The Challenges for Science. Education for the Twenty-First Century
Pontifical Academy of Sciences, *Scripta Varia* 104, Vatican City 2002
www.pas.va/content/dam/accademia/pdf/sv104/sv104-sanchez.pdf

THE PONTIFICAL ACADEMY OF SCIENCES: A HISTORICAL PROFILE

MARCELO SÁNCHEZ SORONDO

Pio XI, 'Motu proprio De Pontificia Academia Scientiarum, 28.10.1936', in *AAS 28* (1936), pp. 421-452; Giovanni Paolo II, 'Discorso alla Pontificia Accademia delle Scienze in occasione del 1000 anniversario della nascita di A. Einstein, 10.11.1979', in *Insegnamenti II*, 2 (1979), pp. 1115-1120; 'Discorso in occasione del 500 della Rifondazione', in *Insegnamenti IX*, 2 (1986), pp. 1274-1285; 'Discorso in occasione della presentazione dei risultati della Commissione di studio sul caso Galileo, 31.10.1992', in *Insegnamenti XV*, 2 (1992), pp. 456-465; 'Messaggio in occasione del 600 della Rifondazione, 22.10.1996', in *EV 15*, pp. 1346-1354.

I. The nature and goals of the Academy. II. A historical survey: from the Accademia dei Lincei to today's Pontifical Academy of Sciences. III. The role of the Academy in the dialogue between scientific thought and Christian faith.

I. The Nature and Goals of the Academy

The Pontifical Academy of Sciences has its origins in the Accademia dei Lincei ('the Academy of Lynxes') which was established in Rome in 1603, under the patronage of Pope Clement VIII, by the learned Roman Prince, Federico Cesi. The leader of this Academy was the famous scientist, Galileo Galilei. It was dissolved after the death of its founder but then recreated by Pope Pius IX in 1847 and given the name 'Accademia Pontificia dei Nuovi Lincei' ('the Pontifical Academy of the New Lynxes'). Pope Pius XI then refounded the Academy in 1936 and gave it its present name, bestowing upon it statutes which were subsequently updated by Paul VI in 1976 and

by John Paul II in 1986. Since 1936 the Pontifical Academy of Sciences has been concerned both with investigating specific scientific subjects belonging to individual disciplines and with the promotion of interdisciplinary co-operation. It has progressively increased the number of its Academicians and the international character of its membership.

The Academy is an independent body within the Holy See and enjoys freedom of research. Although its rebirth was the result of an initiative promoted by the Roman Pontiff and it is under the direct protection of the ruling Pope, it organises its own activities in an autonomous way in line with the goals which are set out in its statutes: 'The Pontifical Academy of Sciences has as its goal the promotion of the progress of the mathematical, physical and natural sciences, and the study of related epistemological questions and issues' (Statutes of 1976, art. 2, § 1). Its deliberations and the studies it engages in, like the membership of its Academicians, are not influenced by factors of a national, political or religious character. For this reason, the Academy is a valuable source of objective scientific information which is made available to the Holy See and to the international scientific community.

Today, the work of the Academy covers six main areas: a) fundamental science; b) the science and technology of global questions and issues; c) science in favour of the problems of the Third World; d) the ethics and politics of science; e) bioethics; and f) epistemology. The disciplines involved are sub-divided into nine fields: the disciplines of physics and related disciplines; astronomy; chemistry; the earth and environment sciences; the life sciences (botany, agronomy, zoology, genetics, molecular biology, biochemistry, the neurosciences, surgery); mathematics; the applied sciences; and the philosophy and history of sciences.

The new members of the Academy are elected by the body of Academicians and are chosen from men and women of every race and religion on the basis of the high scientific value of their activities and their high moral profile. They are then officially appointed by the Roman Pontiff. The Academy is governed by a President, appointed from its members by the Pope, who is helped by a scientific Council and by the Chancellor. Initially made up of eighty Academicians, of whom seventy were appointed for life, in 1986 John Paul II raised the number of members for life to eighty, side by side with a limited number of Honorary Academicians chosen because they are highly qualified figures, and others who are Academicians because of the posts they hold, amongst whom: the Chancellor of the Academy, the Director of the Vatican Observatory, the Prefect of the Vatican Apostolic Library, and the Prefect of the Vatican Secret Archive.

In conformity with the goals set out in its statutes, the Pontifical Academy of Sciences 'a) holds plenary sessions of the Academicians; b) organises meetings directed towards the progress of science and the solution of technical-scientific problems which are thought to be especially important for the development of the peoples of the world; c) promotes scientific inquiries and research which can contribute, in the relevant places and organisations, to the investigation of moral, social and spiritual questions; d) organises conferences and celebrations; e) is responsible for the publication of the deliberations of its own meetings, of the results of the scientific research and the studies of Academicians and other scientists' (Statutes of 1976, art. 3, § 1). To this end, traditional 'study-weeks' are organised and specific 'working-groups' are established. The headquarters of the Academy is the 'Casina Pio IV', a small villa built by the famous architect Piero Ligorio in 1561 as the summer residence of the Pope of the time. Surrounded by the lawns, shrubbery and trees of the Vatican Gardens, frescoes, stuccoes, mosaics, and fountains from the sixteenth century can be admired within its precincts.

