses of current political events. We operate I suppose to some extent in friendly rivalry to the British Academy and the Royal Society also in Northern Ireland where we draw a third of our membership.

May I offer just a couple of brief reflections? One role of the Academy is to provide that free and independent debate so that when decisions are made, not just by us personally but perhaps also by our political and governmental leaderships, they are made in the light of all the evidence as it is now available to us. If there is any way of getting the work of the Academies out to the wider society, it is perhaps through targeted meetings, meetings taking place under privilege, where political and other decision-makers

may arrive at conclusions and may debate important issues in a calm and I hope politically non-partisan atmosphere.

In your debate yesterday on aspects of education there was one compelling contribution from the floor about aspects of education which are not covered by neuroscience and the cognitive sciences. As we rush headlong into the knowledge economy as our political leaderships hope that we do, there is a very great danger that education will be seen as a simple instrument of economic development and this, I think, is a great danger. If there is a flag to be carried by Academies, and I hope it would be taken up by your Academy, it is keeping alive the idea that education is about the whole person in society and that, while we want to cherish the sciences and while we want to correct the deficiencies of educational systems that have not helped the sciences, we also want to keep the humanities alive. I would very much urge you to remember the humanities in your scientific debates. Thank you very much.

HOWARD ALPER

Thank you, President, Chancellor. It is an honour for the Royal Society of Canada to be a participant in this important celebratory event and personally I am extremely happy to be its representative today. We congratulate the Pontifical Academy of Sciences for the significant contributions it has made throughout the years and encourage it in the future to undertake consideration and address issues of major significance to all of us. That is to be done in the context not only of doubts and concerns but I would argue that research and innovation has provided great opportunities in health, extending the quality of life, in new materials, in public policy etc. so it should be done from a positive perspective cognisant of the challenges that we have in society. Finally, I would say that Canada, in terms of research innovation, is at the forefront in certain areas such as stem cells, and in the future, it would be great to invite Canadians to participate in different working groups organised by the Pontifical Academy. Thank you.

ANTHONY KOUNADIS

Mr. President, distinguished colleagues, it is an honour and privilege for me to represent our national Academy, the Academy of Athens, the roots of which come from Plato's ancient Academy.

During my short stay here I was impressed, Mr. President, by the level of the presentations and moreover by the fruitful discussions. However, I would like to stress the interest and the follow-ups for the future. The revolutionary progress in neural sciences obliges us to give more emphasis to the study of the interactions between moral and social sciences on the one hand and natural sciences on the other. I would also like to thank you because, during this stay, I became aware of so many interesting things concerning the Pontifical Academy of Sciences and, on behalf of the Academy of Athens, I would like to extend to you and to the Academy my congratulations on the anniversary of four hundred years from its foundation, and also to thank you very much for your kind invitation and warm hospitality during my stay. Thank you.

NICOLA CABIBBO

Mr. Kounadis, I would like to reassure you that we remember Athens. In most of our books we have the reproduction of the School of Athens by Raphael, which is one of the great works of art here in the Vatican. Thank you very much.

ANTONINO ZICHICHI

Our institution is ten times younger than the *Academia Lynceorum* which celebrates its 400th anniversary. This anniversary has a special significance since it coincides with the 25 years of Apostolate of John Paul II. The WFS has established very strong links with this Pope during the past 25 years of close collaboration.

The past 25 years of Apostolate have no precedents in the History of the world, having witnessed the fall of the Berlin Wall, the rally against Planetary Emergencies and the victory over cultural mystification, of which the main fallacy was the presumed antithesis between Science and Faith. These developments were not foreseen by any futurologist.

Our Culture was already considered to be in its decline when John Paul II was elected. The impact of this Pope on History will be the highlight of historical annals for centuries to come. It was during his Apostolate that the Catholic Culture brought back home the treasures of Galilean Science that have always been its own.

On March 30, 1979, in a meeting with European physicists in the Vatican, the Pope affirmed that Science was born from an act of Faith. Galilei actually studied stones in his search for the Logic of Creation.

He could have discovered Chaos. How could Galilei have presumed the existence of the Fundamental Laws of Nature? And based on what premise, if not through an act of Faith, could he have concluded that these Laws must be Universal and Immutable?

With these reflections, John Paul II opens the Church doors to Science by acknowledging its values as comparable to those of the Church itself, saying that: '*Science and Faith are both gifts of God*'. With these words, a new alliance is born between John Paul II and the largest scientific community ever brought together by any entity in the world: the WFS (World Federation of Scientists).

By clearly distinguishing Science (the study of the Logic of Creation) from Technology (the use of Science, for good and, unfortunately, also for bad), John Paul II reinforces Science in its defence against slanderous attacks by the dominant culture.

In a message to the WFS, John Paul II testifies that: '*Man can perish by the technologies he invents, but not by the truths he discovers through the teachings of Galilei*'. These words permit us to distinguish great scientific discoveries from the technologies of war, unbridled industrialization and genetic manipulation.

The joint initiative of John Paul II and the scientists from 115 Nations as signatories of the Erice Manifesto made a critical contribution to the collapse of the Berlin Wall – a concrete fact that validates the Great Alliance between Science and Faith.

Decrying the threat of Nuclear Holocaust, the Holy Father gives life to another initiative for combating Planetary Emergencies. Here we refer to the establishment by the international scientific community of a corps of Volunteer Scientists that has realized 55 pilot projects all over the world, the results of which point to the conclusion that it is in fact possible to confront and resolve Planetary Emergencies. Our action has been stimulated by another message of John Paul II to the WFS where His Holiness says: '*Voluntary Science is one of the noblest expressions of love for one's fellow men*'. For future generations, this holds out hope for a life of communal well-being and brotherhood among all peoples of the Earth.

If it were not for political and economic violence, scientific discoveries would be applied with one and only one true goal: that of improving the quality of life and defending the dignity of all creatures living on this satellite of the Sun.

If it were not for political and economic violence, there would be no arms race, no unbridled industrialization, no cultural mystification, no Planetary Emergencies.

Science would serve only good ends and would equate to a continuation of the Work of Creation.

This teaching of John Paul II might have seemed Utopian twenty-five years ago. In this last quarter of a century, however, many new lights have come to illuminate the hope that this Utopia might some day become reality.

JÜRGEN MITTELSTRASS

In these days I feel more a member of this great Academy than the President of the Academia Europaea, the European Academy of Sciences founded in 1988. As President of the Academia Europaea I congratulate you on your proud history and on your extraordinary activities today, both for the improvement of science and, referring to the title of one of our recent workshops, for the future of mankind. Thank you very much.

NICOLA CABIBBO

We have had many many interesting contributions for which we are grateful to all of you. They will be published and we will think about them. I would just like to give a few very quick answers. We are very happy to collaborate and have done so in the past, some of our meetings have been organised in collaboration with Academies who proposed interesting themes for collaboration, so we can certainly collaborate and we are happy to do so.

There is then a wider aspect which is the collaboration of all Academies together and we are also active from that point of view in the InterAcademy Panel of which we are a member – and I guess most of your Academies are also members – and finally the invitation to be together means something, I mean, we want to collaborate. Thank you everybody and sorry we reserved this time for the representatives of other Academies, and I hope we will find the occasion also for our members to discuss this discussion. Excuse me for the words which collide but we would like to discuss with our membership what we have heard this morning. Thank you everybody.