Every two years the Academy awards its 'Pius XI Medal', a prize which was established in 1961 by John XXIII. This medal is given to a young scientist who has distinguished himself or herself at an international level because of his or her scientific achievements. Amongst the publications of the Academy reference should be made to three series: *Scripta Varia*, *Documenta*, and *Commentarii*. The most important works, such as for example the papers produced by the study-weeks and the conferences, are published in the *Scripta Varia*. In a smaller format, the *Documenta* series publishes the short texts produced by various activities, as well as the speeches by the Popes or the declarations of the Academicians on subjects of special contemporary relevance. The *Commentarii* series contains articles, observations and comments of a largely monographic character on specific scientific subjects. The expenses incurred by the activities of the Academy are met by the Holy See.

During its various decades of activity, the Academy has had a number of Nobel Prize winners amongst its members, many of whom were appointed Academicians before they received this prestigious international award. Amongst these should be listed: Lord Ernest Rutherford (Nobel Prize for Physics, 1908), Guglielmo Marconi (Physics, 1909), Alexis Carrel (Physiology, 1912), Max von Laue (Physics, 1914), Max Planck (Physics, 1918), Niels Bohr (Physics, 1922), Werner Heisenberg (Physics, 1932), Paul Dirac (Physics, 1933), Erwin Schroedinger (Physics, 1933), Sir Alexander

Fleming (Physiology, 1945), Chen Ning Yang (Physics, 1957), Rudolf L. Mössbauer (Physics, 1961), Max F. Perutz (Chemistry, 1962), John Eccles (Physiology, 1963), Charles H.Townes (Physics, 1964), Manfred Eigen and George Porter (Chemistry, 1967), Har Gobind Khorana and Marshall W. Nirenberg (Physiology, 1968). Recent Nobel Prize winners who have also been or are presently Academicians may also be listed: Christian de Duve (Physiology, 1974), Werner Arber e Geroge E. Palade (Physiology, 1974), David Baltimore (Physiology, 1975), Aage Bohr (Physics, 1975), Abdus Salam (Physics, 1979), Paul Berg (Chemistry, 1980), Kai Siegbahn (Physics, 1981), Sune Bergström (Physiology, 1982), Carlo Rubbia (Physics, 1984), Rita Levi-Montalcini (Physiology, 1986), John C. Polanyi (Chemistry, 1986), Jean-Marie Lehn (Chemistry, 1987), Joseph E. Murray (Physiology, 1990), Gary S. Becker (Economics, 1992), Paul J. Crutzen (Chemistry, 1995), Claude Cohen-Tannoudji (Physics, 1997) and Ahmed H. Zewail (Chemistry, 1999). Padre Agostino Gemelli (1878-1959), the founder of the Catholic University of the Sacred Heart and President of the Academy after its refoundation until 1959, and Mons. Georges Lemaître (1894-1966), one of the fathers of contemporary cosmology who held the office of President from 1960 to 1966, were eminent Academicians of the past. Under the Presidency of the Brazilian biophysicist Carlos Chagas and of his successor Giovanni Battista Marini-Bettòlo, the Academy linked its activity of scientific research to the promotion of peace and the progress of the peoples of the world, and dedicated increasing attention to the scientific and health care problems of the Third World. The Presidency of the Academy is presently entrusted to the Italian physicist, Nicola Cabibbo.

The goals and the hopes of the Academy, within the context of the dialogue between science and faith, were expressed by Pius XI (1922-1939) in the following way in the *Motu Proprio* which brought about its refoundation: 'Amongst the many consolations with which divine Goodness has wished to make happy the years of our Pontificate, I am happy to place that of our having being able to see not a few of those who dedicate themselves to the studies of the sciences mature their attitude and their intellectual approach towards religion. Science, when it is real cognition, is never in contrast with the truth of the Christian faith. Indeed, as is well known to those who study the history of science, it must be recognised on the one hand that the Roman Pontiffs and the Catholic Church have always fostered the research of the learned in the experimental field as well, and on the other hand that such research has opened up the way to the defence of the deposit of supernatural truths entrusted to the Church...We promise again,

and it is our strongly-held intention, that the 'Pontifical Academicians', through their work and our Institution, work ever more and ever more effectively for the progress of the sciences. Of them we do not ask anything else, since in this praiseworthy intent and this noble work is that service in favour of the truth that we expect of them' (*AAS* 28, 1936, p. 427; Italian translation, *OR*, 31.10.1936).

After more than forty years, John Paul II once again emphasised the role and the goals of the Academy at the time of his first speech to the Academicians which was given on 10 November 1979 to commemorate the centenary of the birth of Albert Einstein: 'the existence of this Pontifical Academy of Sciences, of which in its ancient ancestry Galileo was a member and of which today eminent scientists are members, without any form of ethnic or religious discrimination, is a visible sign, raised amongst the peoples of the world, of the profound harmony that can exist between the truths of science and the truths of faith...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. The title of 'Pontifical' given to the Academy means, as you know, the interest and the commitment of the Church, in different forms from the ancient patronage, but no less profound and effective in character. As the lamented and distinguished President of the Academy, Monsignor Lemaître, observed: 'Does the Church need science? But for the Christian nothing that is human is foreign to him. 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 which has been built in a rather complex way, where the traces of the different stages of the long evolution of the world have been covered over and mixed up. The believer, perhaps, has the advantage of knowing that the puzzle has a solution, that the underlying writing is in the final analysis the work of an intelligent being, and that thus the problem posed by nature has been posed to be solved and that its difficulty is without doubt proportionate to the present or future capacity of humanity. This, perhaps, will not give him new resources for the investigation engaged in. But it will contribute to maintaining him in that healthy optimism without which a sustained effort cannot be engaged in for long' ('Discorso alla Pontificia Accademia delle Scienze, 10.11.1979', in *Insegnamenti*, II, 2 (1979), pp. 1119-1120).

It was precisely in that speech that John Paul II formally called on historians, theologians and scientists to examine again in detail the Galileo case.

And he asked them to do this 'in the faithful recognition of errors, by whomsoever committed', in order to 'remove the distrust that this case still generates, in the minds of many people, placing obstacles thereby in the way of fruitful concord between science and faith' (*ibidem*, pp. 1117-1118).

II. A historical survey: from the Accademia dei Lincei to today's Pontifical Academy of Sciences

The historical itinerary of the Academy is summarised in the articles written by Marini-Bettòlo (1986) and by Marchesi (1988), and in broader fashion in the monograph by Régis Ladous (1994). As was observed at the beginning of this paper, the roots of the Pontifical Academy of Sciences are to be traced back to the post-Renaissance epoch. Its origins go back to the ancient Accademia dei Lincei, established in 1603 by Prince Federico Cesi (1585-1630) when he had just reached the age of eighteen. Cesi was a botanist and naturalist, the son of the Duke of Acquasparta, and the member of a noble Roman family. Three other young men took part in this initiative: Giovanni Heck, a Dutch physician aged twenty-seven; Francesco Stelluti di Fabriano; and Anastasio de Filiis de Terni. Thus it was that the first Academy dedicated to the sciences came into being, and it took its place at the side of the other Academies – of literature, history, philosophy and art – which had arisen in the humanistic climate of the Renaissance. The example of Cesi and of the group of scholars led by him was followed some years later in other countries – the Royal Society was created in London in 1662 and the Académie des Sciences was established in France in 1666.

Although he looked back to the model of the Aristotelian-Platonic Academy, his aim was altogether special and innovative. Cesi wanted with his Academicians to create a method of research based upon observation, experiment, and the inductive method. He thus called this Academy 'dei Lincei' because the scientists which adhered to it had to have eyes as sharp as lynxes in order to penetrate the secrets of nature, observing it at both microscopic and macroscopic levels. Seeking to observe the universe in all its dimensions, the 'Lincei' made use of the microscope (*tubulus opticus*) and the telescope (*perspicillus-occhialino*) in their scientific research, and extended the horizon of knowledge from the extremely small to the extremely large. Federico bestowed his own motto on the 'Lincei' – '*minima cura si maxima vis*' ('take care of small things if you want to obtain the greatest results').

The Cesi group was also interested in the new scientific and naturalistic discoveries then coming from the New World, as is demonstrated by the most significant works of the college of the first 'Lincei' – the *Rerum medicarum thesaurus novae Hispaniae*, later known as the *Tesoro Messicano*, which was printed in Rome in 1628. This was a very extensive collection of new geographical and naturalistic knowledge, and contained in addition accounts of explorations carried out in the Americas.

From the outset the Academy had its ups and downs. A few years after its foundation it was strongly obstructed by Cesi's father because he believed that within it activity was being engaged in which was not very transparent in character – for example, studies in alchemy. But after the death of Federico's father, the abundant economic resources which were now obtained thanks to Federico's inheritance, as well as the fact that renowned scholars such as Galileo Galilei, Giovan Battista della Porta, Fabio Colonna, and Cassiano dal Pozzo joined its ranks, enabled the Academy to progress and advance.