ADDITIONAL DOCUMENTS AND PHOTOGRAPHS

PAS Bishop-Chancellor Marcelo Sánchez Sorondo presents
the commemorative medallion to H.H. John Paul II, 10 November 2003

Commemorative medallion, produced by the PAS in silver and bronze, bearing on its obverse a representation of God setting alight the torches of reason and faith held by two maidens, and on its reverse the images of the Holy Father John Paul II and Galileo Galilei

THE ROYAL SOCIETY

6–9 Carlton House Terrace
London SW1Y 5AG

Nicola Cabibbo and Marcelo Sánchez Sorondo
President and Chancellor
Pontificia Academia Scientiarum
Casina Pio IV
V-00120 Città del Vatican
Rome
Italy

From the Foreign Secretary and Vice-President Professor Julia Higgins DBE FRS FREng
21 November 2003
Our ref:

Dear Professor Cabibbo and Dr Sorondo,

I should like to thank the Pontifical Academy for inviting me to share the celebrations of your 400th anniversary which I enjoyed very much. In the interests of arriving at a reasonable lunch time, I did not add a contribution to the formal session on Sunday morning. I should be grateful however, if you would note in reporting the session, the warm congratulations to our sister Academy from the Royal Society. I know Dame Ann MacLaren was arriving to participate in the following session on stem cell research and I am only sorry I could not stay longer.

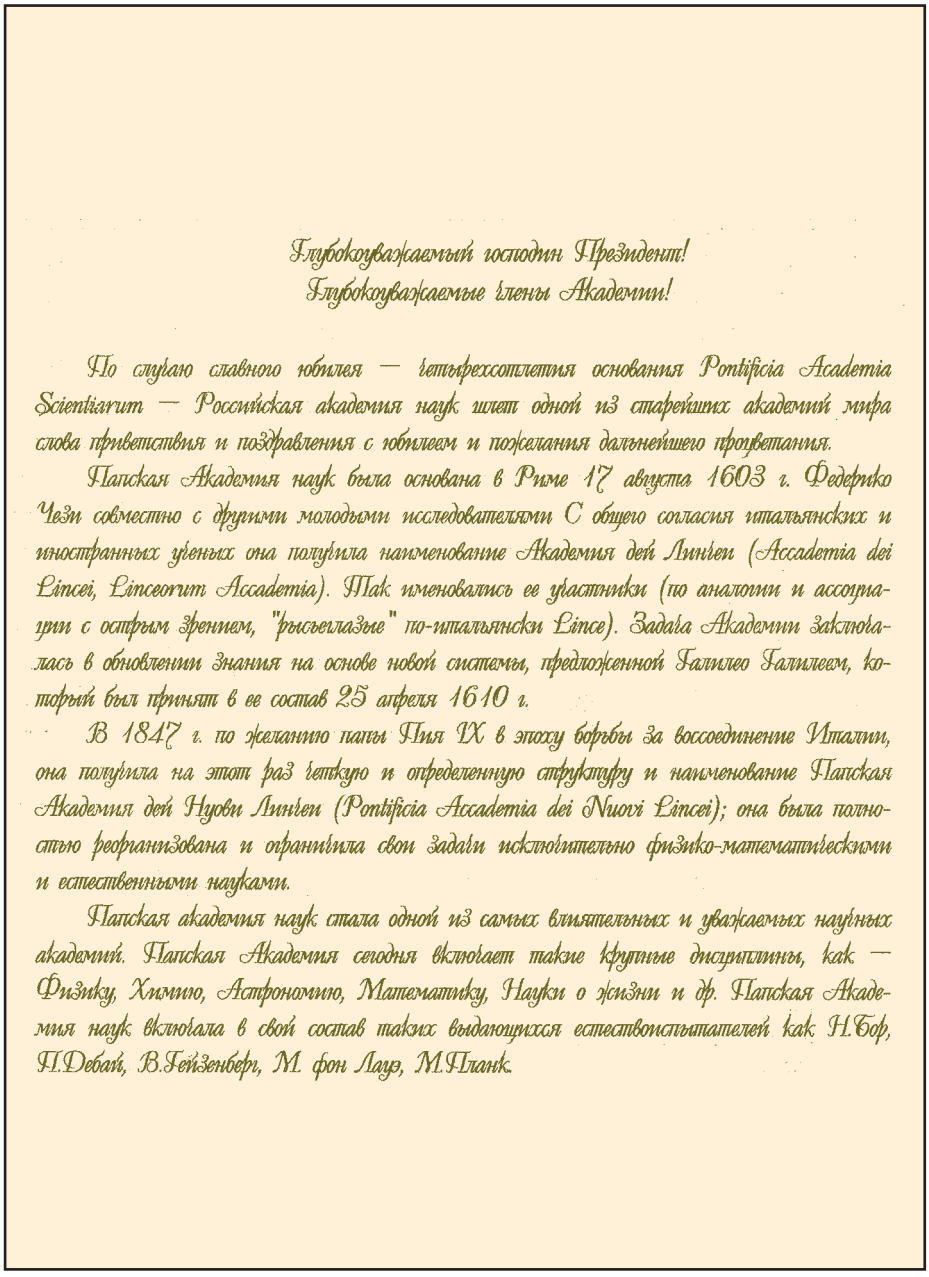
With all good wishes,

Yours sincerely

Julia Higgins

Thank-you letter from the British Royal Society to the Pontifical Academy of Sciences

Cover of the congratulatory letter from the Russian Academy of Sciences to the Pontifical Academy of Sciences



Глубокоуважаемый господин Президент!
Глубокоуважаемые члены Академии!

По случаю славного юбилея — четырехсотлетия основания Pontificia Academia Scientiarum — Российская академия наук шлет одной из старейших академий мира слова приветствия и поздравления с юбилеем и пожелания дальнейшего процветания.

Папская Академия наук была основана в Риме 17 августа 1603 г. Федерико Чези совместно с другими молодыми исследователями С общего согласия итальянских и иностранных ученых она получила наименование Академия дей Линчеи (Accademia dei Lincei, Linceorum Accademia). Так именовались ее участники (по аналогии и ассоциации с острым зрением, "рысьеглазые" по-итальянски Lince). Задача Академии заключалась в обновлении знания на основе новой системы, предложенной Галилео Галилеем, который был принят в ее состав 25 апреля 1610 г.

В 1847 г. по желанию папы Пия IX в эпоху борьбы за воссоединение Италии, она получила на этот раз четкую и определенную структуру и наименование Папская Академия дей Нуови Линчеи (Pontificia Accademia dei Nuovi Lincei); она была полностью реорганизована и ограничила свои задачи исключительно физико-математическими и естественными науками.

Папская академия наук стала одной из самых влиятельных и уважаемых научных академий. Папская Академия сегодня включает такие крупные дисциплины, как — Физику, Химию, Астрономию, Математику, Науки о жизни и др. Папская Академия наук включала в свой состав таких выдающихся естествоиспытателей как Н.Бор, П.Дебай, В.Гейзенберг, М. фон Лауэ, М.Планк.

Congratulatory letter from the Russian Academy of Sciences
to the Pontifical Academy of Sciences. Continues overleaf

Сейчас мы видим в составе Академии — и российских ученых — академиков РАН — Новикова С.П. и Сердеева Р.З.

Деятельность Академии особенно оживилась при Папе Иоанне Павле II. Крупным событием международной культурной жизни последней четверти века стала проведенная в 1979 г. конференция, посвященная 100-летию Альберта Эйнштейна, председателем которой и одним из докладчиков выступил он сам. Среди важнейших направлений деятельности Академии — борьба с угрозой ядерной катастрофы. В 1980 г. в Академии была создана специальная комиссия по оценке ее возможных последствий, проделавшая большую работу и нашедшую широкий отклик во всем мире.