The religious character of the Academy cannot be overlooked. It was placed under the protection of St. John the Evangelist who was often portrayed in the miniatures of its publications with an eagle and a lynx, both of which were symbols of sight and reason. It was therefore conceived as an assembly of scholars whose goal – as one can read in its Rules, described as the 'Linceografo' – was 'knowledge and wisdom of things to be obtained not only through living together with honesty and piety, but with the further goal of communicating them peacefully to men without causing any harm'. Nature was seen not only as a subject of study but also of contemplation. Amongst the suggestions of the 'Linceografo' there is also that of preceding study and work with prayer – 'for this reason the Lynxes, near to doing anything at all, must first raise their minds to God, and humbly pray to him and invoke the intercession of the saints' (cf. di Rovasenda and Marini-Bettòlo, 1986, p. 18). Amongst the practices of the spiritual piety of the members there was the reciting of the liturgical office of the Blessed Virgin Mary and the Davidic Psalter. For this reason, as Enrico di Rovesanda observes, 'the religious inspiration of the Lincei cannot be overlooked, as is done in many quarters, nor can it be reduced to an 'almost mystical glow of the school of Pythagoras', as has also been suggested. The high moral figure of Cesi acts to guarantee the sincere and loyal profession of its religious faith' (*ibidem*, p. 19). One of the mottoes of the Academy – *Sapientiae cupidi* – indicated the striving for constant research into truth through scientific

speculation, based upon the mathematical and natural sciences but always located within a sapiential horizon.

Like Galileo, whose great supporter he was, Cesi admired Aristotle but not the Aristotelians of the University of Padua who had refused to look at things through the telescope of the Pisan scientist. He was in addition rather critical of the university culture of his day. Federico Cesi also engaged in important activity of mediation between the Roman theological world and Galileo, reaching the point of advising the latter to not insist in his polemics about the interpretation of Holy Scripture so that he could dedicate himself in a more effective way to scientific research. Death struck Cesi down in 1630 when Galileo was about to finish his *Dialogo sui Massimi Sistemi*, the manuscript of which Galileo wanted to send to Cesi himself so that the latter could organise its publication. After Cesi's death the activities of the Academy diminished to such an extent as to bring about its closure.

The first attempts to bring the 'Lincei' back into existence took place in 1745 in Rimini as a result of the efforts of a group of scientists belonging to the circle made up of Giovanni Paolo Siomne Bianchi (known as Janus Plancus), Stefano Galli and Giuseppe Garampi. But the new Academy had a very short life. The attempt at refoundation made by Padre Feliciano Scarpellini (1762-1840) in Rome at the beginning of the nineteenth century met with greater success. He gave the name of 'Lincei' to a private academy that he had established in 1795. Despite a lack of funds and a whole series of difficulties, Scarpellini managed to keep the name of 'Lincei' alive and to bring together in a single academic body the various scientists working in the Papal States such as the mathematician Domenico Chelini, the naturalist Carlo Bonaparte, the anatomist Alessandro Flajani, the chemists Domenico Morichini and Pietro Peretti, Prince Baldassarre Odescalchi, the physicists Gioacchino Pessuti and Paolo Volpicelli, and the physician Benedetto Viale (cf. Marini-Bettòlo, 1986, p. 10).

The authorities of the Papal States took new practical initiatives to refound the Academy during the first half of the nineteenth century in response to the wishes of Pope Pius VII (1800-1823) and Leo XII (1823-1829), with the allocation of the second floor of Palazzo Senatorio in Capidoglio to the Academy as its headquarters. But in 1847 it was Pius IX who officially renewed the Academy with the name (which had already been suggested by Gregory XVI in 1838) of 'Accademia Pontificia dei Nuovi Lincei' ('the Pontifical Academy of the New Lynxes'), ensuring the drawing up of new statutes which envisaged, amongst other things, the presence of thirty resident members and forty correspondent members. During this

period of activity famous astronomers and priests were present within its ranks, such as Francesco de Vico and Angelo Secchi. During the revolutionary upheavals of 1848 the Roman Republic sought to expel the Academy from the Campidoglio. However, the institution managed to keep its headquarters by using various bureaucratic manoeuvres. In 1870, following the fall of the independent Papal States and the unification of the Kingdom of Italy, the Academy divided into two different institutions: the 'Reale Accademia dei Lincei', which later became the present Accademia Nazionale dei Lincei with its headquarters in Palazzo Corsini alla Lungara, and the 'Accademia Pontificia dei Nuovi Lincei', which was transferred from the Capidoglio to the Casina Pio IV villa in the Vatican Gardens.

One had to wait, as has already been observed, until 28 October 1936 for a further renewal of the institution, which took place in response to the insistent requests of the Jesuit Giuseppe Gianfranceschi. This scientist was Professor of Physics at the Gregorian University and had been the President of the Accademia Pontificia dei Nuovi Lincei since 1921. A new Pontifical Academy of Sciences was thus created by Pope XI by the Motu Proprio *In Multis Solaciis* (for an Italian translation see Marini-Bettòlo, 1987, pp. 199-203. This work has an accurate summary of the life of the Academy for the years 1936-1986). The Presidency was entrusted to the Rector of the Catholic University Padre, Agostino Gemelli, who was flanked by the Chancellor, Pietro Salviucci, and by a Council composed of four Academicians. Annual (and later two-yearly) plenary sessions were proposed for all the Academicians. The accounts of the activities and the contributions of the members were published in the *Acta Pontificiae Academiae Scientiarum* and later on in the *Commentationes*. The first assembly was inaugurated on 1 June 1937 by the then Cardinal Secretary of State, Eugenio Pacelli, the future Pope Pius XII. In discussing this period of the Academy reference should be made to the presence of such distinguished members as Ugo Armaldi, Giuseppe Armellini, Niels Bohr, Lucien Cuenot, Georges Lemaître, Tullio Levi-Civita, Guglielmo Marconi, Robert Millikan, Umberto Nobile, Max Planck, Ernest Rutherford, Erwin Shrödinger, Francesco Severi, Edmund Whittaker, and Pieter Zeeman.

During the years 1937-1946 the publications of the Academy had a largely Italian character, presenting, for example, the work of the Italian Academicians Pistolesi, Crocco, and Nobile on aerodynamics. But there were also papers by foreign Academicians such those as by E. Schrödinger in 1937 on quantum physics and by M. Tibor in 1937-1939 of an astronomical character. During the Second World War the Academy greatly redu-

ced its activity but nonetheless found space for the publications of Jewish Italian scientists who had been marginalised by the race laws of 1938, amongst whom should be mentioned a group of mathematicians of Jewish descent including Tullio Levi-Civita and Vito Volterra, and others such as Giuseppe Levi, Rita Levi-Montalcini, E. Foà and G.S. Coen. Pius XII (1939-1958), who succeeded Pius X, did not fail to make addresses to the Academicians, even during the war years, such as the address of 30 November 1941 on the occasion of the inauguration of the fourth academic year. This address was dedicated to a long and profound reflection on the position of man in relation to the Creation and God (cf. *Discorsi e Radiomessaggi*, III, pp. 271-281).

In the post-war period, at a time of sensitive reconstruction and the rebuilding of international relations, in the face of the great difficulties encountered at the level of scientific contacts and exchange, the Academy undertook the publication of the research results of greatest interest of the various fields of science which had been achieved during the war in its work *Relationes de Auctis Scientiis tempore belli* (aa. 1939-1945). This publication was of marked importance in fostering the renewal of scientific contacts between the nations which had previously been at war. In 1946 Alexander Fleming (1881-1955) was appointed an Academician in recognition of his discovery of penicillin – a discovery which opened the way to the pharmacological production of antibiotics.

During the 1950s, in parallel with the problems of reconstruction and the development of under-developed regions, the activity of the Pontifical Academy of Sciences centred around the questions and issues of applied science. In 1955 the study-week on trace elements was held, when for the first time the problem of agrarian production and food sources was addressed. After the election to the papacy of John XXIII (1958), Padre Gemelli died in 1959. The Presidency of the Academy was then held by G. Lemaître.

The 1960s witnessed an exponential growth and development of science connected with electronics and the conquest of space. This gave new impetus to industry and technological advance but also to nuclear armaments. In astrophysics the discovery of new sensors and the development of radio-astronomy opened up the universe to new interpretations. Biology became directed towards the molecular study of genetics. In 1961 the Pontifical Academy of Sciences organised a study-week on the macromolecules of interest to biology, and in particular on the nucleoproteins, a subject which was then of major importance for international research. On that occasion, when meeting the Academicians, John XXIII reaffirmed the

educational and cultural mission of the Church and the function of scientific progress in relation to the positive appreciation of the human person. The Pope recalled in addition that science is directed above all else towards the development and growth of the personality of man and the glorification of God the Creator: 'indeed, far from fearing the most audacious discoveries of men, the Church instead believes that every advance in the possession of the truth involves a development of the human person and constitutes a road towards the first truth, and the glorification of the creative work of God' ('Discorso in occasione del XXV dell'Accademia, 30.10.1961', in *Discorsi, Messaggi e Colloqui del Santo Padre Giovanni XXIII*, vol. III, p. 493). In 1962, at the time of the plenary session of that year, a study-week dedicated to astronomy which addressed the subject of cosmic radiation in space was held, guided in first person by the President of the Academy, Monsignor Lemaître.