В анналах деятельности Академии имеются и страницы, связанные с Россией, ее наукой и культурой. При своем приобщении к науке Нового времени средневековая Русь испытала сильное влияние Рима. Это влияние, естественно, проявилось в деятельности первых национальных школ, в частности, первой высшей школы России — основанной в 1687 г. и получившей наименование Славяно-греко-латинской академии.

Следует подчеркнуть, что в последние годы Российская Академия наук развивает сотрудничество с научными учреждениями, архивом и библиотекой Ватикана.

По инициативе РАН в рамках празднования 2000-летия христианства в 2000 г. с большим успехом и научным и общественным резонансом была проведена Международная конференция "Христианство на пороге нового тысячелетия", в которой приняли участие Церковно-научный центр "Православная энциклопедия" и Папский комитет исторических наук.

Сотрудничество науки и религии в деле укрепления мира и стабильности в борьбе за достойное будущее человечества, может стать существенным направлением нашей совместной работы. Одна из ведущих ролей в этой работе может принадлежать Папской Академии наук, вклад которой в развитие науки и культуры будет таким же весомым, как и в предыдущие четыре века.

В связи с 400-летием со времени основания Папской Академии Наук, Президиум Российской академии наук приветствует одну из старейших Академий Наук. Мы желаем Академии дальнейших успехов и надеемся на укрепление сотрудничества между Папской Академией и Российской академией наук.

Президент
Российской академии наук
академик Ю.С. Осипов

Dear Mr. President,
Esteemed Members of the Academy,

On the occasion of the glorious 400th anniversary of the Pontifical Academy of Sciences' foundation the Russian Academy of Sciences sends to one of the world's oldest academies words of greeting and congratulations for the jubilee as well as wishes for further prosperity.

The Pontifical Academy has become one of the most influential and respected scientific academies in the world. The Russian Academy of Sciences with a cycle of natural sciences to take one of the leading places thereat, highly appreciates the fact that, as of today, the Pontifical Academy comprises such major disciplines as physics, chemistry, astronomy, mathematics, Earth sciences, environmental sciences etc. Being an international academy rather than a national one, the Pontifical Academy of Sciences has inscribed in its membership such prominent naturalists as N. Bohr, P. Debye, W. Heisenberg, M. von Laue, M. Planck. Now we also see Russian scientists and RAS members S. Novikov and R. Sagdeyev as members of the Pontifical Academy.

The Academy's activities have been especially revived in the time of Pope John Paul II. A conference held in 1979 and dedicated to the centennial of Albert Einstein, with Pope John Paul II being the chairman and one of the speakers, became a significant event in the international cultural life of the last quarter of the century. One of the Academy's most important activities is the struggle against the threat of a nuclear catastrophe. To evaluate its possible consequences a special committee was set up at the Academy in 1980, which carried out important work and received a broad response all over the world.

In the records of the Academy's activities there are pages associated with Russia, its science and culture. When medieval Russia was given access to the modern science, it experienced Rome's strong influence. Naturally, that influence became apparent in the activities of the first national schools, in particular, the first high school of Russia established in 1687 and named Slavonic-Greek-Latin Academy.

One of the most important issues that Russian scientists and thinkers of the 19th-20th centuries faced was the relationship between Science and Religion. It was posed in a particular acute manner in the works of thinkers that lived in the period of the Russian 'Silver Century' as, for example, in the creative works of Paul Florenskii, a prominent Russian theologian, outstanding philosopher and naturalist of the 19th century. An international conference devoted to his works took place in Bergamo in 1988 with the participation of the Catholic Church.

It should be mentioned that over the last few years the Russian Academy of Sciences has been developing cooperation with the scientific institutions, Archives and Library of the Vatican.

Unofficial translation of the congratulatory letter from the Russian Academy of Sciences to the Pontifical Academy of Sciences. Continues overleaf

At the beginning of 2003 a Center for the Study of the History of Religion and the Church was established at the RAS Institute of General History. One of the tasks of the Center is to coordinate study of the history of religion and the Church in Russia and to develop cooperation with centers abroad which have the same scientific interests.

Among other institutions, Russian historians maintain scientific contacts with the Pontifical Committee for Historical Sciences, jointly implementing the research project 'Russia and the Vatican at the End of the 19th and the Beginning of the 20th Centuries'. Within the framework of this project three bilateral colloquia on the above subject were held in 1998, 2001 and 2003. Reports of the first colloquium have been published and those of the second and third are being prepared for publication. At present documents from the archives of Russia and the Vatican are also being collected and complied for publication under the theme 'Russia and the Vatican. 1917-1930'.

Upon RAS' initiative, the International Conference 'Christianity on the Eve of a New Millennium' was held in the year 2000 with great success, within the framework of celebrating the Second Millennium of Christianity, and had a significant scientific and public response. 'The Orthodox Encyclopaedia' Ecclesiastical and Scientific Center and the Pontifical Committee for Historical Sciences took part in the Conference. His Holiness Patriarch Aleksiy II spoke at the opening ceremony of the Conference held under the auspices of RAS and an address by His Holiness Pope John Paul II was read. Proceedings of the Conference have already been published.

Due to the successful outcome of this event and the importance of the task set, the next conference under the theme 'History and Hagiography of Undivided Church' was held in June of 2003. 'The Orthodox Encyclopaedia' Ecclesiastical and Scientific Center and the Pontifical Committee for Historical Sciences together with RAS were among the organizers of the Conference.

Collaboration of science and religion in strengthening peace and stability in the struggle for the merited future of mankind may become a significant area in our joint work. One of the leading roles in this work may belong to the Pontifical Academy of Sciences with its contribution to the development of science and culture being as significant as that during the previous four centuries.

The President of the Russian Academy of Sciences, academician
Yury Osipov

Russian icon donated by the Russian Academy of Sciences
to the Pontifical Academy of Sciences

L'ACADÉMIE ROYALE
DES SCIENCES, DES LETTRES ET DES BEAUX-ARTS
DE BELGIQUE

adresse à la

PONTIFICIA ACADEMIA SCIENTIARUM

ses plus chaleureuses félicitations à l'occasion du quatre centième anniversaire de sa fondation

Elle est heureuse de pouvoir lui exprimer ses sentiments d'admiration
pour l'œuvre accomplie dans le domaine des mathématiques, de la physique,
des sciences naturelles et de l'épistémologie

L'Académie royale de Belgique forme les vœux les plus cordiaux
pour que la mission de la Pontificia Academia Scientiarum
se poursuive avec le plus grand succès

Bruxelles, le 9 novembre 2003.

Le Secrétaire perpétuel,

Léo HOUZIAUX

Le Président,

Guillaume WUNSCH

Congratulatory letter from the Belgian Royal Academy of Sciences,
Letters and Fine Arts to the Pontifical Academy of Sciences

ACADEMIE ROYALE
des sciences, des lettres & des beaux-arts
DE BELGIQUE

Bruxelles, le 20 novembre 2003

Monseigneur,

Avec un peu de retard, je vous remercie une fois encore pour l'invitation relative au 400ème anniversaire de l'Académie Pontificale. Ce fut une belle et intéressante manifestation.