In 1964, at the time of the pontificate of Paul VI (1963-1978), there appeared amongst the publications of the Pontifical Academy of Sciences the *Miscellanea Galileiana* of Monsignor Pio Paschini, who was Professor of History at the Lateran University. The Galileo case was slowly reopened, a development favoured by the reference made to it by Vatican Council II in n. 36 of *Gaudium et Spes*. This led to the address by John Paul II of 1979 to which reference has already been made. After the death of Georges Lemaître, in 1966 Padre Daniel O'Connell was made President of the Academy. A Jesuit and Irish astronomer, he had previously been Director of the Vatican Observatory and had been an Academician for life since 1964. He was also the author together with other astronomers of an important general atlas of the stars. The year 1967 was marked by the publication of the encyclical *Popularum Progressio*, in which Paul VI brought to worldwide attention all the major problems inherent in the development of the Third World. This document also contained an appeal to engage in international scientific co-operation so that this could in all forms favour developing countries. It introduced the idea that scientific progress and advance must be guided by a 'new humanism': 'every advance of ours, each one of our syntheses reveals something about the design which presides over the universal order of beings, the effort of man and humanity to progress. We are searching for a new humanism, which will allow modern man to refind himself, taking on the higher values of love, friendship, prayer and contemplation' (n. 20). In harmony with the themes of the encyclical, the Academy thought it was necessary to open itself to collaboration with the scientists of the Third World and by 1968 it was already holding a

study-week on the subject of 'organic matter and soil fertility', a subject which dealt with the applications of science to agricultural production and the solution of the problems of hunger in the world.

In 1972 for the first time a secular President was elected – the Brazilian Carlos Chagas, who had already been a member of the United Nations and the General Secretary of the first conference of the United Nations on Science and Technologies for Development. The new President imparted a new direction to the activities of the Academy which were now more centred around solving the great problems of post-industrial society (cf. di Rovesanda, 2000). The scientific activity of the Academy was thus directed not only towards the subjects of science which were more specific to Western culture but also began to be concerned, with the co-operation of Giovanni Battista Marini-Bettòlo (who succeeded Chagas in 1988), with the scientific and health care problems connected with the growth and development of the Third World ('development ethics').

The 1980s witnessed the development of new directions in scientific research which moved in the direction of the life sciences, the earth sciences, and ecology. Mankind had to face up to new problems, such as pollution, changes in the biosphere, energy reserves, and genetic manipulation. In 1982 the Academy committed itself at an international level to the promotion of peace with the drawing up of a document on nuclear armaments (cf. 'Dichiarazione sul disarmo nucleare' ('Declaration on Nuclear Disarmament'), *EV*, 7, pp. 1811-1825) and devoted the next plenary session (of 1983) to the subject of 'science for peace'. In connection with that event, John Paul II appealed to members of governments to work in an effective fashion in order to remove the danger of a new war and invited States to engage in nuclear disarmament (cf. 'Il sapere scientifico edifichi la pace, 12.11.1983' ('Scientific Knowledge should Build Peace, 12.11.1983'), in *Insegnamenti*, VI, 2 (1983), pp. 1054-1060). This document and appeal achieved a strong resonance in the United States of America and the Soviet Union. During the 1990s meetings and study-weeks were held which were dedicated to analysing the question of the prolonging of life; the question of determining the moment of death; the question of transplants and xenografts; and the question of sustainable growth and development. The issues of artificial fertilisation, cloning, and genetic manipulation were also considered. These were subjects which increasingly involved issues of an ethical character (bioethics) and which drew scientists, philosophers and theologians into dialogue. Although the usual practice of involving various disciplines was maintained, the research and the debates of the

Academicians were directed in a special way towards reflection on the anthropological and humanistic dimensions of science. In November 1999 a working-group was held on the subject of 'science for man and man for science', and the Jubilee session of November 2000 was dedicated to the subject 'science and the future of mankind'.

III. The Role of the Academy in the Dialogue between Scientific Thought and Christian Faith

In the relations which exist between Academies and the States in which they carry out their activities, the case of the Pontifical Academy of Sciences can be seen as a singular case, as indeed in basic terms the role of the small State which hosts it is also singular. During these long years this relationship has become very fertile. The Church has paid careful attention to the Academy. She has respected its work and fostered the autonomy of its scientific and organisational dynamics. Through the Academy, the Magisterium of the Church has sought to make the scientific world understand her teaching and her orientations in relation to subjects which concern the good of man and society, the complete human development of all the peoples of the world, and the scientific and cultural co-operation which should animate the relations between States. On the occasion of numerous addresses and messages directed towards the Academy by five pontiffs, the Church has been able to repropose the meaning of the relationship between faith and reason, between science and wisdom, and between love for truth and the search for God. But through the Academy the Church has also been able to understand from nearer to hand, with speed and in depth, the contents and the importance of numerous questions and issues which have been the object of the reflection of the scientific world, whose consequences for society, the environment and the lives of individuals could not but interest her directly, 'given that there is nothing which is genuinely human which does not find echo in her heart' (cf. *Gaudium et Spes*, 1). The Pontifical Academy of Sciences has thus become one of the favoured *forums* for the dialogue between the Gospel and scientific culture, gathering together all the stimulating provocations but also the inspiring possibilities that such dialogue brings with it, almost thereby symbolising a shared growth – of both the scientific community and the Magisterium of the Church – of their respective responsibilities towards truth and good.