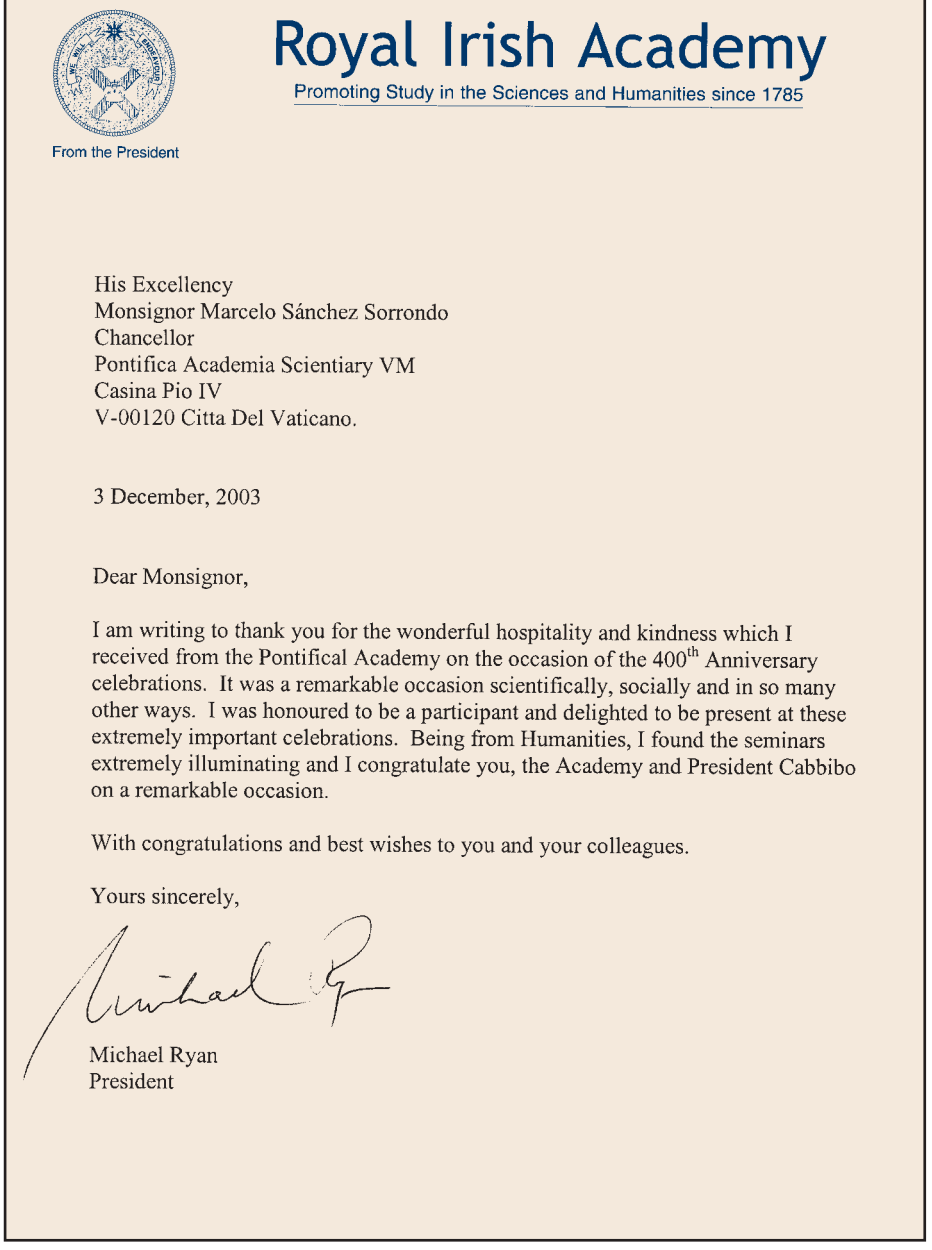
J'espère avoir le plaisir un jour de vous accueillir à l'Académie royale de Belgique… ou à l'Université catholique de Louvain !

Je vous prie d'agréer, Monseigneur, l'expression de mes très cordiales salutations.

Guillaume Wunsch
Président

Mgr. Marcelo Sanchez Sorondo
Chancellier
Académie Pontificale des Sciences
Casina Pius IV
VA-Cité du Vatican
VATICAN

Thank-you letter from the Belgian Royal Academy of Sciences,
Letters and Fine Arts to the Pontifical Academy of Sciences



Royal Irish Academy

Promoting Study in the Sciences and Humanities since 1785

From the President

His Excellency
Monsignor Marcelo Sánchez Sorrondo
Chancellor
Pontifica Academia Scientiary VM
Casina Pio IV
V-00120 Citta Del Vaticano.

3 December, 2003

Dear Monsignor,

I am writing to thank you for the wonderful hospitality and kindness which I received from the Pontifical Academy on the occasion of the 400th Anniversary celebrations. It was a remarkable occasion scientifically, socially and in so many other ways. I was honoured to be a participant and delighted to be present at these extremely important celebrations. Being from Humanities, I found the seminars extremely illuminating and I congratulate you, the Academy and President Cabbibo on a remarkable occasion.

With congratulations and best wishes to you and your colleagues.

Yours sincerely,

Michael Ryan
President

Thank-you letter from the Royal Irish Academy to the Pontifical Academy of Sciences

PAN
POLISH ACADEMY OF SCIENCES

Warsaw, 9 November 2003

PRESIDENT

Professor
Nicola Cabibbo
President
Pontifical Academy of Sciences

Vatican City

Dear Mr. President,

It is with very great pleasure that the Polish Academy of Sciences is able to participate in the jubilee celebrations of the 400th anniversary of the foundation of the Pontifical Academy of Sciences.

Every jubilee, and such a momentous as this one in particular, gives the opportunity for a joy and for the reflection – to contemplate on this what has passed, but also for the look into the future.

This, founded on 17 August 1603, scientific institution of highest rank and supranational character, oriented towards the promotion of pure science, aiming at securing the freedom in the research development as a prerequisite of scientific progress, enjoys the deserved respect all over the world. Its output constitutes an enormous contribution into the current development of knowledge in the field of mathematical and experimental sciences. Having gathered the top rank personalities of world science, including the Nobel Prize winners, the people of various religions and nations, the Pontifical Academy of Sciences is a perfect place for intellectual confrontations.