The above survey, although general in character, dealing with the activity carried out over the sixty years since the foundation of the Pontifical Academy of Science, the subjects of the numerous meetings and study-weeks, and the publications which the Academy has produced, brings out all the contemporary relevance and the importance of the subjects which have been addressed. Scientists from all over the world, often co-operating closely with a group of philosophers and theologians, have examined questions and issues which have ranged from genetics to cosmology, from agriculture to the distribution of resources, from the surgery of transplants to the history of science, and from ecology to telecommunications. The speeches addressed by the Pontiffs to the Academicians, from Pius XI to John Paul II, have offered important elements of reflection not only in relation to the ethical and moral responsibility of their activities but also on the very meaning of scientific research, and on its striving for truth and an increasingly profound knowledge of reality. The subject of the relationship between science and faith, both at an epistemological and an anthropological level, has been the usual framework of almost all these papal addresses. The forms of language employed have been different as these decades have passed, and different emphases have been placed on the various questions and issues, but the attention paid to scientific work has been unchanging, as has been the case in relation to the philosophical and cultural dimensions which that work involves.

Side by side with such dialogue, which we could call 'ordinary', international public opinion has been witness to certain 'out of the ordinary' events. From the mass media it has learnt about speeches of special importance for the relationship between science and faith, speeches given at the Academy in particular during the pontificate of John Paul II. Of these reference should be made to the address with which, as has already been observed (see above section I), John Paul II spoke to the plenary session of the Pontifical Academy of Sciences in November 1979 to express his wish for, and then formally request, the establishment of a committee of historians, scientists, and theologians which would re-examine the Galileo case and present public opinion with a serene analysis of the facts as they occurred (Galileo, IV). The aim of this was not in a historical sense to recognise the inadvisability of the condemnation of the heliocentrism carried out four centuries beforehand by the Sant'Uffizio (something which had already been effected in 1757 with the removal of the works in question from the list of prohibited books), but rather to ensure that the historical-philosophical context of the episode, as well as its implications at a cultural level,

were more illuminated, thereby clarifying in a public way which would be comprehensible to everybody what had already been made clear in a narrower circle of intellectuals and experts. During a new assembly of the Academy which was held on 31 October 1992, Cardinal Paul Poupard, in the presence of the Holy Father, presented the results of the committee and commented on the work which it had carried out.

Four years later, on 22 October 1996, this time in the form of a message on the occasion of the sixtieth anniversary of its refoundation, John Paul II once again chose the Pontifical Academy of Sciences as a qualified interlocutor to expound certain important reflections on the theory of evolution (*Magistero*, V.2; *Uomo, Identità Biologica e Culturale*, V.3). Returning to and developing certain observations made by his predecessor Pius XII in the encyclical *Humani Generis* (cf. *DH* 3896-3899), he now added that 'new knowledge leads the theory of evolution to be no longer considered as a mere hypothesis', thereby recognising 'that this theory has progressively imposed itself on the attention of researchers following a series of discoveries made in the various disciplines of knowledge', imposing itself also therefore on the attention of theologians and bible experts (*Scienze Naturali, Utilizzo in Teologia*).

It would not however be exact to confine only to recent years the climate of mutual listening and serene encounter on subjects of great relevance. History has also been a witness to other episodes of intense dialogue with the Roman Pontiffs of which the Academy or some of its members were the protagonists. This is the case, for example, of Max Planck, who wanted to make himself the interpreter in a direct way with Pius XII in 1943 of the risks of war connected with the use of armaments based upon nuclear fission (cf. Ladous, 1994, p. 144), or the close relationship between Pius XII and Georges Lemaître, who enabled the Pontiff to understand from closer to hand at the beginning of the 1950s the meaning of the new cosmological models which were by then beginning to become established in the scientific world, and the philosophical, or even theological, questions which at first sight appeared to be involved (Lemaître, IV). In more recent years, Carlos Chagas was especially concerned in 1981 to take on board the worries of John Paul II, who was still convalescing after the attack on his life, about the consequences for the planet of a possible nuclear war. He decided to himself present the studies carried out on the subject to the principal Heads of State in his capacity as President of the Academy (cf. di Rovesanda, 2000).

In the letter sent to Padre George Coyne, the Director of the Vatican Observatory and a member of the Council of the Academy, a document

which is certainly one of the most profound there is on the subject of the dialogue between science and faith, John Paul II observed that science has acted to purify faith and that faith has acted to generate scientific research, a truth demonstrated by the fact that Galilean modern science was born in a Christian climate with the increasing assimilation of the message of freedom placed in the heart of man. Thus, in the same letter, referring to the wider context of universities, the Pope declared that: 'The Church and academic institutions, because they represent two institutions which are very different but very important, are mutually involved in the domain of human civilisation and world culture. We carry forward, before God, enormous responsibilities towards 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' ('Lettera al Direttore della Specola Vaticana, 1.6.1988' ('Letter to the Director of the Vatican Observatory, 1.6.1988, *OR* 26.10.1988, p. 7) For this to come about, the Pope stressed the importance of there being experts and places especially dedicated to such a dialogue: 'the Church for a long time has recognised the importance of this by founding the Pontifical Academy of Sciences, in which scientists of world renown regularly meet each other to discuss their research and to communicate to the wider community the directions research is taking. But much more is required' (*ibidem*).

And in this 'more' John Paul II saw the need, in their irreplaceable dialogue, for scientific institutions and the Catholic Church not to think in a reductive way about the settling of ancient conflicts, and also saw the more important need for mutual help in the investigation of truth and a shared growth in their responsibility for the good of the peoples of the world and their future. And it in this logic, with this new readiness to engage in service, that the present President of the Academy, Professor Cabibbo, in his address to John Paul II on the occasion of the Jubilee plenary session on the subject of 'science and the future of mankind' (*OR* 13-14.11.2000, p. 6) was able to speak about the 'renewed commitment' of the Pontifical Academy of Sciences together with the Holy See to the good of the whole Church, of the scientific community, and of those men and women who search and believe.

BIBLIOGRAPHY

For studies and works of a historical character see:

E. di Rovasenda and G.B. Marini-Bettòlo, *Federico Cesi nel quarto centenario della nascita* (Pontificiae Academiae Scientiarum Scripta Varia, 63, 1986).

G.B. Marini-Bettòlo, *Historical Aspects of the Pontifical Academy of Sciences* (Pontificae Academiae Scientiarum Documenta, 21, 1986).

G.B. Marini-Bettòlo, *L'attività della Pontificia Accademia delle Scienze 1936-1986* (Pontificiae Academiae Scientiarum Scripta Varia, 71, 1987).

G. Marchesi, 'La Pontificia Accademia delle Scienze, luogo d'incontro tra ragione e fede', *Civiltà Cattolica* 139 (1988), III, pp. 235-246; R. Ladous, *Des Nobel au Vatican. La fondation de l'academie pontificale des sciences* (Cerf, Paris, 1994).

P. Poupard (ed.), *La nuova immagine del mondo. Il dialogo fra scienza e fede dopo Galileo* (Piemme, Casale Monferrato, 1996).

E. di Rovasenda, 'In ricordo dell'antico Presidente della Pontifica Accademia delle Scienze, C. Chagas', *OR* 21-22.2.2000.

Some publications of the Academy on subjects referred to in this paper:

P. Paschini (ed.), *Miscellanea galileana*, 3 vols., (Pontificiae Academiae Scientiarum Scripta Varia, 1964).

Science and Technology for Developing Countries (Pontificiae Academiae Scientiarum Scripta Varia, 44, 1979).

S.M. Pagano and A.G. Luciani, *I documenti del processo di Galileo Galilei* (Pontificiae Academiae Scientiarum Scripta Varia, 53, 1984).

The Artificial Prolongation of Life and the Determination of the Exact Moment of Death (Pontificiae Academiae Scientiarum Scripta Varia, 60, 1985).

Discorsi indirizzati dai Sommi Pontefici Pio XI, Pio XII, Giovanni XXIII, Paolo VI, Giovanni Paolo II alla Pontificia Accademia delle Scienze dal 1936 al 1986 (Pontificiae Academiae Scientiarum Scripta Varia, 64, 1986).

The Responsibility of Science (Pontificiae Academiae Scientiarum Scripta Varia, 80, 1988).

Science for Development in a Solidarity Framework (Pontificiae Academiae Scientiarum Documenta, 25, 1989).

The Determination of Brain Death and its Relationship to Human Death (Pontificiae Academiae Scientiarum Scripta Varia, 83, 1989).

Science in the Context of Human Culture, I-II (Pontificiae Academiae Scientiarum Scripta Varia, 85-86, 1990-1991).

Resources and Population (Pontificiae Academiae Scientiarum Scripta Varia, 87, 1991).

The Legal and Ethical Aspects Related to the Project of the Human Genome (Pontificiae Academiae Scientiarum Scripta Varia, 91, 1993).

Discorsi dei Papi alla Pontificia Accademia delle Scienze (1936-1993) (Pontificia Academia Scientiarum, Vatican City, 1994).

For all the publications of the Pontifical Academy of Sciences see *Publications of the Pontifical Academy of Sciences (1936-1999)* (Vatican City, 1999).