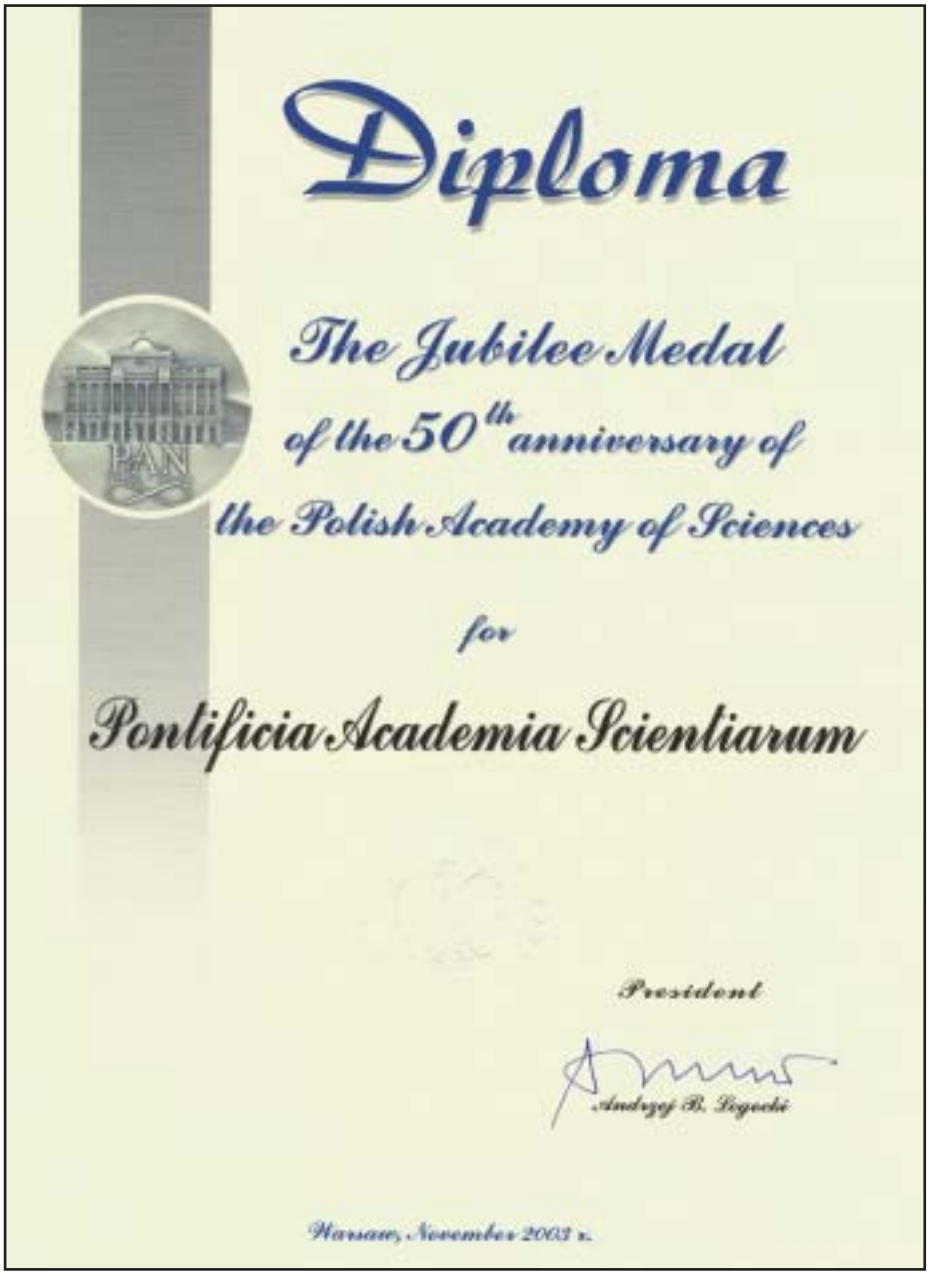
I am particularly pleased to emphasize that the members of Polish Academy of Sciences - Professor Czesław Olech from the Mathematical Institute of PAN and Professor Andrzej Szczeklik from the Jagiellonian University are the Pontifical Academicians.

Today, on the occasion of 400th anniversary of the foundation of the Pontifical Academy of Sciences on behalf of the Authorities of the Polish Academy of Sciences, its Presidium and all scientific community of our Academy I am pleased to send you my heartfelt congratulations. May I also wish you, Mr. President as well as all Academicians of your esteemed institution, further numerous outstanding and significant scientific achievements.

Respectfully yours,

Andrzej B. Legocki

Congratulatory letter from the Polish Academy
of Sciences to the Pontifical Academy of Sciences



Diploma for the 50th anniversary of the Polish Academy of Sciences presented to the Pontifical Academy of Sciences

Jubilee Medal accompanying the Diploma presented
by the Polish Academy of Sciences to the Pontifical Academy of Sciences

THE JAPAN ACADEMY

THE JAPAN ACADEMY
TO
PONTIFICIA ACADEMIA SCIENTIARUM

It is a great honour and a privilege for the Japan Academy to offer a congratulatory address to Pontificia Academia Scientiarum on the occasion of the celebration of the 400th Anniversary of the foundation. It is our pleasure to have Professor Eiichi Hoshino, member of the Japan Academy, participate in the ceremony representing our Academy.

We, the members of the Japan Academy, are deeply impressed by your invaluable role in promoting the progress of the mathematical and natural sciences and studying epistemological problems related thereto. We are also strongly impressed by your principle of choosing members from all over the world, without any discrimination as regards race or religion.

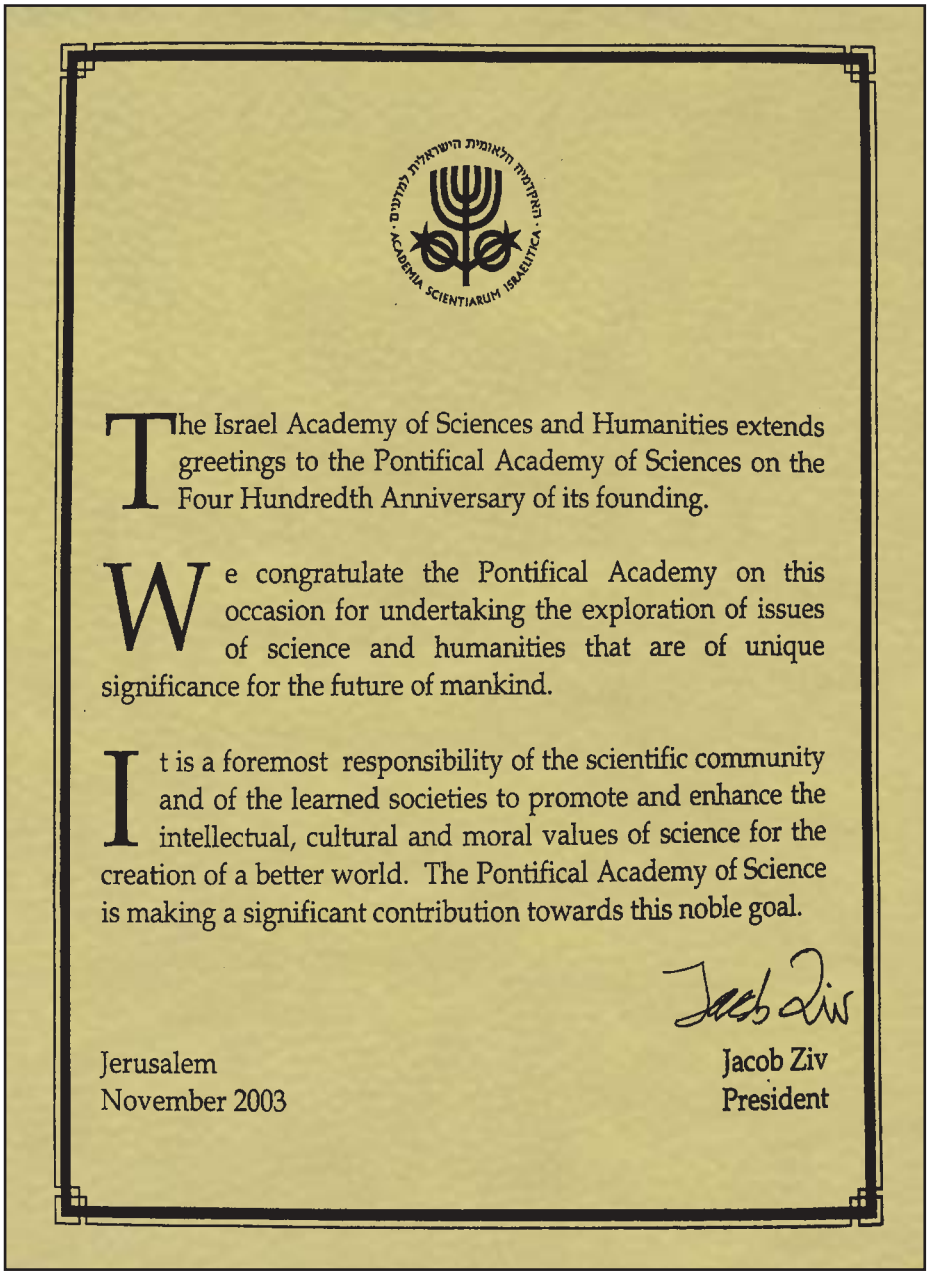
It is our honour and pleasure that several members of our Academy were chosen as members of your Academy: for instance, the late S. Mizushima, H. Umezawa, K. Fukui, and M. Oda. At present, Ryoji Noyori is among your members.

As we are in the world where we enjoy the benefits of science and technology on one hand, but where we face the danger of unlimited use of them on the other, the role of your Academy will become more and more important. So once again we take this opportunity to express our hearty respect and warmest congratulations for Pontificia Academia Scientiarum.

9 November 2003

Saburo Nagakura
President
The Japan Academy

Congratulatory letter from the Japan Academy to the Pontifical Academy of Sciences



The Israel Academy of Sciences and Humanities extends greetings to the Pontifical Academy of Sciences on the Four Hundredth Anniversary of its founding.

We congratulate the Pontifical Academy on this occasion for undertaking the exploration of issues of science and humanities that are of unique significance for the future of mankind.

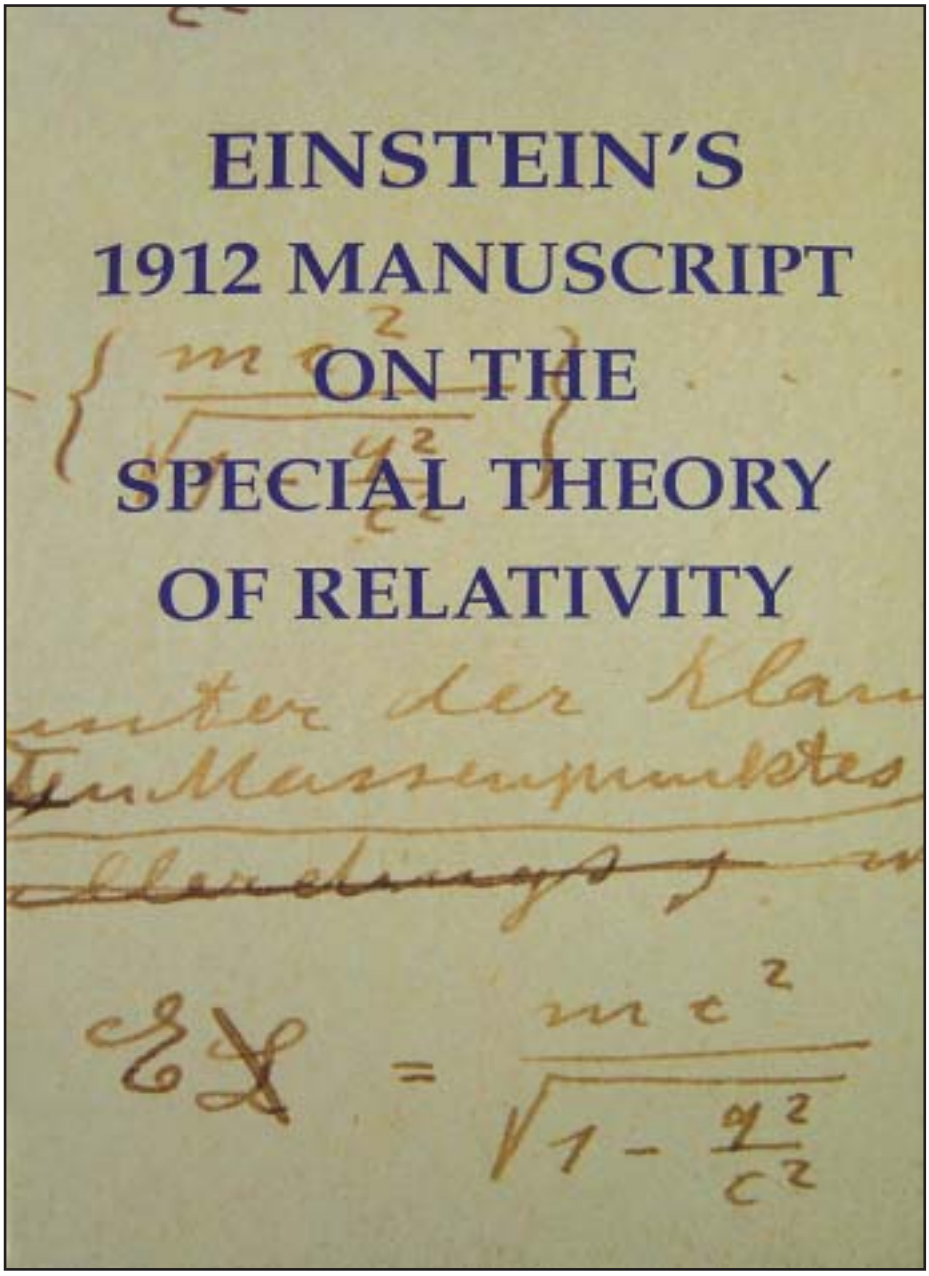
It is a foremost responsibility of the scientific community and of the learned societies to promote and enhance the intellectual, cultural and moral values of science for the creation of a better world. The Pontifical Academy of Science is making a significant contribution towards this noble goal.

Jacob Ziv

Jerusalem
November 2003

Jacob Ziv
President

Congratulatory letter from the Israel Academy of Sciences and Humanities to the Pontifical Academy of Sciences



Title page of the book presented by the Israel Academy of Sciences and Humanities to the Pontifical Academy of Sciences, bearing Einstein's well-known formula

SECRETARÍA DE RELACIONES EXTERIORES
MÉXICO

"2003. Año del CCL Aniversario del Natalicio de
Don Miguel Hidalgo y Costilla. Padre de la Patria".

Tlatelolco, D.F., a 17 de noviembre de 2003.

Profesor Nicola Cabibbo,
Director de la Academia Pontificia de las Ciencias,
Ciudad del Vaticano, Santa Sede.

Me es muy grato dirigirme a usted para expresarle mi más sincera felicitación con motivo del 400 Aniversario de la fundación de la Academia Pontificia de las Ciencias y reconocer la labor de esa institución durante estos cuatro siglos en aras de la investigación científica.

Al reiterar a usted mis felicitaciones por este Aniversario y solicitarle ser el amable conducto para hacerlas extensivas al resto de los miembros de la Academia, aprovecho la ocasión para renovarle las seguridades de mi más atenta y distinguida consideración.

Atentamente,
El Secretario

LUIS ERNESTO DERBEZ BAUTISTA

Congratulatory letter from the Mexican Secretariat
of Foreign Relations to the Pontifical Academy of Sciences

CASE
SCHOOL OF MEDICINE

Robert J. White M.D., Ph.D.
Professor of Neurological Surgery

MetroHealth Medical Center
2500 MetroHealth Drive, H910
Cleveland, Ohio 44109-1998

Phone 216-778-4383
Fax 216-778-3300
Email witheringwhites@aol.com

November 18, 2003

Professor Nicola Cabibbo
President
Pontifical Academy of Sciences
Casina Pius IV
V-00120 Citta Del Vaticano, Roma

Dear Professor Cabibbo:

It was both a pleasure and an honor for me to have attended the 400th Anniversary of the Pontifical Academy of Sciences. My wife and I both found the affair most pleasurable and impressive.

You looked wonderful and I was delighted to visit with you again.

Congratulations on a memorable meeting.

I remain,

Robert J. White, M.D., Ph.D.
Professor of Neurosurgery
Case University School of Medicine

RJW/pjk

Thank-you letter from Professor Robert J. White,
Case University School of Medicine, to the Pontifical Academy of Sciences

A PRAYER

In his *Summa contra gentiles*, St. Thomas Aquinas writes: 'Our discovering mind extends itself into the infinite'. Here, the infinite is both the object of the cognising mind, which we also call God, and its nature, which we also call Reason. How confined, compared to this, is our approach when (in philosophy) we speak of the limits of reason, and (in science) of the end of knowledge, where this means either the limitations of knowledge or its perfection – as putatively complete knowledge. Thomas Aquinas precisely sees in the limitation of knowledge its unlimitedness (as inachievable desire for knowledge), and in the eternal obligation of reason its own infinitude. And he declares just this to be our nature: 'Reason is the nature of man', it says in the *Quaestiones disputatae de malo*, again, the infinite belonging to our nature – not as the 'other' of philosophy and science, but as the medium in which also philosophy and science operate. This is not an assertion of science, of course, but a philosophical assertion, or, following Immanuel Kant, the assertion of a philosophical belief. It agrees with theological wisdom about the nature of man and his striving for God.

Jürgen Mittelstrass

Prayer by Jürgen Mittelstrass during the Commemorative Mass
at the Church of St. Stephen of the Abyssinians, Vatican City, 9 November 2003

The following names are the winners of the one hundred scholarships offered by the PAS and the WFS for the 25th Anniversary of H.H. John Paul II's Apostolate on the occasion of the Fourth Centenary of the Foundation of the First Academy of Sciences

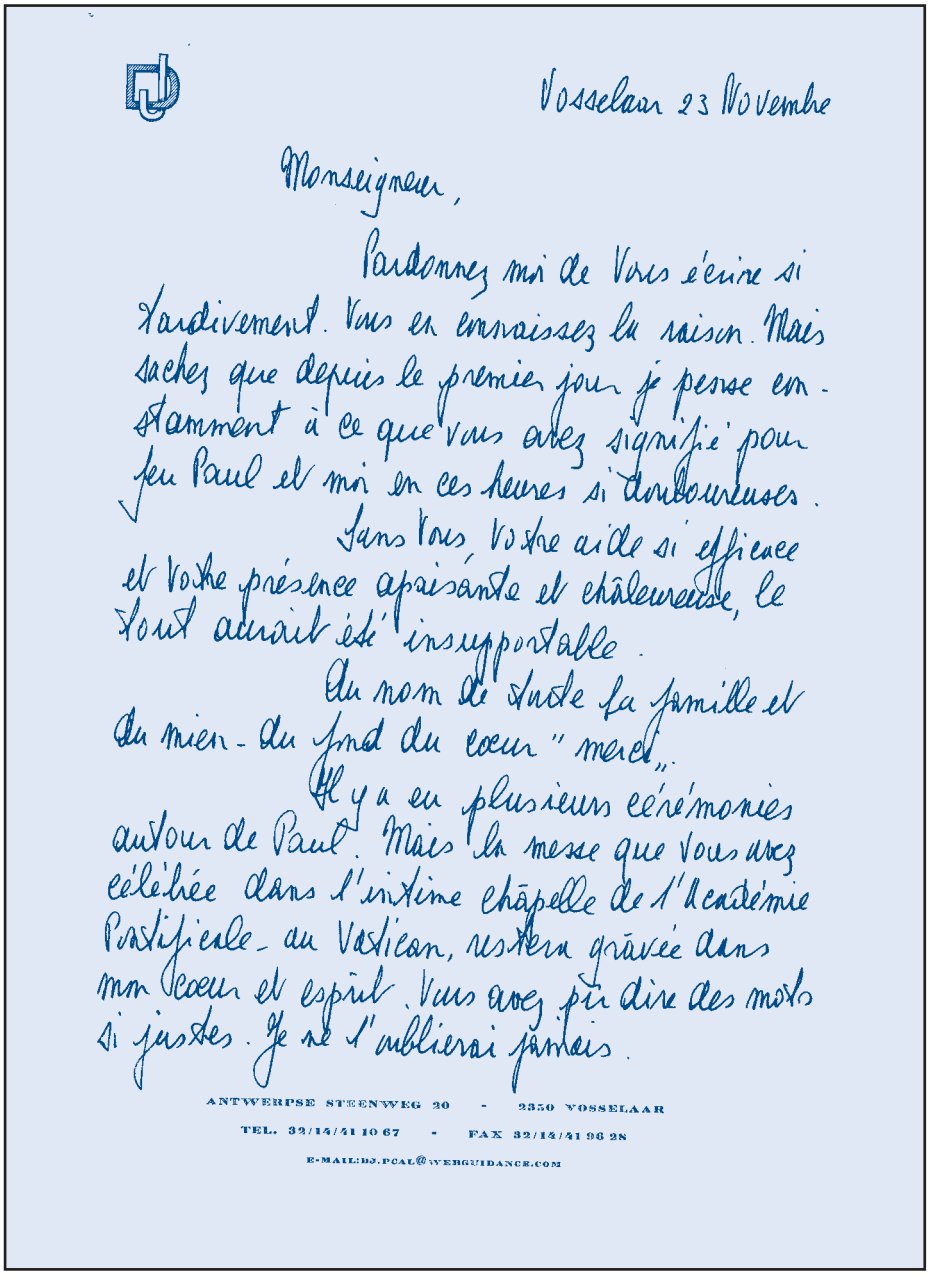
THE JOHN PAUL II ONE HUNDRED SCHOLARSHIPS PROJECT

LIST OF SCHOLARS	COUNTRY	PLANETARY EMERGENCY
Yasser ABDELRAHMAN	Egypt	Science & Technology
Asel A. ABDILDANOVA	Kazakhstan	Science & Technology
Borislav ABRASHEV	Bulgaria	Energy
Irma ACHIRI	Moldova	Food
Elizabeth ADEADEMILUA	Nigeria	Science & Technology
Sunday ADEBUSOYE	Nigeria	Science & Technology
Adeola ADEROUNMU	Nigeria	Science & Technology
Luciana García AGRICOLA	Mexico	Science & Technology
Andrey V. AKULICH	Belarus	Energy
Robertas ALZBUTAS	Lithuania	Energy
Naser AL-ZRIGAT	Jordan	Science & Technology
Ljupco ANTOVSKJ	Macedonia	Science & Technology
Goce ARMENSKI	Macedonia	Science & Technology
Dumitru BADICEAN	Moldova	Food
Luis Gutiérrez BALDERAS	Mexico	Science & Technology
Fred BALIRAINE	Uganda	Biotechnology
Manal BANNOURA	Palestine	Science & Technology
Roza BAPOVA	Kazakhstan	Pollution
Ekaterina BELOUSOVA	Belarus	Medicine
Ales BIZJAK	Slovenia	Water
Kiemen BOHINC	Slovenia	Science & Technology
Darius CEBURNIS	Lithuania	Medicine
Natalya CHESKIDOVA	Kyrgyzstan	Science & Technology
Zhiwei CHONG	PRC	Science & Technology
Romila Marius CIPRIAN	Romania	Medicine
Stela CLAPCO	Moldova	Biotechnology
Pablo Cortina CORREA	Mexico	Science & Technology
Arias CORRIA	Cuba	Science & Technology
Maitrayee DASGUPTA	India	Science & Technology
Bigimjan DUSHEEVA	Kyrgyzstan	Science & Technology
Salah ELHENDAWY	Egypt	Science & Technology
Adis ERKINBAEV	Kyrgyzstan	Science & Technology
Miha HUMAR	Slovenia	Science & Technology
Alma GALEYEVA	Kazakhstan	Energy
Kadirov Muminovich GANI	Tajikistan	Science & Technology

LIST OF SCHOLARS	COUNTRY	PLANETARY EMERGENCY
Damodar P. GOSWAMI	India	AIDS & Infectious Diseases
Miranda GUEVARA	Mexico	Science & Technology
Youcef HACINI	Algeria	Science & Technology
Aminul ISLAM	Bangladesh	Science & Technology
David JEZERSEK	Slovenia	Science & Technology
J.-P. Kabumbu KADIMA	Zambia	Science & Technology
Maitaria KAZUNGU	Kenya	Science & Technology
Noreen P. KELLY	USA	Biology
Vadim KHATKOVSKY	Belarus	Global Monitoring of Planet
Samia KHAYYO	Palestine	Science & Technology
Hristina KIROVA	Bulgaria	Pollution
Archil KOBAKHIDZE	Georgia	Science & Technology
Tatya A. KOTLYAR	Kyrgyzstan	Science & Technology
Gulvira R. KUBENOVA	Kazakhstan	Water/Pollution
Biljana KUZMANOVSKA	Macedonia	Food
Andrei KUZMIN	Belarus	Science & Technology
Ales LAPANJE	Slovenia	Soil/Pollution
Alexander MACKIEWICZ	Belarus	Science & Technology
Lucia Maria Vanrell MAJO	Uruguay	Biology
Konstantin V. MAKAROV	Kyrgyzstan	Climate
Simona P. MALACE	Romania	Science & Technology
Artur MANUKIAN	Armenia	Science & Technology
Aleksey MARTYNIOUK	Belarus	Science & Technology
Vadim MATULIS	Belarus	Energy/Pollution
Vitaly MATULIS	Belarus	Science & Technology
Xin-He MENG	PRC	Science & Technology
Andrey MINKEVICH	Belarus	Science & Technology
Atasi MITRA (DEBRAY)	India	Science & Technology
Lea MOGILNICKI	Slovenia	Science & Technology
Pablo Bellocu MONTANO	Uruguay	Science & Technology
Rodica MORARESCU	Romania	Science & Technology
Maja MRAK	Slovenia	Pollution
Oxana MUNJUT	Moldova	Water/Pollution
Maria NAB	Romania	Science & Technology
Anne Marie NDIAYE	Senegal	Science & Technology
Ricardo Cisneros NEUMANN	Mexico	Science & Technology
Oyunbileg NIAMSUREN	Mongolia	Science & Technology
Mariana NIKOLOVA	Bulgaria	Water/Pollution
Nina NINYO	Bulgaria	Energy
Jim Thierry NTAWARI	Burundi	Science & Technology
Elvira-Claudia OLARU	Romania	Science & Technology
Jenny OLSSON	Sweden	Science & Technology

LIST OF SCHOLARS	COUNTRY	PLANETARY EMERGENCY
Doris Vela PERALTA	Ecuador	Science & Technology
Silvia PETROVA	Bulgaria	Pollution
Matej POZARNIK	Slovenia	Science & Technology
Catalina QUINTANA	Ecuador	Science & Technology
Christopher RADZIMINSKII	Canada	Biology
Mohammed RAHMAN	Bangladesh	Science & Technology
Paul A. RAZAFIMANDIMBY	Madagascar	Science & Technology
Candela SANCHEZ	Peru	Science & Technology
Iztok SAVNIK	Slovenia	Science & Technology
Jaydeep SEN	India	Science & Technology
Milan SERNEK	Slovenia	Energy
Adam SHANNON	Ireland	Medicine
Sonika SHARMA	India	Science & Technology
Maijana SIMONIC	Slovenia	Water/Pollution
Remigijus SMATAS	Lithuania	Food
Goradz SOBOCAN	Slovenia	Science & Technology
Natalia STERFITA	Moldova	Science & Technology
Gordana STOJANOSKA	Macedonia	Science & Technology
Ivan SUJANA	Indonesia	Science & Technology
Zhanat SULTANBEKOVA	Kazakhstan	Pollution
Rustam TASHTANOV	Kyrgyzstan	Science & Technology
Khadar S. TASSIBEKOV	Kazakhstan	Pollution
Janja TRCEK	Slovenia	Biotechnology
Aleksander TREBNIKOV	Belarus	Science & Technology
Lidjia TUSEK	Slovenia	Energy/Pollution
Zhanara TULEMISOVA	Kazakhstan	Science & Technology
Bolor TUMURPUREV	Korea	Science & Technology
Vadim TURCAN	Moldova	Biotechnology
Manijem VAFA	Iran	Water
Arunas VALAIKA	Lithuania	Organ Substitution
Ana VALUTA	Moldova	Biotechnology
Patrick YAMOAH	Ghana	Biology
Nugroho YANUAR	Indonesia	Science & Technology
Hongli YUAN	PRC	Science & Technology
Racotomolala ZAFIMAHERY	Madagascar	Biology
Vladimir ZAKHARENKOV	Belarus	Pollution
Oswaldo ZAPATA	Venezuela	Science & Technology
Valentina ZAVASNIK BERGANT	Slovenia	Biotechnology
Alexander ZHYLKO	Belarus	Biotechnology
Anna ZHUKOVA	Belarus	Water

The visit of the WFS President, Antonino Zichichi, to H.H. the Pope, when the 'parchment' with the 100 names was given to H.H. John Paul II, 10 November 2003



Vosselaar 23 Novembre

Monseigneur,

Pardonnez moi de Vous écrire si tardivement. Vous en connaissez la raison. Mais sachez que depuis le premier jour je pense constamment à ce que Vous avez signifié pour feu Paul et moi en ces heures si douloureuses.

Sans Vous, Votre aide si efficace et Votre présence apaisante et chaleureuse, le tout aurait été insupportable.

Au nom de toute la famille et du mien - du fond du coeur "merci".

Il y a eu plusieurs cérémonies autour de Paul. Mais la messe que Vous avez célébrée dans l'intime chapelle de l'Académie Pontificale - au Vatican, restera gravée dans mon coeur et esprit. Vous avez pu dire des mots si justes. Je ne l'oublierai jamais.

ANTWERPSE STEENWEG 20 - 2350 VOSSELAAR
TEL. 32/14/41 10 67 - FAX 32/14/41 96 28
E-MAIL:HJ.PCAL@SVERGUIDANCE.COM

Facsimile of the letter from Mrs. Dora Arts Janssen
to PAS Bishop-Chancellor Marcelo Sánchez Sorondo

Merci aussi pour vos mots encourageants reçus par courrier et pour la série de photos que vous avez eu la bonté de m'envoyer. Le soir avant son grand départ, Paul m'a dit qu'il aimerait les recevoir et commentait la rencontre avec le Saint Père. Pour une raison encore obscure, il y attachait une grande importance. Plusieurs fois dans la soirée passée à deux, sur la terrasse, devant la basilique de Saint-Pierre il me reparlait de sa rencontre avec sa Sainteté le Pape. De la poignée de mains qu'ils s'étaient donnée. Le contact et ce regard ont dû déclencher une étincelle en lui. J'en suis si heureuse. Cela voulait dire, je crois, le désir d'un rapprochement de Dieu.

Pour terminer - j'ose espérer avoir l'occasion de vous revoir dans le futur. En Belgique chez nous, vous êtes plus que bienvenue. Ou à Rome. Ou dans ce vaste monde.

Pardonnez-moi de vous écrire en français. Mais vous parlez tellement bien cette langue.

Avec gratitude, respect et mes plus sincères pensées

Ina Jansson

PAS Bishop-Chancellor Marcelo Sánchez Sorondo, H.E. Karl Card. Lehmann
and PAS President Nicola Cabibbo during the working group of 10 November 2003

A wiew of the Academy's Conference Hall.
Above: Professor Paul Adriaan Jan Janssen and Carlo Maria Card. Martini

The Participants of the Commemorative Session, 9 November 2003